

الجمهورية التونسية
وزارة الفلاحة والموارد المائية
مؤسسة البحث والتعليم العالي الفلاحي
معهد المناطق القاحلة
مدنين



المؤتمر الثاني للجمعية الدولية للبحث والتنمية في مجال الإبل Second Conference of ISOCARD



جربة (تونس) 12 - 14 مارس 2009
Djerba (Tunisia), 12-14 march 2009



الخطوط التونسية
TUNISAIR
Transporteur officiel



Abstracts

ملخص

**The Second Conference of the International Society of Camelid
Research and Development**

Organized by

**THE ARID LAND INSTITUTE (IRA)
& THE INTERNATIONAL SOCIETY OF CAMELID RESEARCH AND
DEVELOPMENT (ISOCARD)**

In cooperation with

**OFFICE OF LIVESTOCK AND PASTURE (OEP)
& INSTITUTION FOR AGRICULTURAL RESEARCH AND HIGHER EDUCATION
(IRESA)**

Djerba, Tunisia 12th-14th March, 2009

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Preface

It is well documented that camelids form an integral part of the culture and the agriculture of many countries in the world. Since last decades of the last century, many national and international research and/or development programs have been realized to safeguard and/or to improve productivity of *Camelus* and *Lama* Genus. Several national and international scientific meetings on camelids were also organized.

In 2006, Dr Bernard Faye from CIRAD France, Dr Ghaleb Alhadrami from the College of Food and Agriculture in United Arab Emirates, Dr Mohammed Bengoumi from IAV Hassen II Morocco, Dr Ahmed Tibary and David Anderson from USA decided to found the International Society of Camelids Research and Development (ISOCARD) and to organize the 1st Conference of this Society in Al-Ain, UAE on April 15-17, 2006. The ISOCARD is a non-political, non-religious and non profit federation of camelid scientists or similar scientific and professional associations.

The objectives of this Society are:

- To give international scientific status for camelid sciences,
- To promote the camelid science and practice,
- To promote the contributions of camelid scientists to the development of camelid farming,
- To promote scientific publications in camelid fields,
- To set high standards in camelid education and training
- To promote standards of health and welfare in camelids,
- To organise International camelid Conference every 3 years,
- To encourage the exchange of information on camelid interest between the members and different networks and involved organisations,
- To establish and maintain relations with other organisations whose interests are related to the objectives of the Society.

The Arid Lands Institute (Tunisia) and the ISOCARD organize, in collaboration with the Office of Livestock and Pasture and the Institution of Research and Higher Education in Agriculture, the 2nd Conference of the Society. The organizing committee is delighted to welcome you to this important scientific manifestation in Djerba and present the program and the abstracts of 215 accepted submissions dealing with 8 different themes:

- diseases and medicine,
- products,
- farm management systems and development aspects,
- physiology, pharmacology and biochemistry,
- nutrition and behaviour,
- reproduction,
- surgery and anatomy,
- genetics,

Over the two first days of the conference, there will be 124 presentations, distributed over 4 parallel sessions. Remained abstracts will be presented as posters in reserved areas. In this occasion, we would like to thank authors for submitting abstracts, and the Scientific Committee for the great effort making our Conference a success.

In order to encourage young scientists working in camelid field who submitted abstract before 30th November 2008, the organizing committee decided to organize a poster competition for students in Masters, in PhD, in internship or in clinical programmes. Two prizes will be distributed, including one laptop.

In addition to scientific communications, round tables for collaborative research projects will be organized in last day morning. Three topics were selected by participants:

- Promoting the camel as model species for sustainable development in arid climates,
- Milk production in intensive system,
- Infectious diseases and immunology.


This scientific program will be accompanied by social program offered by the travel agency **Iris Tours** for interested people. We are grateful to this travel Agency for its social contribution.

Furthermore, the conference will be also an occasion to elect members to serve on the Executive Council of ISOCARD for the next three year term.

We would like to extend our sincere gratitude to the Ministry of Higher Education and Research and Technology to support the organization of this conference in Medenine.

Finally, without the generosity of many national (Tunisair, GIVlait, SATCO, TechnoScience, Promosciences, Akrou Agenceur, Agrimed, SED Gabes, Biogene, BNA, Electronic City) and internationals sponsors (CTA, Merial, AUF, CEVA, FAO) this conference would not have been possible. On behalf of the organizing committee, we would like to take this opportunity to express our gratitude and appreciation to them.

For the Scientific Committee
Dr Mohamed HAMMADI



For the Organizing Committee
Pr Touhami KHORCHANI



Scientific program

Day 1: Thursday, 12th March, 2009,		
7.30	Registration	
9.00-10.00	Opening Ceremony	Room 1
10.00-10.30	Break coffee	
10.30-12.40	keynote presentations:	Room 1
* 10.30-11.05	* Pr. Faye B : Old world camelids,	
* 11.05-11.15	Discussion	
* 11.15-11.50	* Pr. Johnson W: New world camelids	
* 11.50-12.00	Discussion	
* 12.00-12.35	* Pr. El-Harrak M : Diseases in camelids	
* 12.35-12.45	Discussion	
12.45	Lunch	

		Diseases & Medicine (Room 1) Moderator: Pr Jemli MH	
Day 1 : Thursday, March 12th, 2009	14.00-14.15	Abu-Samra MT : Diseases of the one-humped Arabian camel (<i>Camelus dromedarius</i>)	
	14.15-14.30	Agab H & Bakhiet AO : Camel dermatophilosis: A review	
	14.30-14.45	Dia ML : Review of research on camel trypanosomosis due to <i>Trypanosoma evansi</i>	
	14.45-15.00	Vias Franck SG et al : Causes of death in camel herds in pastoral zone of Zinder (Niger)	
	15.00-15.15	Bakhsh A et al : Death of camels in Saudi Arabia: Analysis of suspected and unknown causes	
	15.15-15.30	Gluecks IV et al : Camel sudden death syndrome outbreak of an unknown camel disease in the Horn of Africa	
	15.30-15.45	Bengoumi et al : Camel death in the Zoo of Ica Peru	
	15.45-16.00	Dande SS et al : Management of pox in camels: a report	
	16.00-16.30	Discussion	
	16.30-17.00	Coffee break	
			Diseases & Medicine (Room 1) Moderator: Pr Abu-Samra MT
	17.00-17.15	Gutierrez C et al : An outbreak of <i>Trypanosoma evansi</i> infection in camels and equines in mainland Spain	
	17.15-17.30	Touratier L et al: The evolution and prevention of the <i>Trypanosoma evansi</i> (Surra) outbreaks in dromedary camels (<i>Camelus dromedarius</i>) on the European mainland	
	17.30-17.45	Antoine-Moussiaux N et al : Investigations on Surra-induced lymphopenia in a murine model	
	17.45-18.00	Rabbani Khorasgani M et al : Seroprevalence of <i>Brucella</i> and <i>Salmonella</i> infections in Bactrian camels	
	18.00-18.15	Al-Majali A : Seroepidemiology of camel brucellosis in Jordan	
	18.15-18.30	Khalafalla AI et al : Virus implicated in respiratory infections of camels	
	18.30-18.45	Seddik MM et al : Krafft disease in dromedary camel in Tunisia	
	18.45-19.00	Kamat NK et al : Pathogens of internal and external purulent lesions in dromedary camels	
19.00-19.30	Discussion		
		Diseases & Medicine (Room 1) Moderator: El-Harrak M	
Day 2 : Friday March 13th, 2009	8.00-8.15	Ishag MY et al : <i>Toxoplasma gondii</i> and rotavirus associated with camel-calves diarrhea in Sudan	
	8.15-8.30	Whitehead C et al : Bluetongue vaccination field trial in Alpacas using the Bovilis BTV8 (Intervet) Vaccine	
	8.30-8.45	Rhalem A et al : Protection against <i>Hyalomma dromedary</i> infestations in camel vaccinated with the <i>B. microplus</i> Bm86-containing vaccine Gavac TM	
	8.45-9.00	Al-Dugahym AM et al : Microbiological studies on mastitis in cattle and camels (<i>Camelus dromedarius</i>) in Saudi Arabia	
	9.00-9.15	Fazlani SA et al : Antimicrobial susceptibility of bacterial organisms identified from mastitic milk samples of camel	
	9.15-9.30	Ahmad N et al : Diazinone and Monensin toxicity in camels	
	9.30-10.00	Discussion	
	10.00-10.30	Coffee break	

		Products (meat, skin & hair) (Room 2) Moderator: Pr. Ben Hamouda M	
Day 1 : Thursday, March 12th, 2009	14.00-14.15	Alowaimer A : Proximate composition and mineral contents of major muscles in camel carcasses	
	14.15-14.30	Shareha A : The effect of age on fat deposition in Longissimus dorsi muscle (between 12th – 13th rib) of camel's and compared with those in beef and sheep	
	14.30-14.45	Kamoun M : Quality of camel meat marketed by butchers in Tunisia	
	14.45-15.00	El-Hatmi et al : Study of chemical composition and quality of camel and goat meat	
	15.00-15.15	Kadim IT et al : Effect of low voltage electrical stimulation on meat quality of the one-humped camel (<i>Camelus dromedarius</i>)	
	15.15-15.30	Moslah et al : Dromedary skin production and valorisation in Tunisia	
	15.30-15.45	Mansori et al : Clean technologies and treatment of dromedary skin in Tunisia	
	15.45-16.00	Moslah et al : Production of the dromedary (<i>Camelus dromedarius</i>) hair in Tunisia	
	16.00-16.15	Harizy T et al : The potential textile utilization of the down fibres from Tunisian dromedary	
	16.15-16.30	Discussion	
	16.30-17.00	Coffee break	
		Milk production & technology (Room 3): Moderator: Pr. Khorchani T	
Day 1 : Thursday, March 12th, 2009	14.00-14.15	Correra A & Faye B: Evolution of the consumption of camel milk products in Nouakchott	
	14.15-14.30	Arshad I et al : Milk production potential of pakistani camel (<i>Camelus dromedarius</i>) under the dry conditions of the Punjab	
	14.30-14.45	Hammadi et al : Short time effects of machine and hand milking on milk yield and milk composition in Tunisian Maghrebi Camels (<i>Camelus dromedarius</i>)	
	14.45-15.00	Ayadi M & Casals R : First results on conjugated linoleic acid content of camel milk	
	15.00-15.15	Konuspayeva G et al (Kazakhstan): Variation of vitamin C content in camel milk from Kazakhstan	
	15.15-15.30	Moosavi-Movahedi et al : Bioactive peptides derived from camel whey as high antioxidant status	
	15.30-15.45	Siboukeur O : Evolution of microbial population in dromedary milk during storage: inhibition effect of PP3	
	15.45-16.00	Kihal M et al : Algerian raw camel's milk: identification of dominant lactic acid bacteria and proteins analysis	
	16.00-16.30	Discussion	
	16.30-17.00	Coffee break	
			Milk production & technology (Room 3): Moderator: Pr. Farah Z
	17.00-17.15	Laleye LC et al : Functional properties of camel milk whey proteins	
	17.15-17.30	Gorakh M & Pathak KML : Effect of heat treatment on camel milk whey proteins	
	17.30-17.45	Brasca et al : How to improve the production of fermented camel milk	
	17.45-18.00	Jans C et al : Biodiversity of lactic acid bacteria responsible for spontaneous acidification of camel milk for the purpose of developing a defined susac starter culture	
	18.00-18.15	Njage PMK et al : Enumeration and identification of pathogenic bacteria and yeasts in raw and naturally soured camel milk in Kenya and Somalia	
	18.15-18.30	Khorchani et al : Production of freeze-dried camel milk to expend its uses	
18.30-19.00	Discussion		

		Farm Management Systems & Development Aspects (Room 2) Moderator: Pr. Guerouali A
Day 1 : Thursday, March 12th, 2009	17.00-17.15	Ben Sassi M & Charni M.S : Camel's national development project in Tunisia
	17.15-17.30	Al Mutairi SE : Camel development in the Kingdom of Saudi Arabia
	17.30-17.45	Ben Goumi M : Camel livestock in Mena region: Current situation and development perspectives
	17.45-18.00	Abdelhadi OMA et al : Husbandry practices of camel herders in Kababish Home Land North Kordofan State, Sudan
	18.00-18.15	Tura I et al : Indigenous camel calves management among the Gabbra and the Rendille camel keeping communities in Kenya
	18.15-18.30	Alary V & Faye B: Overview of the camel chains in East of Africa: Importance of gaps between the data and the apparent reality
	18.30-18.45	Ilona Gunsser : Problems in keeping llamas and Alpacas in Germany
	18.45-19.00	de Verdier K & Bornstein S :Alpacas (<i>Vicugna pacos</i>) in Sweden: a new challenge
	19.00-19.15	Discussion
Day 2 : Friday March 13th, 2009		Farm Management Systems & Development Aspects (Room 2) Moderator: Pr. Nagy P
	8.00-8.15	Vias FSG & Faye B : Camel farming, an important contribution to the poverty alleviation in Niger
	8.15-8.30	Kamoun M et al : Dynamics of the camelid meat channel in Tunisia
	8.30-8.45	Koussou MO: Production and marketing of milk in Chad: the case of Oualad Rachid Arabes transhumants in Chad
	8.45-9.00	Farah et al : Camel dairy in Somalia: Limiting factors and development potential
	9.00-9.15	Nagy P & Juhasz J : Intensification of milk production and machine milking of dromedary camels (<i>Camelus dromedarius</i>)
	9.15-9.30	Bakheit SA et al : The impact of farming system on Sudanese camel calves growth rate
	9.30-10.00	Discussion
	10.00-10.30	Coffee break
		Farm Management Systems & Development Aspects (Room 2) Moderator: Pr Faye B
	10.30-10.45	Mohammed I & Hoffmann I : Factors influencing price of dromedary in northwest Nigeria
	10.45-11.00	Kuria SG et al : Strategies for improving the marketing of camel and camel products: A case study for the arid and semi-arid Northern Kenya
	11.00-11.15	Anastasia K : Better future for camel keepers: Value addition of camel hides and marketing in Northern Kenya
	11.30-12.30	Poster session: Farm Management Systems & Development Aspects/Products
	12.30	Lunch
		Farm Management Systems & Development Aspects (Room 2) Moderator: Pr Guerouali A
	14.00-14.15	Field CR : The camel as a source of income to pastoralists
	14.15-14.30	Ghazanfari SR : Intrepreneurship in camel Breeding
	14.30-14.45	Mohammed I & Hoffmann I : Harnessing dromedary for land preparation in smallholder farming system in northwest Nigeria
	14.45-15.00	Trigui S : Between Arabs and camels a life story
15.00-15.15	Van Straten M : New World Threats for the Old World Camel	
15.15-16.45	Discussion	
16.00-16.30	Coffee break	

		Physiology, pharmacology & biochemistry (Room 4): Moderator: Souilem O
Day 1 : Thursday, March 12th, 2009	17.00-17.15	Omer S. A. & Gameel AA : Normal values of some synovial fluid constituents in Sudanese camels (<i>Camelus dromedarius</i>)
	17.15-17.30	Achaaban MR et al : The cerebrospinal fluid in the dromedary camel (<i>Camelus dromedarius</i>): sampling and composition
	17.30-17.45	Elrayah AH et al : Assessment of thyroid hormones (Tri-iodothyronine T ₃ and Thyroxin T ₄) in Sudanese camels (<i>Camelus dromedarius</i>)
	17.45-18.00	Djazouli AFZ et al : Immunohistochemical demonstration of Vimentin and Neuron-Specific Enolase in the hypothalamo-neurohypophysal system of dromedary
	18.00-18.15	Blanc M et al: A simple one-step purification of immunoglobulin G from camel blood plasma proteins in view of a possible colostrum substitute
	18.15-18.30	Al-Sobayil FA : Influence of gender on bone formation and bone resorption biomarkers in sera of racing dromedary camels
	18.30-18.45	Abu Nikhaila AM & Eisa MO : Observations on some aspects of milk letdown in the she-camel
	18.45-19.00	Discussion
		Physiology, Pharmacology & Biochemistry (room 3) Moderator: Pr Ben Goumi M
Day 2 : Friday March 13th, 2009	8.00-8.15	Rahman ZU et al : Milk composition and enzyme profile of female camel (<i>Camelus dromedarius</i>) injected with oxytocin
	8.15-8.30	Rahman ZU et al : Effect of repeated doses of oxytocin on the lactoperoxidase system of milk in female camels (<i>Camelus dromedarius</i>)
	8.30-8.45	Mohammed Youssif F et al : Pharmacoclinical and residues studies of Cymelarsan® in Sudanese one humped camels (<i>Camelus dromedarius</i>) infected naturally with <i>Trypanosoma evansi</i>
	8.45-9.00	El Hraïki A et al : Florfenicol pharmacokinetics disposition after a single intramuscular administration in camel (<i>Camelus dromedarius</i>)
	9.00-9.15	Wasfi IA et al : The pharmacokinetics and pharmacodynamics of flumethasone in camels
	9.15-9.30	Elghazali M et al : Isolation and identification of lidocaine and prilocaine and their metabolites in camel urine samples after subcutaneous injection
	9.30-9.45	Khogali SME et al : Preliminary pharmacological investigation of camel urine
	9.45-10.00	Discussion
	10.00-10.30	Coffee break
		Physiology, Pharmacology & Biochemistry (room 3) Moderator: Pr Belhaj O
Day 2 : Friday March 13th, 2009	10.30-10.45	Sboui A et al No effect of Can-Insulin as adjunct to camel milk to treat alloxan – induced-diabetic dogs
	10.45-11.00	Aichouni A et al : Preliminary studies of common parameters hematological and biochemical serum dromedary in Algeria
	11.00-11.15	Sboui A et al : Effect of camel milk on blood glucose, cholesterol and total proteins variations in Alloxan – induced diabetic dogs
	11.15-11.30	Barhoumi K et al : Glucose tolerance and insulin tests in camel (<i>Camelus dromedarius</i>)
	11.30-11.45	Souilem O et al : Intestinal disaccharidase activities in camel (<i>Camelus dromedarius</i>): comparison with true ruminants
	11.45-12.00	Discussion
	12.00-12.30	Poster Session Physiology, Pharmacology & Biochemistry/Surgery & Anatomy
12.30	Lunch	

		Nutrition and behaviour (room 4) Moderator: Pr. Alhadhrami G
Day 2 : Friday March 13th, 2009	8.00-8.15	Iqbal A et al : Foraging behaviour of dromedary camels in the mountainous of the Punjab , Pakistan
	8.15-8.30	Al-Mabruk RM & Ab-Aishia A M : Grazing behavior of camels and the nutritive value of some selective range plants in the Libyan Rang
	8.30-8.45	Khorchani et al : Forage intake and diet digestibility in Maghrebi milking camel under oasis conditions
	8.45-9.00	Keita A et al. : Feed intake, <i>in situ</i> degradation and ruminal fermentation in camels during water deprivation and rehydration
	9.00-9.15	Shawekt SM et al : Effect of feeding Atriplex halimus to pregnant and lactating camel on milk yield and calf performances
	9.15-9.30	Samsudin AA et al : The protozoan community of the foregut of the dromedary camel
	9.30-9.45	Samsudin AA et al : DNA profiling of the bacterial community in the foregut of the dromedary camel
	09.45-10.00	Discussion
	10.00-10.30	Coffee break
		Nutrition and behaviour (room 4): Moderator: Pr. Kraiem K
	10.30-10.45	Seboussi R et al : Selenium review in dromedary camels (Camelus dromedarius): Selenium status, GSH-Px activity, hair and organs distribution and excretion
	10.45-11.00	Faye B et al: Maternal transfer of selenium by blood and milk in camel
	11.00-11.15	Al Subaie SM : Camels behaviors and habits
	11.15-11.30	Chammem M et al : Relation of coexistence between camels and wild animals
	11.30-11.40	Discussion
	11.40-12.30	Poster Session Nutrition and behaviour/Genetic
	12.30	Lunch

		Reproduction (Room 1) Moderator: Pr Hammadi M	
Day 2 : Friday March 13th, 2009	10.30-10.45	Vyas S : Early postpartum breeding: a practical approach to reduce calving interval in dromedary camel	
	10.45-11.00	Qureshi ZI & AL-Jabouri A : Clinical prevalence of reproductive disorders in dromedary camel under field conditions	
	11.00-11.15	Sghiri A et al : Clinical and histological investigation of the post-partum in the female dromedary	
	11.15-11.30	Discussion	
	11.30-12.30	Poster Session Diseases / Reproduction	
	12.30	Lunch	
			Reproduction (Room 1) Moderator: Pr Skidmore J
	14.00-14.15	Al Sobayil KA et al : Pregnancy rate following synchronization of estrus and natural mating in camels (<i>Camelus dromedarius</i>)	
	14.15-14.30	Trasorras V et al : Effet of estradiol on maternal recognition of pregnancy after embryo transfer in Llama	
	14.30-14.45	Kershaw-Young CM & Maxwell WMC : Glycosaminoglycans in the alpaca reproductive tract	
	14.45-15.00	El-Bahrawy KA, El-Hassanein, EE : Effect of different mucolytic agents on viscosity and physical characteristics of dromedary camel semen	
	15.00-15.15	Wani, NA & Skidmore JA : Transvaginal ovum pick-up in super-stimulated dromedary camels (<i>Camelus dromedarius</i>)	
	15.15-15.30	Skidmore JA & Billah M : Embryo transfer in dromedary camels using asynchronous recipients	
	15.30-15.45	Khatir H & Anouassi A : Nuclear transfer in dromedary (<i>Camelus dromedarius</i>) using in vitro matured oocytes and two donor cells sources: adult fibroblast and granulosa cells	
15.45-16.00	Discussion		
16.00-16.30	Coffee break		
	16.30-19.00	General Assembly of ISOCARD: [Election of new Executive Council members]	

		Surgery & anatomy (Room 4): 14.00-16.30 Moderator: Pr. Souilem O
Day 1 : Thursday, March 12th, 2009	14.00-14.15	Eisa MO & Ishag IA : Udder morphometry and milk yield of Lahween Camel (<i>Camelus dromedarius</i>)
	14.15-14.30	Rejeb A et al : Histomorphometric variation of thyroid gland of the dromedary (<i>Camelus dromedarius</i>) according to age, sex and season in Tunisia
	14.30-14.45	Rejeb A et al : Anatomopathologic study of the goitre in the dromedary (<i>Camelus dromedarius</i>) in Southern Tunisia
	14.45-15.00	El Allali K et al : Gross anatomy and histology of the hypophysis of camel (<i>Camelus dromedarius</i>)
	15.00-15.15	Al-Assad A et al : Histological studies of testicular structure with relative to puberty in Shami Camel (<i>Camelus dromedarius</i>)
	15.15-15.30	Stelletta C et al : Testicular cytology of alpaca: comparison between impressed and smeared slides
	15.30-15.45	Desantis S et al : Glycohistochemical characterization of cell types in the allantoic duct epithelium of the dromedary umbilical cord
	15.45-16.00	Peshin PK et al : Clinical evaluation of medetomidine hydrochloride as sedative and its reversal with atipamizole in camels
	16.00-16.15	Jadon NS et al : Comparative evaluation of yohimbine and atipamezolefor reversal of medetomidine in camels
	16.15-16.30	Discussion
	16.30-17.00	Coffee break

		Genetics (Room 4) Moderator: Pr Djemali M
Day 2 : Friday March 13th, 2009	14.00-14.15	Ishag IA et al : Phenotypic characterization and description of Sudanese camels (<i>Camelus dromedarius</i>)
	14.15-14.30	Ould Ahmed M et al : Camel genetic resources in Tunisia
	14.30-14.45	Alnajjar K et al : Genetic Parameters of Some Productive Characteristics on Shami Camels in Syria
	14.45-15.00	Mehta SC & Bhure SK : Microsatellite analysis of Indian dromedary breeds
	15.00-15.15	Piro M et al : Genetic characterization of Moroccan camel populations by using microsatellite markers
	15.15-15.30	Hermas S : Genetic and environmental factors affecting camel heifer reproduction
	15.30-15.45	Ben Salah R et al : Genetic diversity of Tunisian dromedary (<i>Camelus dromedarius</i>) as revealed by microsatellites
	15.45-16.00	Ould Ahmed M et al : The use of microsatellite markers for detection of genetic diversity in Tunisian dromedary (<i>Camelus dromedarius</i>) populations
	16.00-16.15	Discussion
	16.15-16.30	Coffee break

Day 3	Time	Activities/sessions	Room
Saturday 14 th , March 2009			
Morning	8.00-10:00	Round tables for collaborative research projects	
		* Promoting the camel as model species for sustainable model in arid climates (Coordinator: Pr. Faye B)	1
		* Milk production in intensive system (Coordinator : Pr. Nagy P)	2
		* infectious diseases, Immunology (Coordinator : Pr. Kechrid F)	3
	10-10:30	Break coffee	
	10:30-12	Closing session	1
Afternoon	12:30	lunch	
		Optional post conference tours (see social program)	

List of posters

Diseases & Medicine Room 1 (11:30 – 12:30)
Kane Y et al : Prevalence of Sarcocystis spp. in the dromedaries meats consumed in Nouakchott (Mauritania)
Goreish IA et al : Internal parasites and Trypanosomosis prevalence in camels in Gedarif and Kasala, Eastern Sudan
Rahman Z et al : Dynamics of cystic fluid, serum biochemical, amino acid and mineral profile in Echinococcus granulosus affected camels
Seddik MM : Clinical case of Echinococcosis in dromedary camel
Seddik MM et al : Ticks infestation in dromedary camel in spring and summer periods in southern Tunisia
Al-Hizab F & Ramadan RO : Joint Diseases in camel (Camelus dromedarius) in Saudi Arabia
Ramadan RO et al : Clinicopathological Studies on Mastitis in Camels (Camelus dromedarius) in Saudi Arabia
Al Juboori A et al : Some aspects of haemorrhagic disease in camels
Bouhous A : Study of camel parasitism with Ixodidae in South Algeria (Adrar area)
Gluecks IV et al : Combination of participatory approaches and molecular diagnostics to investigate the epidemiology of Haemorrhagic Septicaemia in camels (Camelus dromedarius)
Sahibi H et al : Ticks infesting camels in Morocco
Tejedor-Junco MT et al : Prevalence, serotypes and antimicrobial resistance patterns of Salmonella isolates from apparently healthy camels in Canary Islands (Spain)
Brostein S & De Verdier K : Important ectoparasites of alpaca (Vicugna pacos) and Llama (Lama glama)
Hussain MH et al : Gastrointestinal helminthiasis in one humped camels (Camelus dromedarius) of metropolis jhang, Pakistan
Fouda TA et al : Impacts of some disease conditions on the cellular and biochemical constituents of blood and biophysical characteristics of ruminal fluid in Arabian Camels (Camelus dromedarius) in Saudi Arabia
Umar YA et al : Distribution of some ecto-parasites infesting camels in Kano State, Nigeria.
Bakhiet AO et al : Studies on the lung pathology of camels (Camelus dromedarius) in Tamboul slaughter house, Sudan
Aissaoui C et al : Ticks infestation in dromedary camel in South-east of Algeria
Sadiq MA et al : Epidemiological logical investigation of Brucellosis in one humped camels (Camelus dromedarius) in lake chad area of Borno state, Nigeria
Abubakar MS et al : Studies on lung lesions and associated agents in One-Humped Camel (Camelus dromedarius) in Northwestern Nigeria
Yagi RA et al : The sensitivity of Trypanosoma evansi infection in camels to treatment with Quinapyramines and Cymelarsan
Sheick E.A & Al Saiady MY : The use of Baymec 1% (ivermectin) in treatment of parasites in camels
Desquesnes M et al: First outbreak of trypanosomosis due to Trypanosoma evansi in camels, Camelus dromedarius, in Aveyron, metropolitan France: diagnosis, treatment and follow up

Products Room 2 (11:30 – 12:30)
Ouologuem B et al : Influence of cotton side cake on camel milk production
Raziq A & Younas M : Milk composition as affected by parity and stage of lactation in Kohi camel of Balochistan, Pakistan
Gnan SO & Gdeeri H : Effect of lactoperoxidase in preserving raw camel milk and its effect on some pathogenic bacteria
Gorakh M & Pathak KML : Camel milk-properties and its products
Boudjenah S et al : Contribution to Optimisation of Cameline Cheese Using Gastric Enzymes from Dromedaries of Different Ages
Zaied RH & Yassin OE : Production and consumption of camel milk in Khartoum State, Sudan
Al-Dobaib SN : Effect of palm oil supplementation on composition and milk yield in camel
Aljumaah RS et al : Effect of Udder Health Status on some Milk Constituents of Camels in Riyadh Area, Saudi Arabia
Bensalah F et al : A preliminary study of taxonomic enterococci isolated from dairy camel by using PCR based method
Bensalah F et al : Characterization of thermoresistant cocci from fermented milk in arid area and DNA identification of atypical enterococci and lactococci strains
Akhmetsadykova S et al (Kazakhstan): Interaction of lead and cadmium with lactic bacteria isolated from camel milk and shubat from Kazakhstan
Seifu E : Production, handling, preservation and utilization of camel (Camelus dromedarius) milk in eastern Ethiopia
Ahmed NAA & El Zubeir IEM : Effect of salt level on some physico-chemical properties and acceptability of camel milk
El Hatmi H & Khorchani T : Identification of minor proteins camel colostrums and mature milk by two-dimensional

electrophoresis
Ibrahim GA & Nour IA : Physical and chemical properties of burgers manufactured with different levels of camel meat
Moslah M et al : Monitoring of private dromedary calves fattening units in southern Tunisia
Mohamed HK et al : Evaluation of performance and carcass characteristics of camel-calves fattened with molasses
Harizi T et al : Worsted yarn performances of dromedary hairs

Farm Management Systems & Development Aspects Room 2 (11:30 – 12:30)
Dioli M : Traditional Milking, Fostering and Weaning techniques of the One-Humped camel (<i>Camelus dromedarius</i>) in the Horn of Africa
Berredjough D et al : Situation of the camel breeding in Ziban region of Wilayat Biskra Algeria ituation of the breeding of Cameline in the wilaya of Biskra (case of Ziban)
Albrecht CEA : Camel milk marketing: Challenges and constraints
Miranzadeh H et al : Camel situation in Iran
Yagoub SO : Camels in Sudan and challenges faced their breeding and production
Miranzadeh H & Ghazanfari SR : Job opportunities in camel breeding
Al-Ani FK : Camels of Oman: Management and Diseases
Kamili A et al : Camel farming types and skin diseases in Morocco: preliminary results
Ngeiywa KJ : How Kenya Camel Association is promoting the camel as a model species for sustainable development in ASALs of Kenya

Physiology, Pharmacology & Biochemistry Room 3 (12:00 – 12:30)
Abbas M et al : Relationship study of mineral status with reference to soil, water, serum, urine and faeces at different physiological stages in camels (<i>Camelus dromedarius</i>)
Peshin PK et al : Effect of thiopentone on osmotic fragility of erythrocytes in camels
Abdelrahman SH et al : Preliminary chemical screening and thin layer chromatography of camel urine
Atigui M et al : Milk partitioning in the udder of Tunisian Maghrebi dairy camel (<i>Camelus dromedarius</i>)
Wasfi IA et al : The pharmacokinetics of salbutamol in camels
Omer SA & Gameel AA : Normal concentration of some cerebrospinal fluid constituents in Sudanese camels (<i>Camelus dromedarius</i>)
Khalifa SAM et al : Study of the treatment effect of camel's urine and milk on liver and kidney of rats carcinogenic by carbon tetrachloride in comparison with chemotherapy (cytological, Histological& Ultrastructural studies)
Al-Qudah KM : Level of antioxidant enzymes and peroxidation products in camel (<i>Camelus dromedarius</i>) blood at lower altitude at the dead sea (-400m)
Rahman Z et al : Biomarkers of health and minerals status in pregnant camels (<i>Camelus dromedarius</i>)
Ismail S et al : Vitamin A and vitamin E: she-camel's serum concentrations and state of transfer before and after colostrum intake
Djegham M et al : Contribution to the study of blood glucose in the dromedary in the region of Kairouan (Tunisia Central)
Djegham M et al : Blood lipid profile of camels in Tunisia and physiological changes

Surgery & Anatomy Room 3 (12:00 – 12:30)
Jain RK : Topographic anatomy, blood supply and nerve supply of the muscles of the eye ball in camel (<i>Camelus dromedarius</i>)
Azrib R et al : Abdominal Ultrasonography in the Dromedary (<i>Camelus dromedarius</i>)
Achaaban MR et al : The cerebral ventricles of the dromedary camel (<i>Camelus dromedarius</i>): conformation and topography
Omer NS & Osman D : Histochemical investigation on the carotid and aortic bodies and the related arteries of the dromedary camel
Barhoumi K et al : Electrocardiogram in young male camel (<i>Camelus dromedarius</i>)
El Allali K et al : The osteology of the head of the camel (<i>Camelus dromedarius</i>): Revisited
Guintard C et al : Isolated, injected and MRI aspects of the dromedary's kidney

Nutrition and behaviour Room 4 (11:40 – 12:30)
Chaibou M. et al : Pastoral productivity of Niger arid regions and their valorisation by dromedary
Mustafa AB & Abdel Atti KA : Some Trace Minerals Profile in Natural Pasture and Blood Serum of Camel in Butana Region, Sudan

Chehma A & Faye B : Spatial and seasonal variation of chemical composition of desert plant and camel faeces
Boubaker A et al : A comparative study of ruminal fermentation, protozoa population, in vitro fermentation and in situ degradation in camels, sheep and goats
Seboussi R et al : Selenium toxicity in dromedary camel (<i>Camelus dromedarius</i>)
Basmaeil S : Calculating Camel Dietary Requirement Compare to Cattle NRC Requirement
Laudadio V et al : Fecal liquor as microbial inoculum source for in vitro (DaisyII) technique to estimate the digestibility of feeds for camels

Reproduction Room 1 (11:30 – 12:30)
AL-Sobayil KA : Seasonal variation of reproductive behaviour and hormone concentrations in dromedary camels in Al-Qassim region of Saudi Arabia
Adamou A & Bairi A : Peripheral levels of estradiol-17 β and progesterone in Chaambi dromedary camel during the beginning of the sexual season
Monaco D et al : Ovarian steroid levels in female dromedary camel (<i>Camelus dromedarius</i>) after male parades during the non breeding season
Al-Eknah MM : The Dilemma of the Left Horn Predominance in the Camelid Pregnancy: Uterine contractility
Salhab SA et al : Monitoring the testosterone and Luteinizing hormone with relative to puberty in growing male Shami camels (<i>Camelus dromedarius</i>)
El-Battawy KA : Morphology of the testes of one humped camel (<i>Camelus dromedarius</i>) in relation to the testosterone profile and epididymal sperm content
Stelletta C et al : Effect of GnRH test on scrotal surface temperature in Alpaca
Morton K M et al : Assessing the effects of preservation on Camelid sperm: the full picture
Hammadi M et al : Biophysical and biochemical characteristics of Maghrebi dromedary semen
Kershaw-Young CM et al : Semen Characteristics in the Alpaca

Genetics Room 4 (11:40 – 12:30)
Chniter M et al : Body measurements in Maghrebi camel types (<i>Camelus dromedarius</i>) in the Southern Tunisia
Raziq A & Kakar M A : Who came first in suleiman mountainous region? Bacterian or dromedary
Raziq A & Younas M : Raigi camel: a newly discovered breed from Balochistan, Pakistan
Hashim Mohamed W et al : Molecular identification of some Sudanese and African camel types using RAPD-PCR (DAF/AP-PCR)
Khoory H. et al: Sequencing the M-allele for microsatellite markers used for paternity testing of <i>Camelus dromedarius</i>
El khasmi M et al: Effects of preslaughter stress on meat quality and phosphocalcic metabolism in Camels (<i>Camelus dromedarius</i>)

Oral Communications

Communications orales

Diseases & Medicine

Abstract # 1

Diseases of the One-humped Arabian camel (*Camelus dromedarius*)

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Twenty-two salient clinical symptoms indicative of disease in the One-humped Arabian camel (*Camelus dromedarius*) are described.

Eight viral infections causing clinical disease in camels (Camel pox, contagious ecthyma, camel papillomatosis, neonatal diarrhea, rabies, Rift valley fever, parainfluenza, Peste des petits ruminants –PPR) and their etiological agents are tabulated. The clinical picture of the disease caused by the first five viruses are shown. Moreover, five non-pathogenic viral infections (Foot-and-mouth, Akabane disease, blue tongue, infectious bovine rhinotracheitis and African horse sickness) for which camels are seropositive without showing clinical signs are also tabulated.

Twenty-seven bacterial and one fungal disease and their etiological agents are tabulated (Anthrax, brucellosis, salmonellosis, hemorrhagic septicemia, pseudotuberculosis, contagious skin necrosis, pneumonia, tetanus, blackleg, enterotoxaemia, paratuberculosis "John's" disease, tuberculosis, colibacillosis, nocardiosis, listeriosis, strangles, leptospirosis, dermatophilosis, mastitis, abscesses, neonatal diarrhea, otitis media, hemorrhagic disease, keratoconjunctivitis, heart water, anaplasmosis and chlamydiosis). The clinical picture, pathological and/or histopathological changes produced by 15 of these diseases are shown.

Eight protozoa infecting camels are tabulated (Trypanosomiasis, babesiosis, theileriosis, blantidiasis, coccidiosis, trichomoniasis, toxoplasmosis, sarcocystosis). The clinical picture and/or pathological changes of 4 of these diseases are shown.

Sixteen genera and 32 species of Nematodes and Three genera and five species of Filarial worms infecting camels and their site of infection are tabulated. Samples of eggs of some nematodes are shown. Six genera and nine species of Trematodes infecting camels together with their intermediate hosts and site of infection are tabulated. The mature worms, eggs and pathological changes caused by two genera of these worms are shown.

Two genera and three species of Cestodes infecting the small intestine and one genus and species infecting the bile ducts of camels are tabulated. The intermediate stages of Cestodes infecting the small intestine of *Canidae* (*Hydatid cysts of Echinococcus granulosus*, *Cysticercus cerebralis of Taenia multiceps*, *Cysticercus tenuicollis of Taenia hydatigena* and *Cysticercus dromedarii of Taenia hyaenae*) and *Cysticercus bovis of Taenia saginata* infecting the small intestine of man are tabulated and are shown in the different organs and muscles of camels. The clinical picture and signs of mange caused by *Sarcoptes scabiei*, adult and embryonated eggs, life cycle of the mite and the pathological changes resulting from the disease are shown. Different genera and species of ticks infesting camels are tabulated and shown. Flies causing different types of myiasis and flies causing nuisance and transmitting viral, bacterial and parasitic diseases to camels are also tabulated and shown.

The clinical picture and/or pathological changes of some management (lactic acidosis, bloat) and nutritional deficiency diseases (copper, selenium and vitamin E) are shown.

The clinical picture and post mortem changes caused by *Aspergillus clavatus*, Salinomycin and aluminium toxicity resulting in the mortality of a large number of camels fed accidentally on contaminated wheat bran is shown.

Key words: Viral infections, bacterial and fungal diseases, Arabian camel.

Abstract # 2

Camel dermatophilosis: A review

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Camels were formerly considered resistant to most of the diseases commonly affecting livestock, but as more research was conducted, camels were found to be susceptible to a large number of pathogenic agents, particularly, skin diseases. The most common dermatologic problems in camels include: mange, ringworm, pox, papillomatosis, dermatophilosis, pruritus, alopecia, non-healing wounds, nodules and tumours, and ulcerative disorders and abscesses.

Dermatophilosis is a skin disease caused by a bacterium called *Dermatophilus congolensis*. The disease affects many species of domestic and wild animals and occasionally, humans. It is most prevalent in the tropics. The lesions are characterized by an exudative dermatitis with scab formation. The disease causes severe skin matting resulting in hide depreciation, overall decrease in animal productivity and, in severe cases, mortality in susceptible weak animals may be as high as 50% in the absence of treatment. *Dermatophilus sp.* has hyphae, or branching filaments similar to fungi, and also produces spores. Factors including prolonged wetting of the skin, high humidity, high temperature, and various ectoparasitosis infestations that can damage the skin surface are required to influence the development, seasonal incidence and transmission of dermatophilosis.

Although only recently (in 1990) described, camel dermatophilosis is recognised as widespread in several camel rearing countries in the tropics. Natural *D. congolensis* infection of camels was first reported in Kenya in semi-arid conditions. Camel dermatophilosis was found to be one of the most serious skin problems faced by camel herders in Butana area of Sudan and in several camel rearing areas in Saudi Arabia where *D. congolensis* and *Microsporum gypseum* infections have both been recorded as mixed infections in a camel dairy farm. Camel calves were more likely to be infected than adults. Lesions began as hair matting and later developed hard crusts. Fatality ranged from 10 to 30%.

The most effective control measure of this disease was thought to be through control of tick infestations. Several treatment regimes were tried in other animal species but with varying degrees of success. The only control method of this disease practiced in dromedary camels was the regular washing with 1% potassium aluminium sulphate solution.

The review details some aspects of the clinical picture, epidemiology, chemotherapy and control measures of the disease in camels.

Key words: Dermatophilosis, camel.

Abstract # 3

Review of research on camel Trypanosomosis due to *Trypanosoma evansi*

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Camel trypanosomosis due to *Trypanosoma evansi* is transmitted mechanically by hematophagous diptera (tabanids, stomoxids, hippoboscids). In its acute form, the disease results in a generalized weakness. The animal lies down as of the least effort, the milk production falls with the abortion of females. Often the animal dies after a prolonged decubitus. But in 80% cases, the disease is in its chronic form which characterized by considerable economic losses: abortion, reduction in milk production, loss weight, even cachexia, etc

T. evansi is widespread throughout the world as well in moderate climate as in very hot climate and arid or hot and wet climate. It infects mainly dromedaries, in Africa, buffaloes, cattle and horses, in Asia and horses in Latin America. This is why the reason that the disease for which it is responsible received various local names: *Surra*, *Tabourit*, *Debab*, *Dioufar*, *Mal de Caderas*, *Derrengadera* etc. So, in order to better apprehending the incidence and the economic importance of this parasite, to specify its various receptive hosts, to harmonize the diagnosis and to promote its treatment, a working group within OIE was created in 1983.

With the climatic changes which condition the ecology of *T. evansi* vectors and the transhumance of animals causing mixing and concentration in the pasture and the water points of the dromedaries with other animals, the difficulty to detect *T. evansi* during chronical form, with the development of new tools for the diagnosis (molecular biology), and the tools to study risk factors affecting camels trypanosomosis (SIG), the absence of new trypanocides on the market as consequence the adaptation of *T. evansi* stocks to the old the trypanocides, even selection of trypanoresistant stocks, the author present the review of research and factors that it is necessary to integrate in an epidemiologic approach to study camel trypanosomosis.

Key words: Camel trypanosomosis, *T. evansi*, dromedaries, mechanical vectors, diagnosis, epidemiology.

Abstract # 4

Causes of death in camel herds in pastoral zone of Zinder (Niger)

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In order to determine the causes of death in camel (*Camelus dromedarius*) herds managed extensively, 1875 camels, shared in 20 herds, were monitored in the North of Zinder in Niger. The results showed that the mean mortality rate of herd was 4.4%. Except in the first year where the mortality rates were 23 and 34% respectively in the class of age 0-1 year and 1-2

years, the between year variability of the mortality was low. Elsewhere, the probability of death before weaning did not vary between males and females. The mortality rate was 5.9% at six month weaning and 9.9% at 12 months whatever the gender. At reverse, the study of mortality by class of age according to the gender showed that most of the death involved the males less than 2-year old and the female less than one-year old. The higher sensitivity of males between 1 and 2 years could be linked to an early weaning in order to satisfy the milk needs of the family.

The determination of the causes of death in camels revealed that young camel diarrhoea was responsible of 80% of the losses. This study confirmed that the health disorders were the main constraints to the camel productivity in extensive system in Niger.

Key words: Mortality, camel, extensive system, Niger

Abstract # 5

Death of camels in Saudi Arabia: Analysis of suspected and unknown causes

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Several disease conditions are encountered as cause of death among camels; but much more cases are passed only with tentative diagnosis. In the last two decades, a total number of 1230 camel cases were reported. Areas of investigation were as following: Saudi-Kuwait zone, Hafer Al-Batin, Alhindia, Guibah, Dawasir, Al-Khurj and open desert. Toxicity by organic and inorganic substances were assumed. Nervous signs in most cases and GIT disturbances in some cases were reported. The paper discusses clinical and epidemiological findings behind the death. Preventive measures to avoid such problem shall be pointed as a significant role.

Key words: Sudden death in camels, Saudi Arabia.

Abstract # 6

**Camel sudden death syndrome outbreak of an unknown camel disease
in the Horn of Africa**

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In December 2005 unusually high numbers of camel deaths were reported from Afar and Oromia Region of Ethiopia. Similar reports were received from Somalia (2006), South Ethiopia and North Kenya (2007). The syndrome named ‘Camel Sudden Death’ (CSD) mainly affected adult camels, especially lactating and pregnant females, breeding bulls and pack camels. – Investigations were carried out in Ethiopia (2006) and jointly in Somalia and Kenya in 2007. Field investigations using Participatory Epidemiology and data analysis supports the hypothesis that CSD is a new disease entity in camels, as it does not have any traditional disease names in the many local pastoralist languages of the region. Median within herd mortality rates were calculated at 6.8 % and 2 % for Kenya and Somalia, respectively. Laboratory findings indicated that Anthrax, other bacteria and parasites commonly found in camels were not involved in CSD. Inflammatory cell responses seen in histology and results from attempted virus isolation carried out in Kenya indicated involvement of a viral agent. Dead camels showed myocarditis, myocardial and sub-epicardial bleeding and left-sided congestive heart failure. Analysis by immunohistology for the detection of inflammatory infiltrates and PCR investigation using primer pair specific for conserved regions of *enterovirus (EV)*, *adenovirus (ADV)*, *cytomegalovirus (CMV)*, *Ebstein Barr virus (EBV)*, *parvovirus B 19 (PVB 19)*, *influenza virus A*, *chlamydia pneumonia* and *Borrelia burgdorferi* failed to identify any causative agent.

Key words: Camel Sudden Death, immunohistology analysis, PCR.

Abstract # 7

Camel death in the Zoo of Ica Peru

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Ten adult camels (5 males and 5 females) died successively following severe respiratory symptoms. They have been placed in the zoological park of Ica where the climatic and geographical conditions are ideal for the dromedary. They were fed mainly and sometimes exclusively alfalfa hay. They received corn straw occasionally, dried leaves of artichokes or

dried asparaguses. This diet shows a nutritional unbalance with very high level of nitrogen. Indeed, three days before the beginning of the symptoms, the dromedaries received high quantities of young and fresh plants of alfalfa (10 kg/animal/day). First, camels presented the following clinical signs: inanition, nasal discharge, respiratory embarrassment, vomiting and death in 1 to 2 days. Antibiotic and corticoid injections had no effect. Except high blood urea concentration (28 mmol/l), toxicological, bacteriological and parasitological laboratory analysis were normal especially:

- no gastrointestinal parasites, nor *fasciola hepatica* larvae nor bronchopulmonary parasite larva, no parasitemia;
- no clostridia in the intestinal contents;
- no trypanosoma in the blood;
- no antrax nor salmonella nor pasteurella in blood;
- no johne's diseases;
- normal biochemical and hematological blood parameters
- Clinical pathology examination showed low renal and hepatic congestion and interstitial pneumonia with congestion and no macrophage infiltration.

The diagnosis would be in favor of food poisoning. The food sudden change can be also at the origin of a toxi-infection (struck). In the same way, the poisoning by the mycotoxines could be also considered.

Key words: Camel death, food poisoning, mycotoxines.

Abstract # 8

Management of Pox in camels: a report

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Among the world camel population of 19.3 million, Indian sub-continent has a total of 0.63 millions of camels with 7th position (FAO, 2005). The camels are mostly confined to the Western arid parts as well as Thar desert of India contributing to one of the livelihood resource for the farmers prevailing in this area. Camels, though hardy animals do suffer from viral, bacterial and parasitic diseases and the losses conferred due to these infections pose a major threat to the camel owners. The morbidity due to these infections does have a greater economic significance.

In the present paper, camel pox a viral disease affecting camels, caused by orthopox virus will be described. A total of 10 clinical cases suffering from camel pox were studied for their clinical implications, disease pattern, feeding and management practices followed during the course of disease. A total of 3 camels suffered from rise in temperature, which was controlled after therapy. The entire course of disease was around 2-4 weeks depending on the severity of lesions. No mortality was observed in these camels. The primary stage of erythema, followed by papule, vesicle, pustule and later scab formation was noticed. The skin lesions were noticed on face, eyes, oral mucosa, neck, hind parts of the body, legs etc. In severely affected cases lesions were noticed almost on the entire body surface. The haematological parameters viz., Packed cell volume, Haemoglobin, Total Leucocyte Count and Differential leucocyte counts were done at weekly intervals till day 21. The biochemical parameters of serum protein profile, creatinine, bilirubin were also estimated till day 21 at weekly intervals. Long acting antibiotic was administered at 72-hour interval twice or thrice depending on clinical

condition. Levamisole were administered on alternate days thrice. In the feeding schedule plenty of neem (*Azadirachta indica*) leaves were administered. All the camels were recovered within a month.

Key words: Camel pox, clinical symptoms, biochemical parameters.

Abstract # 9

An outbreak of *Trypanosoma evansi* infection in camels and equines in mainland Spain

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An outbreak of *Trypanosoma evansi* (surra) infection occurred in Alicante province, mainland Spain, is described. The affected farm was composed of 50 horses, 20 donkeys and 21 dromedary camels. All these animals were used for riding and for traditional parties in the province and in other surrounding areas.

So far, camels had been imported from the Canary Islands in the past with any health problem. However, one camel out of 5 camels which had been imported in September 2007 from an infected area located in Gran Canaria island, developed clinical signs of surra 6 months after its arrival and *T. evansi* was detected by blood smear examination. The main clinical signs observed were anorexia, progressive weight loss and severe anemia.

The animal was treated with melarsomine (Cymelarsan®, 0.25 mg/kg b.w.) and improved within 2 weeks after treatment. Afterwards, the prevalence of surra was assessed in all animals present in the farm with following results :

- 17 camels were seropositive using CATT/*T. evansi* (ITM, Antwerp, Belgium) and 7 were parasitaemic (Woo technique),
- 2 donkeys were seropositive and one of them was also parasitaemic (by PCR)
- 1 young horse (a female colt) was seropositive and parasitaemic (Woo technique).

Based on these results all camels, all donkeys and the colt group were treated using melarsomine (Cymelarsan®) at 0.50 mg/kg b.w both for camels and equines. The first blood evaluation 48 hours after treatment, performed on all positive animals (by serology and/or parasitology), showed non parasitemia by Woo technique. Other blood examinations will be necessary in order to assess the absence of parasitaemia in the treated animals and their progressive sero-conversion.

Key words: *T evansi*, clinical sings, PCR, camels, equines, Spain.

The evolution and prevention of the *Trypanosoma evansi* (Surra) outbreaks in dromedary camels (*Camelus dromedarius*) on the European mainland

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Chronologically, the *Trypanosoma evansi* infection in dromedary camels appeared in Europe for the first time in the insular part of Spain (Canary islands) in 1997 in a dromedary presenting the chronic form of the disease, then in France (departement of Aveyron) in 2006 following the importation of 5 camels from the infected island Gran Canaria and again in Spain but on the mainland (province of Alicante) in camels and some equines in April 2008. Surra in camels, being not an OIE listed disease like Surra in horses, was not officially reported to the World Organisation for Animal Health (OIE). Moreover, it was not inscribed in the national list of the dangerous animal diseases in Spain as it is the case in France.

However, the situation was regularly followed in Spain thanks to the cooperation of colleagues of the Las Palmas University, responsible for the control of this outbreak. Their remarks were circulated through the annual reports of the NTTAT Group each year in May and to the OIE General Sessions. In particular, in 2005, the sudden increase of the Surra cases gave rise to a special warning in the report and was repeated in May 2006.

In islands as on the mainland the same measures of control are used: after diagnosis (mainly blood smears, CATT and sometimes PCR) positive animals are treated with trypanocidal drugs (mainly melarsomine). Spraying of insecticides is also practised at the period of the activity of vectors.

In France, the importation from Gran Canaria of dromedary camels of which one died from *T. evansi* infection triggered a considerable amount of surveys and research work, mostly carried out by the Trypanosome Laboratory in Montpellier and some by the Institute of Tropical Medicine, Antwerp, during more than 2 years. Numerous data were obtained which were published or are still in press. As a conclusion, a legal provision from the Minister of Agriculture officially printed on 17 July 08 mentions: "Every animal recognised as infected (*of surra*) has to be slaughtered even if it was treated according to the therapy mentioned in the article 3 by any means of treatment and at any dose, this considering the lack of guarantee about the definite elimination of *Trypanosoma evansi* and therefore the lack of relapse".

(This consideration denies every efficacy to any treatment of Surra. But, after checking the protocols of treatment carried out in 2006/07 it has been discovered that the weight of the treated camel – which was alone to relapse after trypanocidal treatments - was estimated completely wrong and, practically, the animal received only half the recommended efficacious doses of trypanocidal drugs; Its relapse occurred 10 months afterwards. Treated again at correct doses then followed monthly for 14 months, the same animal remained negative parasitologically, serologically (CATT and ELISA) and PCR. -)

Sanitary progress in the control of Surra.

A) Addition of *Trypanosoma evansi* infections to the OIE listed diseases and other diseases of importance to International trade:

See/ Manual of Diagnostic Tests and Vaccines for Terrestrial Animal 2008

(Published on 17th July 2008)

Online : http://www.oie.int/eng/normes/mmanual/A_summry.htm

2.1. Multiple species

Chapter 2.1.1.7. *Trypanosoma evansi* infections (including surra) pp.352-360.

B) Official information communicated to the OIE Delegates for France and Spain by the Director General of the OIE , Dr. Bernard VALLAT :

- to obtain notification and applied control measures on the outbreaks of Surra in camels which occur in these countries ;
- - to announce that camels are now classified “ in the category of surra sensitive animals “ since the latest OIE 76th General Session , May 2008.

C) Recommendations of the “Manual of Diagnostic Tests and Vaccines for Terrestrial Animal 2008”

Serological surveys.

....” Estimates of predictive values of different serological tests indicate that enzyme linked immunosorbent assays (ELISAs) for detecting IgG antibodies are more likely to classify correctly uninfected animals, and agglutination tests (CATT) are more likely to classify correctly truly infected animals. An IgG ELISA would thus be suitable for verifying that animals are free from infection, prior to movement or during quarantine. In situations where there is overt disease, CATTs can be used to target individual animals for treatment with trypanocidal drugs”.

Key words: *T. evansi*, evolution, prevention, dromedary camels, European mainland.

Abstract # 11

Investigations on surra-induced lymphopenia in a murine model

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Immunodepression in general and lymphopenia in particular are important outcomes of *Trypanosoma evansi*-infection of camels. In a recent study dealing with a mouse model of *Trypanosoma evansi*-associated disease, a remarkable synchrony between the parasitaemia peak and the white-blood-cell count nadir was noticed. The present study was designed to establish whether there is a direct causal link between the parasite load during its exponential phase of growth and the disappearance of peripheral blood leukocytes. *In vitro* experiments performed with trypanosomes and mouse purified peripheral blood mononucleated cells revealed the existence of a lymphotoxin, which was found to be membrane-associated, proteinic or peptidic in nature, with a small molecular weight. Lymphocytes death induced by this protein was found to depend on the intervention of a lymphocytic protein tyrosine phosphatase. When lymphocytes were exposed to increasing quantities of a monoclonal antibody raised against the extracellular portion of CD45, a transmembrane protein tyrosine phosphatase covering over 10% of the lymphocyte surface, *T. evansi* membrane extracts showed a dose-dependent decrease in cytotoxicity. As the regulatory functions of CD45 concern not only the fate of lymphocytes but also the activation threshold of the TCR-dependent signal and the amplitude and nature of cytokinetic effects, this demonstration of its

involvement in *T. evansi*-dependent lymphotoxicity suggests that *T. evansi* might manipulate, via CD45, the host's cytokinic and adaptive responses.

Key words: *T. evansi*, lymphocytic protein tyrosine phosphatase, lymphopenia.

Abstract # 12

Seroprevalence of *Brucella* and *Salmonella* infections in Bactrian camels

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Brucellosis and Salmonellosis are two important zoonoses in the world. In camels, *Brucella* can cause abortion and *Salmonella* can cause enteritis, septicemia and abortion. In Dromedary camels, a healthy animal may also be a carrier of *Salmonella*. Bactrian camel in Iran is threatened with extinction with the population of 100 camels left in Ardabil province, north-west, of Iran. This survey was conducted to evaluate the prevalence of *Brucella* and *Salmonella* infections in Bactrian camels. 28 sera samples obtained from Bactrian camels and examined with RBPT, mRB, Wright and 2ME tests for diagnosis of brucellosis and Widal test for diagnosis of Salmonellosis. Only, one sample was sero-positive in RBPT and mRB tests but the disease was not confirmed with Wright and 2ME tests; therefore, we could not confirm brucellosis in sera samples obtained from Bactrian camels. Five sera samples (18%) were positive in Widal tests against B antigen (O group) with different low titers from 1/20 to 1/160. Seventeen sera samples (61%) were positive in Widal tests against D antigen (O group) with different titers from 1/20 to 1/160. Four sera samples were positive in Widal tests against B & D antigens. In conclusion, brucellosis may not be a major concern but further investigations are required prior to valid conclusion regarding Salmonellosis in Iranian Bactrian camel.

Key words: Brucellosis, Salmonellosis, Bactrian camels.

Abstract # 13

Seroepidemiology of camel Brucellosis in Jordan

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The seroprevalence and risk factors for *Brucella* seropositivity in camels in Jordan were investigated. Serum samples were collected from 590 camels randomly from 60 herds. The rose bengal plate test and the complement fixation test were used to detect antibodies against *Brucella*. A structured questionnaire was used to collect information on camel health and management. Questionnaire information was tested in a multivariable logistic regression model to identify risk factors for *Brucella* seropositivity. In addition, the incidence of

Brucella-specific abortion was investigated in 5 large camel herds located in the northern Badia region of Jordan. Of the 590 camels sampled, 101 (17%) had antibodies against *Brucella*. Twenty-one herds (35%) had at least one *Brucella* seropositive camel. The prevalence of brucellosis in camels was significantly higher ($P < 0.05$) in the southern part of Jordan than that in central or northern Jordan. The multivariable logistic regression model identified large herds, mix farming and contact with other camel herds as risk factors for *Brucella* seropositivity. The incidence of *Brucella*-caused abortion was 8%. Most of the isolated *Brucella* strains from the aborted fetuses and vaginal swabs were characterized as *Brucella melitensis* biotype 3.

Key words: Brucellosis, camel, Jordan.

Abstract # 14

Virus implicated in respiratory infections of camels

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This study was intended to investigate the role of viruses in respiratory infection in camels. A total of 281 camel lung specimens showing pneumonia were collected from slaughter houses at five different areas in Sudan. PPR antigen was detected by ELISA in 130 specimens (48.5%). Highest prevalence was found in Central followed by Northern Sudan. Out of PPR positives a total of 50 samples were also positive for RP antigen. Trials to isolate the causative virus in cell culture failed. Using sandwich ELISA 1.6% of 186 lungs were positive for IBR antigen; all were from Central Sudan. Direct IF confirmed the BHV-1 ELISA positives. PCR was used to detect BHV-1 genome with 3 positive results. BHV-1 was isolated from two camel lungs in MDBK cells, isolates were identified using ELISA and IF. Using antigen detection ELISA six specimens were positive for PI3 antigen (2.1%). Positive results were confirmed by IF and RT/PCR. Highest prevalence was noticed in Eastern Sudan (4.2%) followed by Central and Northern (1.4%). The PI3 virus was isolated in cell culture from four ELISA positive specimens. Four specimens were positive for RSV (1.4%); all were from Central Sudan. Positive results were confirmed by IF and RT/PCR. Thirteen lung specimens out of 186 (7%) were positive for BVD antigens in ELISA. Adenovirus type 3 antigen was detected using sandwich ELISA in 1.3% of 239 tested camel lungs and results confirmed by IF. Antibody prevalence as detected by ELISA was 1.8% for PPR, 1.6% for RP, 77% for IBR, 82% for PI3, 27% for RSV, 85% for BVD and 90% for adeno virus 3. The role played by these viruses in causation of respiratory infections in camels in view to these results and field observations is discussed.

Key words: Virus, respiratory infections, PPR antigen, ELISA, PCR, camels.

Abstract # 15

Krafft disease in dromedary camel in Tunisia

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This presentation aims to identify the symptoms of the disease and its circumstances of appearance according an investigation in the east pastures of the south of Tunisia.

The Krafft disease is one of the most known diseases by the camel breeders in the south of Tunisia, it is an oseo-articular trouble characterized by locomotor disorders starting by the boitery and finishing by the immobilization which affect the general state of the animal.

The epidemiologic study indicate that the disease had an average prevalence of 5% in the studied herds and it is variable according to different parameters: it is related to physiological state of the animal, environmental condition and the passage of the herds towards the pastures of Dhahar. Analysis of the mineral compound of some plants in Dhahar pasture indicates disequilibrium in phosphor and calcium rate. This disease is observed especially during the winter and spring, which affects the females at the end of the gestation and at the beginning of lactation.

Key words: Osteo-articular trouble, Krafft, dromedary, south of Tunisia.

Abstract # 16

Pathogens of internal and external purulent lesions in dromedary camels

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Infections with pathogens those developing internal or external purulent lesions (abscesses) are common in different species of animals with variation of causative agents and predisposing factors or clinical illnesses leading to them, camels may be among the most predisposed animals due to the nature of the life and the hard circumstances of deserts and for some instance no apparent clinical signs may be seen on the animal until few weeks of illness especially in localised lesions. This study was designed to determine the most prevalent causes for the clinically apparent purulent lesions or those described under the Post Mortem findings by the pathologists based on locally isolated strains in the Central Veterinary Laboratory in AL-Wathba Abu Dhabi. A total of 62 specimens of purulent lesions collected as a whole sealed and surgically removed abscess or aseptically drained or aspirated content , reported to the lab for isolation , identification and antibiotic sensitivity profile of the causative agents. The investigation revealed the presence of several pathogens with varied frequency, *Actinomyces pyogenes* (previously known as *Corynebacterium pyogenes*) and the *Corynebacterium pseudotuberculosis* came in the first two places with the highest frequency rate 55% and 38% respectively. While the *Pseudomonas aeruginosa* and *Clostridium perfringins* and *Escherichia coli* following with less frequency rate, *Streptococcus equi sub*

species zooepidemicus were isolated from a case of multiple abscesses in head. All isolated organisms were tested against a wide range of antimicrobials (In vitro). It is important to consider in isolating pathogens from this kind of specimens that it might take longer time than expected to yield a growth and to be monitored for some time before declaring them as sterile or non significant growth.

Key words: Pathogens, purulent lesions, *Actinomyces pyogenes*, *Corynebacterium pseudotuberculosis*, dromedary.

Abstract # 17

***Toxoplasma gondii* and rotavirus associated with camel-calves diarrhea in Sudan**

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Neonatal camel-calves diarrhea is a costly disease, it is considered one of the main killing signs of diseases among calf camels up to 6 month of age in the Sudan with a death loss of up to 23% *Toxoplasma gondii* and Rotavirus are considered as causative agents of calf-diarrhea. Two hundred and seventy eight (278) serum samples were collected from diarrheic camel-calf (less than one year age) in five locations in Sudan; River Nile (North), El-Gedarif (East), Sennar & Blue Nile (Central to South) and kordofan (West). Out of 278 serum samples, 157 sera (56.5%) were sero-positive for anti-*Toxoplasma* antibodies by latex agglutination test, ELISA test was applied on the sero-reacted sera, IgM and IgG were detected in sera. Also a competitive ELISA kits for rotavirus antibodies detection were used, results showed that 66 sera (23.7%) were sero-positive for rotavirus antibodies. Statistical analysis using software analysis programs showed no significant difference ($P>0.05$) between the five surveyed locations for both *Toxoplasma* and rotavirus infections. The sero-prevalence of rotavirus in different age groups was found to be statistically significant ($P<0.05$), however, there is no statistical difference in the occurrence of *Toxoplasma* in different age groups; this may reveal an occurrence of congenital infection. There was no statistical difference ($P>0.05$) in the occurrence of sero-prevalence of *Toxoplasma* and rotavirus in male and female. The aim of this study is to determine the role of *Toxoplasma gondii* and rotavirus infection in camel-calves diarrhea in Sudan.

Key words: *Toxoplasma gondii*, rotavirus, camel-calves diarrhea, Sudan.

Bluetongue vaccination field trial in Alpacas using the Bovilis BTV8 (Intervet) Vaccine

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Bluetongue virus (serotype 8) was first documented in the UK in September 2007, having caused extensive losses to livestock on mainland Europe during the summers of 2006 and 2007. The effects of bluetongue virus on camelids are largely unknown but they are known to produce antibodies to some serotypes of the virus and are thought to be susceptible. This study evaluated a newly available vaccine (Bovilis[®] BTV8, Intervet) licensed for use in sheep and cattle, in alpacas. Three groups of alpacas were enrolled in the vaccine field trial: Group 1 (10 alpacas) received one 1ml dose of vaccine only (dose recommended for sheep); Group 2 (10 alpacas) received two 1ml doses of vaccine, 3 weeks apart (dose recommended for cattle); Group 3 (6 alpacas) received no vaccine and formed the control group. All alpacas were healthy, adult male and non-pregnant female alpacas kept at pasture on a large commercial alpaca farm in the UK. Blood samples were collected at Day 0 (before vaccination, vaccination given immediately after blood sampling in groups 1 and 2), day 21 (day of 2nd vaccination for group 2) and day 42. All blood samples underwent routine haematology and biochemistry to ensure that alpacas were healthy, and ELISA and PCR testing for presence of antibody and virus respectively. All samples except those in the negative control group and those from day 0 were subjected to serum neutralisation test (SNT) to evaluate for the presence of neutralising antibody. Soft tissue reactions to the vaccine were common, including transient lameness in one alpaca. All alpacas were negative on PCR throughout the study indicating no exposure to virus, and all alpacas were seronegative for BTV8 at the start of the study. Control alpacas were negative for both antibody and virus throughout the study. After one dose of vaccine (day 21), Group 1 and 2 alpacas showed weak antibody responses on ELISA and SNT. At day 42, Group 2 alpacas were all seropositive, had significantly greater percentage inhibition (PI) due to presence of antibodies on ELISA compared with Group 1 alpacas, and significantly higher serum neutralisation titres. This study suggests that the vaccine appears to be safe in healthy adult (non-pregnant) alpacas and that it does stimulate an antibody response in alpacas. Further, this study suggests that two doses given 3 weeks apart is an acceptable vaccination strategy for this vaccine in alpacas.

Key words: Bluetongue, vaccination, *Bovilis BTV8*, Alpacas.

Abstract # 19

Protection against *Hyalomma dromedary* infestations in camel vaccinated with the *B. microplus* Bm86-containing vaccine Gavac™

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A vaccine trial was performed to assess the effect of the *Boophilus*-derived vaccine ‘‘Bm86, Gavac™’’ against the most prevalent tick species in camels experimentally infested with *H. dromedarii* ticks. It was the first to be done with this vaccine in camels as a new alternative approach to control ticks in camels. The choice of the vaccine was determined by previous observations that it may induce cross reactive protection against other tick species.

The data reveal for the first time that immunization of camels against *H. dromedarii* using Gavac™ vaccine has a positive effect on the challenge infestation.

Tick characteristics (physiology and fertility) were significantly damaged on vaccinated-challenged camels. The length of tick feeding was prolonged by 7 days and there was a reduction of 55% in the weight of engorged female ticks; and 70% reduction in the weight of egg mass in the vaccinated challenged camel groups when compared with the controlled challenged camels group. The obtained results indicated that the Gavac™ vaccine can give a protection of 70% to protect the camels experimentally infested with *H. dromedarii*.

Key words: Vaccine, *H. dromedarii*, Gavac™, camel.

Abstract # 20

Microbiological studies on mastitis in cattle and camels (*Camelus dromedarius*) in Saudi Arabia

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Many bacterial and fungal species have been isolated from the udder of mastitic camels; some of them constitute a first report.

From camels' acute mastitis, the most prevalent isolates were *Staph aureus* and *Streptagalactiae* with fungi constituting 10.8% of all isolates. From chronic mastitis, highest rates were for *Staph aureus*, coagulase-negative Staphylococci and *Corynebacterium pseudotuberculosis*; fungi at 20.1%. From subclinical mastitis, *Staph aureus* and coagulase-negative Staphylococci were most prevalent with fungi at 12.4%. Further details if the isolates will be presented.

From clinical mastitis in cattle, *Escherichia coli* was isolated in a percentage of 31.9%, *Staphylococcus aureus* (13.6%), *Streptococcus uberis* (11.9%), *Streptococcus dysgalactiae*

(9.1%) and *Streptococcus agalactiae* (8.5%) together with other bacterial species including *Mycoplasma bovis* and some anaerobes. Fungi were isolated at 4.8% including *Candida krusei*, *C. tropicalis* and *C. parapsilosis*. From subclinical mastitis, coagulase-negative Staphylo -cocci were isolated at 54.6%, *Staph aureus* (10.2%), *E.coli* (6.1%) and *Strept uberis* (4.6%).

In cattle, environmental mastitis was most prevalent in winter while contagious mastitis was more prevalent in summer with even prevalence for fungi in all seasons. A host of bacterial and fungal isolates was recovered from the animals' environment; some species have also been isolated from mastitic cases. Acquaintance with environmental risk factors and hygiene standards to manage was stressed.

Key words: Mastitis, *E. coli*, *S. aureus*, cattle, camels, Saudi Arabia.

Abstract # 21

Antimicrobial susceptibility of bacterial organisms identified from mastitic milk samples of camel

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Twelve different antibiotics were used against bacterial species to record their sensitivity. The antibiotics were amikacin, amoxicillin, ampicillin, cephalexin, chloramphenicol, erythromycin, gentamycin, kanamycin, neomycin, ofloxacin, sulphamethoxazole trimethoprim and tetracycline. The species showed sensitivity to amikacin were: *Corynebacterium pyogenes* (100%), *Bacillus cereus* (91.6%), *Staphylococcus aureus* (85.7%) and *Pseudomonas aeruginosa* (66.6%). Whereas *Bacillus cereus* (100%), *Corynebacterium pyogenes* (70.5%), *Micrococcus luteus* (78.5%), *Pasteurella haemolytica* (100%), *Pasteurella multocida* (100%), *Pseudomonas aeruginosa* (72.2%) and *Staphylococcus aureus* (100%) were observed highly sensitive to tetracycline. The species *Staphylococcus aureus* (100%), *Pseudomonas aeruginosa* (100%) and *Bacillus cereus* (91.6%) were highly sensitive to sulphamethoxazole trimethoprim. The species *Escherichia coli* (100%), *Micrococcus luteus* (100%), *Pasteurella haemolytica* (92.8%) and *Pasteurella multocida* (93%) showed sensitivity to chloramphenicol. Moreover, *Pasteurella haemolytica* (100%), *Pasteurella multocida* (100%), *Corynebacterium pyogenes* (70.5%) and *Staphylococcus aureus* (85.7%) were sensitive to neomycin. The other species recorded as highly sensitive to cephalexin were: *Corynebacterium pyogenes* (100%), *Pasteurella multocida* (80%), *Pseudomonas aeruginosa* (72.2%) and *Staphylococcus aureus* (85.7%) respectively.

Key words: Antimicrobial susceptibility, bacterial organisms, dromedary camel, mastitis

Abstract # 22

Diazinone and Monensin toxicity in camels

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Organophosphorus compound poisoning is one of the commonest poisoning in animal agriculture as these compounds are still frequently used for control of ectoparasites. Monensin is a carboxylic ionophore antibiotic frequently added to commercial livestock feed as an anticoccidial and a growth promoter. Toxicity due to organophosphorus compound diazinone (-o-o-Diethyl-o{2-isopropyl-4-Methyl-6-Pyrimidinyl} phosphorothionate) was diagnosed in five camel farms. The camels were showing the symptoms of frothy salivation, lacrimation, muscle twitching, staggering gait, ataxia, tympany, weakness and dyspnea post spraying or direct application of diazinone. Monensin toxicity was diagnosed in one farm in which poultry feed (broiler starter supplemented with monensin) was fed to a group of ten animals. The camels showed the symptoms of ruminal atony, muscular tremors weakness, inability to stand and passage of coffee colored urine. In camels with diazinone toxicity there was no any significant changes in haematological and blood biochemical parameters while as leukocytosis with marked lymphopenia and neutrophilia was observed in monensin toxicity. Serum enzymes (CPK, ALT and LDH) also showed a significant increase in these camels. The camels with diazinone toxicity responded very well to atropine sulphate which was administered at a dose rate of 0.25mg/Kg body weight. One third of the dose was given intravenously and remainder intramuscularly. Ten out of twelve animals survived. Two animals did not respond to treatment and died within 12 hours post exposure to diazinone. Four animals were dead before treatment could be attempted. Monensin toxicity group animals did not respond to the treatment with vitamin E (Introvit-E Selen @1ml/kg B.W thiamine hydrochloride 0.50 ml/100 kg B W) fluid therapy and antibiotics. Though five out of ten animals survived but the animals remained recumbent.

Key words: Organophosphorus, Diazinone, Monensin, toxicity, camels.

Posters

Communications affichées

Diseases & Medicine

Prevalence of *Sarcocystis spp.* in the dromedaries meats consumed in Nouakchott (Mauritania)

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Diseases caused by food and the zoonoses are generally recognized as being an important problem of public health and a major cause of fall of the economic productivity as well in the countries developed as in the developing countries. The inspection of the animals at the slaughter-house can contribute usefully to the monitoring of diseases which have an importance for animal health, in particular the emergent diseases. Consequently, the control and/or the reduction of the public and animal health hazard by the inspection ante and post-mortem of the meats are a big step for sanitary security of food.

In addition, the fast rise of the trade of food, as well with the local scales as international, focuses the attention on the biosecurity and the transmission risks, by the means of the human and animal food chain, of the diseases which have an impact on animal health.

The Sarcosporidiosis affects several animal species of which some are domesticated for the consumption of their meat. Often, this affection remains without major clinical signs. However, in certain cases, it results in muscular lesions visible at post-mortem inspection of the ruminants at the slaughter-houses.

In the majority of the countries where the infection was supervised, the prevalence was up to 100% in the cattle, sheep, dromedaries and the horses and less in the pig. The disease is due to a protozoon (*Sarcocystis spp.*) whose cycle includes two phases (development at the intermediate and final hosts). This protozoon includes several species of which some have the man as final host. It is thus a zoonosis.

Several studies gave prevalence of the infestation by of *Sarcocystis spp.* in the ruminants including the dromedary. On the other hand, there are no data on the prevalence of this infestation in Mauritania. Taking into account the importance of the consumption of meats in Mauritania and possible harmful impact of this parasite for the consumers health, it is vital to undertake studies in order to have reliable data on the presence or not of *Sarcocystis spp.* in the muscles of dromedaries. Therefore, the main aim of this study is to determine the prevalence of this parasite in the muscles of consumed dromedaries at Nouakchott and to identify the parasitic species observed.

For this purpose, samples of skeletal muscles at various localizations (tongue, diaphragm, shoulder, thigh) are taken, fixed at formaline 10%, then treated by histological techniques.

The reading of the histological slides is in hand and the results will be analyzed and discussed. These results will permit to give a description of the situation of this infestation in the dromedaries of Mauritania and to evaluate the possible risk for the consumers.

Key words: *Sarcocystis spp.*, muscles, dromedary, Mauritania.

Abstract # 24

Internal parasites and Trypanosomosis prevalence in camels in Gedarif and Kasala, Eastern Sudan

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Trypanosomosis and internal parasites in camels were surveyed during the dry and rainy seasons of the year 2004 at different localities along the camels' migratory routes in Eastern Sudan. A total of 400 camels were examined for trypanosomosis during late rainy season (Sep.-Oct.) and 1.5% were found infected with *T. evansi*. During the late dry season (April-May), 180 camels were also examined for trypanosomosis and 0.5% were found infected. A total of 188 camels were examined for internal parasites in the dry season. The prevalence of major internal parasites found was 10% for *Schistosoma* spp, 28.7%, for *Strongyle* spp., 6.4% for *Ascaris* spp., 9% for *Moneizea* spp and 10% infection rate for coccidian spp. On the other hand 140 camels were examined for internal parasites during the rainy season. The prevalence rate of the major internal parasites encountered was 37% for *Strongyles* spp, 3% for *Shistosoma* spp., 12% for *Ascaris* spp. 8% for *Strongyloides* spp. and 8% for *Trichuris* spp. The results were discussed in relation to climatic conditions, the ecology of each locality, internal parasitic burden and the system of herd management.

Key words: Parasites, Trypanosomosis, prevalence, camels, Gedarif, Kasala, Sudan.

Abstract # 25

Dynamics of cystic fluid, serum biochemical, amino acid and mineral profile in *Echinococcus granulosus* affected camels

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The current study was intended to observe the effects of *Echinococcus granulosus* infection in camels on the serum health biomarkers like total oxidant status and paraoxonase, arylesterase and ceruloplasmin activity. The biochemical and the mineral profile of the hydatid cystic fluid were also determined to exploit the significant difference between the fertile and sterile cysts. The biochemical profile includes glucose, protein, albumin, globulin, lipids, aspartate aminotransferase (AST), alanine aminotransferase (ALT) and the minerals include Na, K, Ca, Mg, Mn, Fe, Cu, Zn and Se. A detailed amino acid profile was also determined in both types of cystic fluids. Four hundred and fifty (450) samples were collected by the regular visits to

the Local abattoir of Faisalabad and Lahore, Pakistan. The fertile and sterile cysts were differentiated by the presence of protoscolices of *Echinococcus granulosus* in the cystic fluid under the microscope. The serum was also collected from the infected as well as the normal camels. The serum oxidant status was significantly high in the infected as compared to the normal, while paraoxonase, arylesterase and ceruloplasmin status was significantly low in the infected camels. In Cystic fluid analysis the ceruloplasmin status was high and the oxidant status was low significantly in the sterile cystic fluid as compared to the fertile cystic fluid. The concentration of protein, albumin, lipids, AST and ALT was significantly high in the fertile cystic fluid while glucose and globulin was significantly high in the sterile cystic fluid. In the minerals Na, K, Ca, Mg and Cu were significantly high in the fertile while Fe, Zn and Se were significantly high in the sterile cystic fluid. In the amino acid profile only the aspartate was significantly high in the fertile cystic fluid while all other amino acids were not significant. The significant difference in the biochemical profile and minerals status reveals that these were affected by the fertility of the cyst.

Key words: *Echinococcus granulosus*, camels, total oxidant, paraoxonase, arylesterase.

Abstract # 26

Clinical case of Echinococcosis in dromedary camel

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Echinococcosis is an animal and human disease which affect especially the small ruminants and which is related to the development of the larva of *Ecchinococcus granulosus*. In the dromedary this attack is seldom described.

The aim of this communication is to describe the clinical symptoms related to this disease and to fix the differential diagnosis with other diseases in camel.

For this, we have recorded the clinical symptoms and the necropsic lesions following the clinical examination and the autopsy of a 3 years old dromedary camel presenting the signs of slimming and digestive and circulatory disorders evolving for three months. The autopsy revealed mainly the hepatic attack by hydatid cyst. So the camel can be one of the intermediary hosts of this parasite in the arid land.

Key words: Ecchinococcosis, hydatid cyst, dromedary camel.

Abstract # 27

Ticks infestation in dromedary camel in spring and summer periods in Southern Tunisia

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Ticks (ixodida) are wide spread in all biotopes in the world and infest many animals' species and have a direct effect (obligatory hematophagous) and indirect effect (vector of some livestock disease) but the tick infestation depend to several conditions such as climatic parameters and host availability.

The animals followed were led in semi extensive system by staying in the pastures 8 hours per day. The aim of this work is to study the ticks' infestation of the dromedaries in two periods; the first study has been carried out in spring period, the second in the summer period. For that, after removing all ticks by chemical treatment and manual elimination, a daily counting of the ticks' infestation was carried out on the animals taking part in the study.

We are limited to count ticks in the sternal, inguinal and perineal areas, without withdrawing them. The goal is indeed to evaluate at which speed the animal were reinfested, and to define an interval of treatment in this two seasons.

The result indicate that in the condition of this survey a treatment should be used after 20 days in the two season and when the average number of ticks exceed 100 on the body. Nevertheless, the degree of infestation on the body areas and with gorged or engorged ticks were different between spring and summer season.

Key words: Ticks, dromedary camel, Tunisia.

Abstract # 28

Joint diseases in camel (*Camelus dromedarius*) in Saudi Arabia

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The present study was executed to investigate camel arthropathies. Camels of different breeds, sex, and age were examined with complete history, physical examination, documentation of the clinical signs, radiographic and pathological analysis. Among 500 animals admitted to KFU Teaching Hospital with different ailments, arthritis was diagnosed in (5%) among the previous 7 years. The site was in the tarsus, stifle, and fetlock joints. The majority of these affections was in the form of degenerated joint disease. During a survey in 7 farms (80%) rearing about 3500 camels, arthritis constituted 1-3%. The lesions were in the form of serous arthritis of carpus, tarsus or polyarthritis of aging animals.

Key words: Camel, arthropathies, Saudi Arabia.

Abstract # 29

Clinicopathological studies on Mastitis in camels (*Camelus dromedarius*) in Saudi Arabia

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This study involves the mastitic camels admitted to the Veterinary Teaching Hospital of King Faisal University, Saudi Arabia. The mean age of the animals was above twelve years old and all appeared clinically sound. The fore quarters of the udder were more frequently affected, alone or together with the hind quarters. Mastitis was categorized as: Per-acute necrotizing (gangrenous), Acute, sub-acute and chronic. The latter was further subdivided into chronic obstructive mastitis, chronic fibrosing “nonsuppurative” or chronic suppurative mastitis. The necrotizing mastitis was characterized by degeneration and necroses of acinal epithelium, abscess formation and thrombosis. Loss of glandular tissue and diffuse fibrosis was seen in chronic nonsuppurative mastitis. In chronic obstructive type, periductal fibrosis hypertrophy of smooth muscles and dilatation of the duct were seen. Teat canal was lined with keratinized epithelium. Intramammary installation of antibiotic and local liniments were tried to treat the acute type. Treatment of the chronic mastitis was by radical amputation of the affected gland(s). Surgery was conducted under sedation with xylazine supplemented with ketamine hydrochloride or under epidural analgesia supplemented with xylazine/ketamine mixture. Milk samples and tissue samples from amputated glands were taken aseptically for bacteriology. Milk samples were collected from apparently healthy she-camel to detect subclinical mastitis.

Key words: Mastitis, antibiotic treatment, camels, Saudi Arabia.

Abstract # 30

Some aspects of haemorrhagic disease in camels

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Haemorrhagic disease is the most important disease of racing camels in the United Arab Emirates. This disease continues to take a heavy toll of camels particularly racing camels of two to three years of age. During the year 2007-08 more than twenty five cases were reported to Central Veterinary Hospital Al Wathaba Abu Dhabi. The disease occurred mostly during hot and humid summer months from May to September. The disease clinically characterized by high body temperature (>40-41.5°C), inappitance, ruminal stasis, cough/grunt, and passage of black tarry faeces before death. Haematological and blood biochemical parameters showed leukopenia ($4.5 \times 10^3/\text{ul}$) with neutrophilia (70-90%) and decreased platelet count. The serum

iron levels were also decreased (40-50 ug/dl). The disease has an obscure etiology though a number of infectious agents like, *Aspergillus fumigatus*, *E. coli*, *clostridium perferingens* were isolated from tissue samples of camels died of this disease. Stress sudden change of diet and acidosis are the common predisposing factors responsible for the disease. Haemorrhages of varying sizes in different organs and tissues, enlargement of lymph nodes with haemorrhages and ulceration of abomasm were the typical lesions on necropsy. The success of the treatment using different treatment regimens including administration of antibiotics, analgesics, antacids with supportive therapy using isotonic fluids and vitamins was achieved in most number of cases.

Key words: Haemorrhagic disease, racing camels, United Arab Emirates.

Abstract # 31

Study of camel parasitism with *Ixodidae* in South Algeria (Adrar area)

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A study was undertaken in Algeria between July 2005 and Jun 2006 to monitor, camels infestation by ticks in Adrar Abattoir. A total of 3,234 camels were examined. The prevalence of infested camels was at 99.41%. The number of collected ticks was at 143,132. Adult ticks and immature stages were present throughout the year. The number of ticks per camel ranged from 1 to 1,425. Nine species of ticks were found, the large majority of which belonged to *Hyalomma* genus (99.97 %).

Key words: Prevalence, ticks, South Algeria.

Abstract # 32

Combination of participatory approaches and molecular diagnostics to investigate the epidemiology of Haemorrhagic Septicaemia in camels (*Camelus dromedarius*)

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For pastoralists living in the semi arid and arid lands of Somalia and Northern Kenya the dromedary camel (*Camelus dromedarius*) is the most important livestock species in terms of food security. The camel is an essential partner for their livelihood and the main source of milk, especially during the dry season. Furthermore it provides them with meat, means of transport and plays an important role for the socio-cultural set up of the community.

Pasteurella (*P.*) *multocida* Carter serotype B:2 and E:2 is the cause of Haemorrhagic Septicaemia (HS), a highly fatal disease in bovines. The role of *P. multocida* in HS of camels remains unclear. In Somalia and Kenya HS of camels is known to pastoralists as “Khanid”

(Rendille), “Quarir” (Somali), “Quandich” (Gabbra) or “Quandho” (Borana). During participatory assessments HS was ranked by pastoralists in North Kenya and in North Somalia among the first to fourth most important health problem of camels.

There is deep clinical and epidemiological knowledge of the disease in pastoralist communities, which has remained largely untapped up to now.

To bridge the gap between indigenous and scientific knowledge this study combines conventional bacteriology, molecular diagnostic tools and participatory epidemiology to:

1. Build up an epidemiological database on HS in camels
2. Determine the carrier status of camels for *Pasteurella multocida* and other Pasteurellaceae species in North Kenya
3. Investigate outbreaks of HS in camels and to identify *Pasteurella multocida* and other potential pathogens using bacteriological and molecular tools (Polymerase Chain Reaction, PCR)
4. Disseminate the study results back to camel owners, veterinary auxiliaries and professionals and relevant organisations involved in provision of animal health services to pastoralist communities

Pasteurella multocida Carter serotype B:2 and E:2 was neither isolated nor was the serotype B:2 and E:2 specific DNA sequence present in eluates of nasal swabs from 392 individual camels from all major camel keeping districts in Kenya. PE data confirmed the economic importance and mostly seasonal occurrence of HS outbreaks in camels in North Kenya. Additional diagnostic and PE findings are discussed in this paper.

Key words: Haemorrhagic Septicaemia, *P. multocida*, camel, PCR, participatory approaches.

Abstract # 33

Ticks infesting camels in Morocco

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Very little work has been carried out on ticks infesting camels in Morocco. Of some 16 ticks species recorded in Morocco. Results of the identification and prevalence of ticks collected from 1200 camels during the period of 2 years from different bioclimatic stratum shows the presence of 5 species of different genera, two belonging to the genus *Rhipicephalus* and 3 the genus *Hyalomma*. A map showing the areas surveyed and the distribution of ticks are reported. Nevertheless, the seasonal abundance, population dynamics and transmission role are poorly studied in camels tick.

Key words: Tick species, camels, Morocco.

Abstract # 34

Prevalence, serotypes and antimicrobial resistance patterns of *Salmonella* isolates from apparently healthy camels in Canary Islands (Spain)

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The prevalence, serotypes and antimicrobial resistance patterns of *Salmonella* strains isolated from apparently healthy camels in Canary Islands (Spain) were determined. A total of 52 camels from 3 different farms were tested for the presence of *Salmonella* spp. in feces. *Salmonella* was detected in 9 (17.3 %) of the samples. All of the isolates were characterized as *Salmonella enterica* subsp. *enterica* serotype *Frintrop*. Feeds (oats, alfalfa, wheat straw and maize) and water were analyzed for *Salmonella* isolament. *Salmonella enterica* subsp. *enterica* serotype *Limete* was isolated from water; feed samples resulted negative. All the isolates were susceptible to all antimicrobial agents tested: ampicillin, amoxicillin/ clavulanic acid, tetracycline, enrofloxacin, chloramphenicol, nalidixic acid, piperacillin and trimethoprim-sulfamethoxazole. Some sanitary measures should be taken for veterinarians and animal handlers in order to avoid the risk of *Salmonella* transmission.

Key words: *Salmonella*, prevalence, serotypes, antimicrobial resistance, camels, Canary Islands.

Abstract # 35

Important ectoparasites of alpaca (*Vicugna pacos*) and Llama (*Lama glama*)

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The alpaca (*Vicugna pacos*) and llama (*Lama glama*), native to South America (SA) belong to the family Camelidae, often referred to as the domestic South American Camelids (SACs). These evolved and developed parallel to the Ruminantiae and developed special anatomical and physiological features, which are of great significance to their biology. They are very important livestock for over half a million *campesinos*, particularly in the Andes.

Increasing numbers of alpacas and llamas are being imported to various countries outside of SA, particularly for fibre production, breeding, shows, as companion animals (pets) and trekking. This fairly recent phenomenon started with larger exports in 1983-84 from Chile to North America (NA) and later from neighbouring countries. Other countries followed suit importing SACs and today there are large populations world-wide. The veterinary profession outside SA was unprepared to deal with these new animals, with their unique anatomy, physiology and behaviour, with different disease panoramas, and reactions to pathogens and pharmacokinetics.

The SACs are exposed to and affected by a range of ectoparasites as are other livestock. Of particular importance are mange mites and lice. Problems with mange are frequently reported from several countries apart from SA, in NA, Europe, Australia and New Zealand. The

number one health problem in SACs according to breeders in UK and Sweden are skin disease.

Sarcoptes scabiei is very prevalent. It is said to be responsible for 95 % of all losses due to ectoparasites in alpacas in SA. Infestations with *Chorioptes* sp are also very common. Some regard it as the most common ectoparasite infesting SACs in countries outside SA. *Psoroptes* sp may also be found to infest particularly the ear-laps and the outer ear canals, but can also be found elsewhere on the body. Mixed infections/infestations occur with two and even three of these mite species. Any pruritic dermatitis may mimic infestations by mange mites. Damage to the fibre and loss of condition occur. In very severe infections sarcoptic mange may result in death.

Cross-transmission of these mange mites from SACs to other livestock is a concern. *Sarcoptes scabiei* e.g. and particularly *Psoroptes* sp which causes sheep scab, is a serious and in some countries a notifiable disease.

Alpacas are more often infested with the sucking lice, *Microthoracius mazzai* than with the biting lice, *Bovicola breviceps*. Infestations of these are fairly common in SA, but are rarely reported in Europe. Case reports of infestations of *Bovicola (Damalinia) breviceps* are reported from Australia and New Zealand.

Treatment of mange has proved difficult. There are no licenced drugs available e.g. in the EU. Pharmacokinetic studies of macrocyclic lactones as well as other acaricides and insecticides are limited in SACs, although a variety of such substances have been used with varying success. Enough controlled clinical trials are lacking to clarify optimal routes of administration, dosing regimens of different drugs and their safety.

Key words: Parasites, *Sarcoptes scabiei*, *Chorioptes* sp, *Microthoracius mazzai*, alpaca, Llama

Abstract # 36

Gastrointestinal helminthiasis in one humped camels (*Camelus dromedarius*) of metropolis jhang, Pakistan

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A field survey was conducted in Jhang metropolis of Pakistan to investigate the prevalence of different species of gastrointestinal (GI) parasites in one humped camels (*Camelus dromedarius*). A total of 100 camels including 21 pneumatic cart pulling, 13 from different camel herds and 66 from mix-herds (kept with other animal species comprising ruminants, equines and dogs) were randomly selected and data were collected on pre-designed questionnaire. Information concerning managemental practices, past disease history and current health status of the animal were recorded. For the coprological examination 5-10 gm of faecal samples were collected directly from the rectum, packed separately in polythene bags and labeled accordingly. Smears prepared by floatation technique were subjected to direct microscopic examination for the prevalence of GI parasites. The overall prevalence rate was 64% (n = 64) in the study population. Out of this 7.81% prevalence was recorded in the camels kept alone and 9.37% in animals living with camel cohorts. A significantly higher (P<0.01) prevalence rate (82.81%) was registered among camels managed with other animal species. Univariate analysis indicated that camels kept in mixed herds had higher risk (Odds Ratio = 0.12) of contracting gastrointestinal parasitism. Over all nematode infection was

found to be 76.56% (n = 49) followed by cestodes 3.13% (n = 2). 20.31 percent samples were positive for mixed infection. Among nematodes, *Trichostrongylus* (25%) was the most prevalent species followed by *Haemonchus contortus* (15.63%), *Stongyloids* (15.62%) and *Ostertagia* (9.38%). *Moneizia expensa* (3.13%) was the only cestode identified in the present study. The results indicate that gastrointestinal parasitic infections are widespread in the camels of Jhang and could be a major threat to the health and production, which requires adaptation of prompt and strict worming schedules.

Key words: Gastrointestinal parasitic infection, *helminthiasis*, one humped camel.

Abstract # 37

Impacts of some disease conditions on the cellular and biochemical constituents of blood and biophysical characteristics of ruminal fluid in Arabian Camels (*Camelus dromedarius*) in Saudi Arabia

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Camels are unique animals in their physiological and pathological status. Camel population have been increased over the last years (more than 450,000 in Saudi Arabia) Annual report of Ministry of Agriculture, associated with increased awareness of camel owners. Several diseases are encountered among camels. Such diseases are reported to have a deleterious effect on both cellular and biochemical constituents of blood and ruminal fluid characteristics. However, many factors are observed to have a predisposing effects including age, sex, season and management.

A total number of 65 diseased camels with different age groups and of both sexes were involved in this study. The most prominent and diagnosed diseases and affections were mastitis, endometritis, gastrointestinal disturbances such as rumen impaction, tympany and esophageal or intestinal obstructions, diarrhea, and fractured limbs.

Blood samples as well as ruminal fluid were obtained from the selected animals and were subjected to laboratory analysis. The obtained results revealed an adverse effect of these disease conditions not only on the health status of the animals and their performance but also on the cellular and biochemical constituents of blood and ruminal fluid characteristics.

The obtained results of hemogram revealed significant increase in the mean values of total leucocytic counts in diseased camels with endometritis, mastitis and diarrhea if compared with their values in healthy control calves. In addition packed cell volume showed a significant increase in diseased camels with rumen impaction, intestinal obstruction and diarrhea. Biochemical analysis of blood sera samples revealed significant elevation in the mean values of potassium and blood urea nitrogen with significant reduction in the mean values of total proteins, albumin, sodium and chloride in the diarrheic camel-calves and in camels with impaction and intestinal obstruction if compared with their values in the healthy control animals.

Also it was observed that there is a significant reduction in the mean values of rumen pH in cases of impaction and tympany. The biophysical characteristics of ruminal fluid and variations in the total rumen protozoal count were also reported. The correlation between such values of blood and ruminal fluid and age, sex, season and diseases were explained.

Key words: Impacts of diseases, blood constituents, ruminal fluid, Arabian Camels, Saudi Arabia.

Abstract # 38

Distribution of some ecto-parasites infesting camels in Kano State, Nigeria

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To determine the distribution of ecto-parasites infesting camels in Kano State, Nigeria, 206 one - humped camels were selected by simple random sampling technique and examined between January and December 2006. Three species of ticks (*Amblyomma variegatum*, *Hyalomma dromedarii* and *Rhipicephalus pravus*) were found to be common. *H. dromedarii* had the highest prevalence of 58.25%, followed by *A. variegatum* (42.23%) and *R. pravus* (25.24%). Of the 5,216 ticks collected, 62.69% were *H. dromedarii* while *A. variegatum* and *R. pravus* formed 28.70% and 8.61% respectively. However, irrespective of tick species, males of all species formed 60.54% of the total ticks collected on camels in the area. To minimize the enormous dangers associated with indiscriminate acaricide use, strategic control methods could be useful in the control of the ecto-parasites recorded during the survey considering the marked differences in the distribution of these parasites especially with respect to sex of camel and seasons of the year with highest tick burdens.

Key words: Ecto-parasites, infestation, prevalence, camel, Kano, Nigeria.

Abstract # 39

Studies on the lung pathology of camels (*Camelus dromedarius*) in Tamboul slaughter house, Sudan

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The present research was conducted to study the lung pathology of camels (*Camelus dromedarius*) in Tamboul slaughter house, (Butana region of the Sudan) in May 2008. 103 camels were inspected at postmortem. The age of slaughtered camels ranged between months up to 10 years and the female to male ratio was high (1.3 : 0.8). Clinical examination, clinical signs were done antemortem followed by post mortem examination for lungs and lymph nodes. The major lesions found in lungs were pneumonia with different stages (33.98%), hydatid cysts (14.56%), fibrosis (5.82%) congestion (2.91%) and emphysema (1.94%). Observed pathological conditions were categorized according to camels location. Camels came from Gedarif (eastern Sudan) and Butana (central Sudan) were the highest infected camels with hydatid cysts and Gedarif area was the highest camels location affected with pneumonia. Grossly the hydatidosis infection was found to be associated with other pathological lesions. The hydatid cyst sections showed pneumonic changes like emphysema and oedema. Red hepatization of lungs and areas of consolidation were observed. The lungs

also showed multiple focal areas of consolidation with a dark grayish color and had lobular distribution. Some affected part of lungs had patchy areas of congestion and consolidation with thickening of interlobular septa. Hydatid cysts were observed in lungs as clear, calcified and in caseated form. Histopathology sections had confirmed the variable degrees of pneumonias found in the lungs and showed different stages of pneumonia, bronchopneumonia and chronic pleuropneumonia. The chronic proliferative bronchopneumonia was characterized by a hepatized texture of the affected tissue. Microscopically, the lesions were characterized by severe monocellular infiltration, fibrous proliferation, thickening of alveolar walls and infiltration of lymphocytes. The alveoli were filled with inflammatory cells. The bronchi were filled with inflammatory cells and congested blood vessels. In interstitial pneumonia; the lung was characterized by thickening of alveolar wall and presence of inflammatory cells in moderate numbers. The lymph node sections showed lymphadenitis. The major causes of lung condemnation in Tamboul slaughterhouse were found to be pneumonia and hydatidosis.

Key words: Lung pathology, pneumonia, hydatidosis, camels, Sudan.

Abstract # 40

Ticks infestation in dromedary camel in South-east of Algeria

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It is well documented that ticks infestation is the main external parasite infestation in camel. The present study, which was realised in the South-east of Algeria during the period of May 2005 to February 2006 aimed to identify the major tick species and their prevalence in dromedary. Ticks are collected in tubes containing alcohol (70°) and immediately transferred to laboratory for identification using the Estrada Penea et al. (2004) diagnosis.

Among 50 camels, which were involved in this study, only 31 camels have been infected. Ticks are found in udder and inguinal regions. Five tick species belonging to three genera have been identified:

1. Hyalomma: *H. dromaderii*, *H. anatoalicum*, *H. impelatum*

2. Rhipicephalus: *R. turanicus*

3. Boophilus: *B. annulatus*

H. dromaderii and *H. anataolicum* are predominant; they represented 53.70 and 27.77%, respectively. Male ticks are more important than females (60.18% and 39.82%, respectively).

The prevalence is around 66% and the infection intensity averaged 3.84 ticks by animal. Also, dams are most affected (58.33%) than males (41.67%) and adults are most infested (64.81 %) than calves (35.19%).

Key words: Ticks, infestation, dromedary, Algeria.

Abstract # 41

Epidemiological logical investigation of Brucellosis in one humped camels (*Camelus dromedarius*) in lake chad area of Borno state, Nigeria

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An epidemiological investigation of the one-humped camel (*Camelus dromedarius*) was carried out to determine the status of camel brucellosis in the Lake Chad area of Borno state. A total of five hundred and eleven (511) sera were collected from adult one-humped camels and tested by Rose Bengal plate test (RBPT) and Microtitre serum agglutination test (MSAT). Sixty two (12.13%) of this samples tested positive by both RBPT and MSAT, out of which 23(4.5%) were male and 39(7.6%) were female camels. There was no statistically significant association between sex and reaction to either of the serological tests $P>0.05$; $OR=0.388-1.161$. Two hundred and fifty seven (257) of the 511 sera collected were from slaughtered camels from abattoir while the remaining two hundred and fifty four were from range camels. Thirty eight (14.8%) of the 257 camels slaughtered in the abattoir and 24 (9.4%) of those in the range were positive by both RBPT and MSAT respectively. The association was also not significant at $P>0.05$. Ten (3.9%) and 14 (5.5%) males and females respectively were positive by both RBPT and MSAT, out of the 254 samples collected from range herds in the Lake Chad area of Borno state. Thirteen (5.05%) of the 144 males from the abattoir samples were positive while 25 (9.7%) of the 113 female were positive by both RBPT and MSAT. There was statistically significant association between females camels slaughtered in abattoir and those in herds in the range ($OR=1.514-6.202$; $P<0.05$). The overall prevalence of brucellosis among camels in Borno state was 12.13%.

Key words: Brucellosis, serology, camels, range, Lake Chad, Nigeria.

Abstract # 42

Studies on lung lesions and associated agents in one-humped camel (*Camelus dromedarius*) in Northwestern Nigeria

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In Nigeria, data on the the pulmonary diseases of the camels are rare. The aim of this study was to determine the prevalence of the pulmonary lesions and associated aetiology in the lungs of camels at randomly selected Camel slaughter houses (Sokoto and Kano Main Abattoirs) in Northwestern, Nigeria. For this purpose, two hundred and eighty-three (283)

lungs samples from apparently healthy camels presented for slaughter were collected and examined [227 (80.2%) from Kano Abattoir while 56 (19.8%) from Sokoto Abattoir]. Among these 80 (28.3%) were males and 203 (71.7%) were females. Two hundred and eight, 208 (73.5%) of the lungs examined presented gross lesions such as, pneumonia 139 (49.1%), cyst 9 (3.2%), haemorrhage 2 (0.7%), abscess 12 (4.2%), oedema 40 (14.1%), and emphysema 6 (2.1%). Microscopic examination of swab samples and cystic fluid revealed bacterial and parasitic agents involvements viz: *Staphylococcus spp* 46 (22.1%), *Corynebacterium spp* 27(13.0%), *Streptococcus spp* 14 (6.7%), *Micrococcus spp* 6(2.9%), *Escherichia coli* 13(6.3%), *Bacillus spp* 10 (4.8%), *Proteus spp* 12 (5.8%), *Pasteurella spp* 9(4.3%), *Arcanobacterium pyogenes* 5 (2.4%) and larva stage of *Echinococcus sp* 9(4.3%). It was concluded that camels harbour in their lower respiratory tract potentially pathogenic organisms that may likely be involve in spread of infection to other animals, and therefore, the need for camel herd health programme and strict transborder movement of animals in Nigeria.

Keywords: Lung, Lesion, *Camelus dromedarius*, Northwestern, Nigeria

Abstract # 43

The sensitivity of *Trypanosoma evansi* infection in camels to treatment with Quinapyramines and Cymelarsan

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This study was conducted to investigate the sensitivity of a stock of *Trypanosoma evansi* isolated from naturally infected camels in Showak, Eastern Sudan, to both quinapyramines and Cymelarsan. Two experiments were conducted and in each one six male camels were used. Three were infected & treated with either quinapyramine or Cymelarsan, one was infected non-treated control and two were non-infected, non-treated control. In experiment (I) quinapyramine was tested at a dose of 5 mg/kg body weight. In experiment (II), Cymelarsan was tested at the recommended dose of 0.25 mg/kg body weight. The camels infected and treated with quinapyramine remained parasitemic for a period of 12 days post infection after which they started to show fluctuating parasitaemias. The trypanosomes parasites disappeared from the blood stream of the Cymelarsan treated camels within 24 hours post treatment, then the camels relapsed 19 days, 23 days and 75 days post treatment.

It was concluded that quinapyramine did not give parasitological cure in *T. evansi* infected camels, while Cymelarsan gave parasitological cure up to 19 days after treatment followed by clinical cure. The results were discussed in relation to camel's tolerance to trypanosomosis infection.

Key words: *T. evansi*, sensitivity, Quinapyramines, Cymelarsan, camel.

Abstract # 44

The use of Baymec 1% (ivermectin) in treatment of parasites in camels

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Body condition is an important aspect in camel's economic value in Saudi Arabia. However parasitic infestation causes huge burden on body condition & production. The stress of internal and external parasites also exposed camels for other infection and appearance of emaciating diseases.

Bayamic 1% (Ivermectin) from Bayer is a wide spectrum endectocide for the treatment and control of internal and external parasites at a recommended dose of 1 ml per 50 kg. body weight to be applied s/c. The drug was used for the control of gastrointestinal parasites in 40 camels showing characteristic symptoms of the disease were studied. As a comparison 200 sheep and 20 goats were included. Faeces were collected and analyzed before and after treatment using the flotation technique. Types of parasites were indicated. Stress of parasitic infestation exposed infection by Mycobacterium Para tuberculosis. Treatment with Baymec at the recommended dose had significant effect on body condition and skin coat appearance.

Key words: Parasitic infestation, Bayamic, treatment, camel.

Abstract # 45

First outbreak of trypanosomosis due to *Trypanosoma evansi* in camels, *Camelus dromedarius*, in Aveyron, metropolitan France: diagnosis, treatment and follow up

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An outbreak of *Trypanosoma evansi* in camels was detected for the first time on the French mainland, in October 2006, in a mixed farm (camels and ewes) of Aveyron Department, further to the importation of 5 camels in June 2006 from Canary Island (CI), Spain (CI are known to be infected and have regular surra outbreaks since 1994). One animal died prior to the identification of the parasite and 5 other camels were proved to be infected by microscopical observation of the blood or mice inoculation. All camels were treated in 3 instances at one month interval with melarsamine (Cymelarsan® 0.25mg/Kg IM), quinapyramine (Triquin® 3.75mg/Kg IM) and melarsamine again. A follow-up was made by microscopic examination of blood, CATT/*T. evansi*, ELISA *T. evansi* and PCR with specific

primer for *T. evansi*. All animals became negative to all tests within 2-3 months after treatments. Parasites were not observed in sheep, but the sheep positive to any of the test were slaughtered to ensure the elimination of potential reservoir.

In August 2007, one camel previously found infected, was positive again to all tests. It was immediately treated with quinapyramine and parasites disappeared. One month later it was treated with a double dose of melarsamine (0.5mg/Kg IM). All tests became and remained negative up to date, for one year. Origin of the infection, relapse/re-infection, was questioned. Re-infection was of low probability since there is no obvious reservoir of the parasite, but the hypothesis could not be rejected. Multi-resistance to melarsamine and quinapyramine is of very low probability since it has never been described. Finally the main hypothesis is a relapse due to under-dosage of the chemicals and the refuge of the parasite in an extra-vascular focus (biological compartments of the organism where parasites are poorly exposed to the drugs and the host immune system). A retrospective study proved that the weight of this animal had been strongly under-estimated in December 2006 (250 Kg for 2 years of age) since it was 420Kg when it was weighted in September 2007. It is then hypothesised that the initial treatments killed the circulating parasites but that some trypanosomes could survive in extra-vascular foci and re-invaded the blood in August 2007. After one year of follow-up of this animal and a 2 years follow-up of the other 11 camels, the infection seems to be cleared from that herd.

Robust diagnostic techniques certified prophylactic and curative treatments and quarantine regulation should be defined to accompany the importation of Camelids into France.

Key words: *Trypanosoma evansi*, outbreak, in Aveyron, metropolitan France.

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Abstract # 46

Antibiotic resistance analysis of enterococci, staphylococci and streptococci in East African raw and fermented camel milk

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Camel milk, fresh or spontaneously fermented to “suusac”, can be contaminated by various pathogenic bacteria originating from man or animal. Selected pathogenic or opportunistic pathogenic Gram-positive bacteria were examined to assess the extent of their antibiotic (AB) resistance potential which represents an ecological marker for AB exposition of these bacteria. We found partially high-titers of more than 10⁷ cfu/ml for *Enterococcus* spp., *Staphylococcus aureus*, *Streptococcus agalactiae* or the *Streptococcus bovis* / *Streptococcus equinus* complex (SBSEC) in market “suusac” samples originating from Kenya and Somalia. Among these groups, highest prevalences were determined for tetracycline resistance in all four bacterial groups. Typically, we identified from a total of 105 tetracycline resistant isolates originating from 35 samples 33 as *S. aureus*, 34 as *S. agalactiae* and 38 as enterococci. A genotypic analysis showed that *tet(K)* was present in *S. aureus* at 80 % of the isolates whereas *tet(M)* was present at 100 % in *S. agalactiae* and at 60 % in *Enterococcus* spp. where also *tet(L)* was found (40 %). *S. agalactiae* isolates were phenotypically resistant to oxytetracycline, ciprofloxacin and chloramphenicol at high (> 50 %) prevalences.

Microarray hybridization technology revealed many multiresistant strains containing a broad spectrum of AB resistance genes such as *tet(M)*, *tet(L)*, *tet(S)*, *tet(K)*, *tet(U)*, *msrC*, *mreA* and *ermB* in these three bacterial groups. A high prevalence of multiresistance was also detected in the SBSEC isolates. In a particular isolate we found *tet(L)*, *tet(M)*, *aac(6')-li*, *msrC* and *cat-TC*.

In conclusion, ABR and particularly tetracycline resistance are widespread among the four bacterial groups investigated in this study, even in remote areas and suggest a wide usage of antibiotics in both veterinary and human medicine. The impacts to human health will be discussed.

Key words: Antibiotic resistance, enterococci, staphylococci, streptococci, camel milk.

Abstract # 47

Proximate composition and mineral contents of major muscles in camel carcasses

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The objective of this study was to determine the chemical composition and mineral contents of major camel muscles. Twelve muscles [*semitendinosus*, *triceps brachii*, *recuts femoris*, *biceps femoris*, *triceps brachii*, *infraspinatus*, *gluteus medius*, *semimembranosus*,

supraspinatus, psoas major, longissimus lumborum, longissimus thoracis] were removed from eight young male Najdi camel with similar background and weights (average carcass weight 120 kg). Samples were chilled (2 °C) for 48 h, trimmed all external fat and ground to homogenous. Moisture, crude protein, fat, ash and were mineral contents (Fe, Mn, Ca, K, Na, and Zn) were determined. Significant ($P < 0.05$) differences were found among camel major muscles in moisture percentage. Fat content ranged between 2.33 to 0.56% in camel muscles with the highest in *longissimus lumborum, longissimus thoracis* and the lowest in *Recuts brachii* and *Triceps brachii*. Protein percentages of camel muscles ranged between 20.54-19.48% and have no significant differences ($P > 0.05$) among camel muscles. Significant differences ($P < 0.05$) were found in ash contents with a range between 1.43-1.05%. There were significant differences in all minerals that have been studied with highest element in potassium followed by sodium, calcium and zinc. *Psoas major Longissimus thoracis* and *Longissimus lumborum* were among the lowest mineral content in all camel muscles.

Key words: Camel, carcass, muscles, proximate composition, mineral contents.

Abstract # 48

The effect of age on fat deposition in Longissimus dorsi muscle (between 12th – 13th rib) of camels and compared with those in beef and sheep

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The aim of this study was to determine the effects of age on chemical composition and histological study of Longissimus dorsi (12th – 13th rib) of the Libyan one-humped camel's meat compared with beef and sheep. Samples of Longissimus Dorsi muscles between (12th – 13th rib) were randomly collected from 15 male camels and 15 male of sheep and 15 male of beef, the three different age group : group I (0.5 – 1.5years), group II (2 -3 years) and group III (over than 4 years) .each group contain five animals for each species . Sample were chilled (1- 3 ° C) for about one month, Moisture, crude protein, fat and ash were determined on freeze-dried ground muscle. Parts of the used muscle from each experimental animal were taken for histological study.

The result indicated that in general the species effects have significant influence on fat deposition, protein and expressible moisture, but not on ash.

However, the age had a significant influence ($P \leq 0.05$) on percent deposition of protein and moisture in all of the used species, but did not have an effect on fat deposition, except on the animals aged over 4 years especially in camels.

In term of histological study the result showed that the age had a significant influence on mass and diameter of Longissimus Dorsi muscle (12th – 13th rib) especially on camels, which indicated that it increased with age increase if it is compared with those in sheep and beef.

The increase in density and diameter of muscle myofibrils of camel meat reduce the percentage of fat deposition between the muscle fibers specially in old ages (over 4 years) if it compared with those in cows and sheep of the same ages .

In general, camel meat is similar in taste and texture to beef and sheep (1 -2 years). The amino acid and mineral contents of camel meat are often higher than beef and sheep, probably due to lower intramuscular fat levels. This study confirmed that camel meat is healthy and nutritious

as it contains low fat as well as being a good source of minerals. Age is an important factor in determining meat quality and composition.

Future research efforts need to focus on exploiting the potential of the camel as a source of meat through multidisciplinary research into the efficient production systems and improving meat technology and marketing.

Key words: Camel meat, fat deposition.

Abstract # 49

Quality of camel meat marketed by butchers in Tunisia

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Data on Quality of Camel Meat, particularly on relationships among production systems (conditions) and fattening aspects are rare. The quality of camel meat was studied via chemical and sensory properties of the following six muscles of camel: Psoas major (PM), Longissimus dorsi (LD), Semimembranosus (SM), Semitendinosus (ST), Vastus lateralis (VL) and Triceps brachii caput longum (TB). Muscles were taken from carcasses of six non fattened young males. The young animals were purchased from Gafsa cattle market by butcher's in Kairouan. Muscles were compared with those of camels managed under intensive production conditions and also meat characteristics with beef meat marketed in the same shop. The moisture content of marketed camel meat was $78.29 \pm 0.84\%$. Camel meat contained $19.88 \pm 0.89\%$ proteins but only $0.63 \pm 0.40\%$ fat. We observed few differences between muscles for dry matter excluding fat. However, there was a large range in percent fat (determined in lean tissue trimmed of all external fat). The LD had the highest fat content ($6.21 \pm 2.13\%$ on dry weight) and LV had the lowest ($2.02 \pm 0.59\%$ on dry weight). The PM – LD – SM – ST - LV and TB were ranked by percent fat, total myoglobin (Color) and total collagen (Tenderness). The classification was: leaner to fatty (LV - TB - ST - SM - PM - LD), pale pink to bright red (ST- PM - LV - LD - TB –SM) and most tender to least tender (PM - TB -LV -LD - SM - ST). Where fat content, myoglobin and collagen ranged from 0.43 ± 0.12 to $1.37 \pm 0.45\%$, 2.14 ± 0.46 to 4.08 ± 1.13 mg, and 4.14 ± 0.37 to 7.12 ± 1.87 mg per g of fresh muscle, respectively. The chemical composition varied with management conditions. In all cases, crud fat and total myoglobin increased while moisture and collagen decreased with body condition. Contrary to camels reared under extensive conditions, camels reared under intensive conditions were heavy, with good conformation and had convexed muscles. Percent fat increased as fattening state increased while moisture decreased. The LD muscle is the one that varied the most with conformation. LD hardeness and moisture decreased while fat content increased as body form was improved. Chemically, camel meat was compared with meat of 15 month old steers. Camel meat contained more moisture $78,29 \pm 0,84$ versus $75,19 \pm 1,59\%$, less intra muscular fat $0,63 \pm 0,40$ versus $2,56 \pm 1,40\%$ and the same level of collagen $5,57 \pm 1,27$ mg/g compared with $6,69 \pm 1,96$ mg/g in steer meat. However, few differences between camel and beef meat were observed for Myoglobin $3,20 \pm 1,01$ mg/gF for camel and $4,52 \pm 0,68$ mg/gF for steer.

Key words: Camel, meat, chemical composition, myoglobin, collagen.

Abstract # 50

Study of chemical composition and quality of camel and goat meat

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In the present study, we investigate the differences in nutritional, organoleptic and microbiological quality of camel and goat meat during *postmortem* aging. Muscle of two distinct anatomic regions (haunch and shoulder) was excised at slaughter-house, butchery and laboratory and muscle pH was measured at 1 to 7 days after storage at 4°C.

Obviously, animals were slaughtered stressed and exhausted their energetic reserve. The produced meat has then a high pH value 6.2 and didn't mature properly after seven day of storage, the pH value of carcass didn't reach 5.2; this is responsible for an inferior organoleptic and microbiological quality of meat (camel $6.5 \cdot 10^4$ - $1.4 \cdot 10^5$ ufc/ml);

Camels carcass contains about 77% muscle, 15% of bone, 16% fat. Camel meat contains about 76% water, 23% protein, 1.3-1.6% fat with a small amount of intramuscular fat and low level of cholesterol compared to goat meat, which renders it a healthy food for humans. Ash content of camel and goat meat are comparable, potassium and sodium contents were higher in camel meat.

The consumer take care especially for the quality of his diet. So that, many specialists must appears great interest at livestock farming of animals, their transport conditions to slaughter-house, maturing and keeping of meat. Though, the temperature, pH value and time of storage have a great effect in maturation of different type of meat (camel, goat, sheep...).

Key words: Camel meat, pH, slaughter, composition, meat quality.

Abstract # 51

Effect of low voltage electrical stimulation on meat quality of the one-humped camel (*Camelus dromedarius*)

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The one-humped camel (*Camelus dromedarius*) is one of the most useful domestic animals in the arid and semi arid regions. It can produce good quality meat at comparatively low cost under extremely harsh environments. Camel has great tolerance to high temperatures, solar radiation, water scarcity, sandy terrain and poor vegetation due to its unique anatomy and feeding habits. The camels, therefore, can be economically raised for meat production in these

ecologically constrained areas. A strategy to increase postmortem muscle metabolism and hasten the onset of rigor mortis, might improve the quality characteristics of camel meat. Additionally, a more rapid pH decline could potentially result in better meat quality characteristics. Electrical stimulation is a proven method for improving the tenderness and meat colour from several meat animal species. No reports are available on the effects of electrical stimulation on meat quality characteristics of camel meat. The objectives of the present study were to investigate the effect of age (2, and 12 year), ageing (2 vs. 7 days) and low voltage electrical stimulation (90 V, 14 Hz (pulse of 7.5-millisecond duration every 70 milliseconds) on meat quality characteristics of *Longissimus thoracis* muscles of camel. Ultimate pH, sarcomere length, myofibrillar fragmentation index, expressed juice, cooking loss% and CIE L^* , a^* , b^* colour values were evaluated. Age of camel and low voltage electrical stimulation had significant effect on quality characteristics of *Longissimus thoracis* muscle. Muscles from low voltage electrically-stimulated carcasses had significantly ($P<0.05$) lower ultimate pH values than those from non-stimulated ones. Electrically stimulated carcasses had significantly ($P<0.05$) longer mean sarcomere length, and lower shear force value than non-stimulated carcasses. Myofibrillar fragmentation index was significantly ($P<0.05$) higher for stimulated samples than for non-stimulated samples. Expressed juice was significantly ($P<0.05$) higher for stimulated samples than for non-stimulated samples. Camel meat from the stimulated samples was significantly ($P<0.05$) lighter in colour than the non-stimulated samples based on L^* value. Muscles of 2 year-old camels had significantly ($P<0.05$) lower shear force value, pH, but higher sarcomere length, myofibrillar fragmentation index, expressed juice, and lightness colour (L^*) than those from 12 year-old camels. These results indicated that age had a significant effect on camel meat quality. Low voltage electrical stimulation and ageing for 7 days improved quality characteristics of camel meat.

Key words: Camel meat, electrical stimulation, quality characteristics.

Abstract # 52

Dromedary skin production and valorisation in Tunisia

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Skin is a by-product of animal slaughtering which could contribute to satisfy leather requirements of the country. Tunisia imports an important part of its leather requirements in varied forms. Nevertheless, skin of some animal species is lost and considered having a poor technological property and thus may constitute an environmental problem due to the lack of industrial valorisation. The number of dromedary camel (*Camelus dromedarius*) slaughtered in Tunisia is estimated to 18000 heads (Khorchani et al., 2006), leaving a significant amount of skin that should be estimated accurately in view of a potential industrial valorisation. To better estimate dromedary skin production, a monitoring of slaughter houses in south-east of Tunisia concerned a total of 337 heads divided in two categories of age. Category 1 (cat.1) is formed by 247 animals aged less than 2 years and category 2 (cat.2) included 90 animals aged more than 2 years. Individual mean weight of skin of younger dromedary (cat.1) was significantly lower ($P< 0.001$) than skin weight of cat.2 with 15.134 ± 2.564 and 22.229 ± 3.201 kg, respectively. Mean individual fresh weight of the skin was 17.023 ± 4.173 kg for the total population. The shape of the dromedary skin, the conditions of skin and some

parasitic diseases lead to a relatively low yield of finished leather which does not exceed 70 % on average. However, a better artisanal valorisation with better quality of tanned leathers is conceivable. Industrial tanning of the dromedary skins give finished leather with quality comparable to that of bovine. This result opens the prospect for a dromedary skin valorisation in the manufacture of shoes, in particular the protection shoes and leather craft (Mansouri et al., 2009) thus allowing a better valorisation of this resource and a reduction of the leather products import.

Key words: Dromedary, skin, production, valorization, Tunisia.

Abstract # 53

Clean technologies and treatment of dromedary skin in Tunisia

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The transformation of the skin into leather is carried out during a succession of stages implementing at the same time chemicals, materials and equipments. This transformation makes it possible to eliminate from the skin, of the components incompatible with a good quality of leather.

The leather of dromedary is specific, by the presence of the bump, which it is necessary to arrange during the skin, to keep the whole skin. Callosities present at the medium of the chest, the elbows and the grassets oblige us to cut the skin in three parts (the neck and two bands). Considering the dromedary is an animal which lives in nature, its skin differs from that of bovine and equidae. In each stage of the production, the treatment is specific. The finished leather of dromedary is appropriate well for safety shoes, city shoes for man. The accentuated grain of dromedary leather can be developed in leather craft (hand bag for lady and man, portfolio, travels bag...)

In this communication, the various stages of the manufacture of the skins of dromedary will be evoked, the products, the processes and materials, which lead today, or which are likely the most to lead to the production of a leather which can be marketed on a large scale, on the local and international market, while reducing the pollution produced by the industry of leather manufacture.

A significant part of the manufacture of the dromedary leather proceeds in aqueous phase and led to a consequent waste water discharge containing proteins resulting from the skin and excesses from chemicals implemented throughout production cycle.

The conditions of conservation of the raw hide are also responsible for significant quantities of salt (sodium chloride), evacuated in the first step of the tanning process. Currently various techniques are proposed to reduce the impact of the treatment of leather on the environment. These techniques relate to more powerful equipments of treatment, less harmful chemicals, processes less pollutant and making it possible to better develop the waste eliminated at the various stages from manufacture.

Key words: Dromedary, leather, clean, technology.

Production of the dromedary (*Camelus dromedarius*) hair in Tunisia

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The shearing of the dromedary in Tunisia is carried out during the second half of May until the end of June. In the absence of a market for these natural fibers, it is not systematically carried and is made only to meet a limited special need (Moslah and al., 2006). The difficulty of handling of the animals and the spontaneous breaking of the fiber contributed to the progressive loss of the practice of shearing of the dromedaries contrary to the sheep. Thus, fiber is generally a lost product although opportunities of marketing exist due to the smoothness of certain categories which can reach 20 μm (Harizi et al., 2004). To evaluate the production of dromedary hair under the conditions of southern Tunisia, the shearing of 393 animals was carried out on several campaigns, the animals are partly from the experimental herd of the Arid Land Institute but the majority belongs to private stockbreeders. Animals were divided in 5 categories following their age: cat. 1: up to 6 months old, cat.2: 1.5 years, cat.3: 2.5 - 4.5 years, cat.4: 5.5 to 9.5 years and cat.5: more than 10 years. Two parts of the body were considered: left ventral and dorsal part on the basis of a difference of smoothness of fibers (Harizi et al., 2004) except for the cat.1 (only the ventral part). The average individual production of the ventral part was 0.523 ± 0.161 ; 0.395 ± 0.127 ; 0.416 ± 0.155 ; 0.356 ± 0.135 and 0.448 ± 0.162 kg respectively for the categories 1 to 5. The average individual quantity of the dorsal part reached 0.329 ± 0.112 ; 0.297 ± 0.099 ; 0.311 ± 0.134 ; 0.337 ± 0.128 and 0.318 ± 0.118 kg respectively in the same order. The total individual average production recorded was 0.375 ± 0.079 ; 0.852 ± 0.218 ; 0.692 ± 0.177 ; 0.727 ± 0.247 ; 0.693 ± 0.235 and 0.745 ± 0.242 kg respectively for the categories of age from 1 to 5. The effect of the age was highly significant ($P < 0.05$). The maximum individual production was recorded in category 4 with 2.42 kg and the minimal production was 0.38 kg (category 3). For category 1, the individual production (partial) varied from 0.3 to 0.55 kg. Some values are underestimated, in particular those of the ventral part due to spontaneous breaking of the fiber. In conclusion a better valorization of the hair of the dromedary in craft industry and in the industry of the textile would encourage stockbreeders to carry out a systematic shearing of their herds, thereby contributing to the improvement of their incomes. The valorization of the hair of dromedary will be facilitated if the separation between fine and large hair currently manual would be mechanized. Stimulation of a hair market intended for local use in the country or export will also contribute to better consider these natural fibers.

Key words: Dromedary, hair, production, Tunisia.

Abstract # 55

The potential textile utilization of the down fibres from Tunisian dromedary

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The unique and highly desirable characteristics of luxury animal fibres, such as softness and comfort, have increasingly been sought after by discerning customers world-wide. There has also been a trend towards lighter, casual and easy care garments.

From a textile view point dromedary hair are classified as a luxury fibre. Because of their superb softness and comfort, fine dromedary hairs (finer than 18 micron, essentially for younger dromedary) present similar quality to cashmere which is one of the world's most sought after animal fibres today.

In the light of the above and the fact that dromedary have the potential to produce a fine "down" cashmere type of fibre, we are embarked on this project aimed at investigating the economic feasibility of, and requirements for, utilising fine down components of Tunisian dromedary for producing marketable products.

This report addresses results obtained on fibre samples obtained from the Tunisian dromedary fleeces.

The availability of the Tunisian dromedary offers an opportunity for the diversification of existing agricultural resources without a large capital outlay. The utilization of the fibres as an additional source of income (value addition) could make this animal more profitable. The fibre characteristics, notably fineness and yield, of the Tunisian dromedaries were therefore investigated with a view to assessing the potential of the undercoat as a textile fibre and for value addition. It was found that the Tunisian dromedaries showed potential in terms of the utilisation of their fine undercoat fibres in the high value added textiles.

The recent possession of a dehairing machine in IRA (Tunisia) provides the opportunity for Tunisian dromedary farmers to exploit the potential and ability of the dromedary to produce fine, high quality unique garments.

Key words: Dromedary hair, fibre diameter, fibres dehairing, Tunisian dromedaery.

Abstract # 56

Evolution of the consumption of camel milk products in Nouakchott

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Mauritania is a country of traditional cattle farming. The production of the milk was intended for the self consumption of farmers and for giving free to non producers. From the end of the eighties, there was a settlement of two modern factories for the production of milk products:

“*Laiterie de Mauritanie*” in 1989 and “*Toplait*” in 1994. The marketing of dairy products began with pasteurized camel milk due to a significant concentration of herds of camels around the city of Nouakchott and the growing demand for quality products. The milk of camel is appreciated due to its low fat content compared to that of cows, goats, ewes. This led to the decrease of imported milk products from 14 000 tons in 1992 to 7 000 tons in 2000. This oral presentation will assess the consumption of dromedary dairy products in the city of Nouakchott. The data were get from the factories, networks vendors (farmers), retailers (shopkeepers), supplemented by consumers bibliographic data. The results show that despite the development of the supply chain of urban market in the city of Nouakchott in recent years, the consumption of camel milk is decreasing due to the lack of fodder and the high cost of animal feeding on a global scale.

Key words: Camel milk, consumption, Nouakchott.

Abstract # 57

Milk production potential of pakistani camel (*Camelus dromedarius*) under the dry conditions of the Punjab

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The study was undertaken to assess the dairy character of single humped non-descript (locally called as Desi) camels raised under dry land conditions. Animals belonged to the Barani Livestock Production Research Institute (BLPRI) Kherimurat, District Attock (Punjab-Pakistan). Milk production of five she-camels was recorded monthly from 7th day post-calving till the completion of six months lactation. The browsing/grazing for these animals in the mountainous rangeland mainly comprised of Pholai (*Acacia modesta*), Kandair (*Alhaji camelorum*) and Kao (*Olea ferruginea*) trees and some local grasses like Palwan (*Olea cuspidata*), Chita (*Cymbopogon distance*) and Sariala (*Heteropogon contortus*). Common salt and water were provided *ad-libitum*. All the camels were hand milked after the calves suckled the udder. Experimental animals produced 2100.61 ± 163.32 litres milk in a period of 180 days. The mean milk production was 11.66 ± 0.90 L/d, with the peak milk production in the second month of lactation. The results of the study revealed that camel possess an appreciable dairy potential even under the ranges or dry land conditions. This can be further exploited under good feeding and management conditions coupled with their careful selection and breeding. Conclusively being a member of food producing family, through the application of biotechnology for instance embryo transfer, camels' milk production can significantly be improved. This step will certainly bring prosperity for the people towards their sustainability, particularly belonging to arid/semi arid areas. Moreover undertaking certain biomedical studies on camel milk can prove this animal more vulnerable among the various farm animal species.

Key words: Milk production, dry land, Pakistan.

Short time effects of machine and hand milking on milk yield and milk composition in Tunisian Maghrebi Camels (*Camelus dromedarius*)

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As a result of market demand, intensive camel dairy farms have been recently established in Southern Tunisia for commercial milk production. Perenniality of these farms is strongly related to their profitability which depends on quantity and quality of sold milk. Hand milking is the most used system now, but machine milking start to be adopted by some of them to produce more commercial milk. In order to evaluate the short time effects of machine milking on milk yield and milk composition, 6 healthy female Maghrebi camels (10.8 ± 5.0 yr of age; 436 ± 36 kg BW) at the beginning of lactation (144 ± 21 days; 5.33 ± 1.73 L/d) were followed up during 3 weeks. During the first week, dams were twice (08:00 and 16:00) hand milked and during the two last weeks they were trained and machine milked. In hand milking system, milk let-down was induced by allowing the calf to suckle only the two right teats. The two left teats were manually milked by one qualified person. In machine milking system, an i.v. injection of oxytocin (10 IU/camel) was given to each camel before milking to allow a complete udder emptying. For each hand and machine milking, milk yield, lag time and milking time were individually recorded during one week for both morning and afternoon milking. Sampling of milk for analyse were realized for physicochemical analysis.

In morning (8:00) as well in afternoon (16:00), lag time was half shorter ($P < 0.001$) in machine milking than in hand milking (30.5 ± 1.8 and 27.6 ± 1.2 s vs. 62.1 ± 5.8 and 58.0 ± 4.0 s, respectively). However, milking time was longer (305.2 ± 14.1 and 273.8 ± 21.2 s vs. 192.7 ± 4.5 and 158.0 ± 7.1 s) in machine and hand milking, respectively. Daily milk yield was 26% higher in machine than hand milking system; it averaged 6.69 ± 0.14 and 5.29 ± 0.27 L, respectively. pH of milk was more important ($P < 0.01$) in machine (6.45 ± 0.02 and 6.43 ± 0.02 , in 8:00 and 16:00, respectively) than in hand (6.40 ± 0.01 and 6.31 ± 0.01 , in 8:00 and 16:00, respectively) milking system. In morning, milk density was comparable ($P > 0.05$) between the two milking system (1.0287 ± 0.0003 and 1.0283 ± 0.0006 , for machine and hand milking system, respectively). In afternoon, density was more important ($P > 0.05$) in machine than in hand milking system (1.0262 ± 0.0003 vs. 1.0237 ± 0.0004 , respectively). Excepting the fat content, which was higher (48.3 ± 2.4 vs. 43.1 ± 1.8 g/L, $P < 0.05$) in afternoon hand milking, all other studied chemical parameters of milk of camel (total solid, proteins and ash) were comparable ($P > 0.05$) between the two studied milking systems. During the trial period no clinical mastitis in udder quarters of following dams was observed. In conclusion, machine milking is a practical technology to improve milk yield in intensive production system without altering chemical composition of milk and health of udder in dairy camel.

Key words: Camel, machine and hand milking, milk yield and composition.

First results on conjugated linoleic acid content of camel milk

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Camel milk is an important nutrition source for inhabitants in arid and semiarid areas, but its fatty acids (FA) profile, particularly conjugated linoleic acid (CLA), is not well known. CLA is a term which refers to several isomers of linoleic acid (C18:2) containing a double insaturation in a conjugated configuration and is considered a functional food because of its positive effects on human health. Rumenic acid (*cis*-9, *trans*-11 CLA), the major CLA isomer in milk fat of ruminants, has anticarcinogenic properties, and for this reason there is a growing interest for increasing its content in ruminant's milk. Similarly, vaccenic acid (VA, *trans*-11 C18:1), precursor of CLA, is gaining interest. To our knowledge CLA and VA contents in camel milk have not been reported previously. Therefore, the main objective of this work was to evaluate the CLA and VA contents in camel milk under semi-extensive management conditions. Four primiparous and 13 multiparous Tunisian Maghrebi dairy Dromedaries (*Camelus Dromedarius*) at the beginning of lactation (31 ± 11 DIM) were hand-milked to obtain the milk remained after suckling the calves (allowed to suckle *ad libitum* until 4 months of age). Milk samples were analyzed by a gas chromatograph to assess their FA profile. Camels grazed in a halophyte pasture (6% CP) in the Southeast of Tunisia and received a daily supplement of olive cake (1 kg), wheat bran (0.5 kg), and barley (0.5 kg). Milk yield, excluding that consumed by the calves, was greater in multiparous than in primiparous camels (3.37 ± 0.46 vs. 1.00 ± 0.18 L/d, $P < 0.0001$), but the milk FA profile was similar regardless of lactation number. Main FA of camel milk were: C18:1 (oleic, 30.5% of total FA), C16:0 (palmitic, 25.2%), C18:0 (stearic, 17.2%), C14:0 (myristic, 6.4%), and C18:2 (linoleic, 3.3%). Nevertheless, short chain FA (C4-C12) were detected at lower concentrations, agreeing with previously published reports. The *cis*-9, *trans*-11 CLA and VA contents were 1.1% and 2.8% of total FA, respectively, and significantly correlated ($R^2 = 0.74$; $P < 0.05$). These values are quite similar to those observed in dairy cows and small ruminants receiving diets with moderate quality pastures or not supplemented with sources of linoleic acid.

In conclusion, camel milk produced under semi-extensive conditions is a good source of CLA and VA, which reinforces its health benefits for people in arid areas.

Key words: Camel milk, conjugated linoleic acid.

Abstract # 60

Variation of vitamin C content in camel milk from Kazakhstan

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Camel milk is well known for its richness in vitamin C but the variability of the vitamin C content is rarely studied. In a survey, achieved in Kazakhstan, 42 milk samples from Bactrian (double-humped camel), 73 from dromedary, 19 from hybrids, 22 from mixed farms and 24 undetermined species were collected for vitamin C determination. The samples were collected in four regions of the country and at four season of the year. In the whole sample, the mean value was 150.4 ± 105 mg/L with a range of 15 to 435 mg/L, i.e. variability from 1 to 29.

The vitamin C in camel milk varied significantly according to the place of sampling: the content was higher in Atyrau (175 ± 118 mg/L) in the western part of the country, compared to Almaty (161 ± 96 mg/L) and Shymkent (157 ± 109 mg/L) and quite lower at Aralsk (80 ± 61 mg/L). Milk from Bactrian was richer (169 ± 110 mg/L) than dromedary milk (146 ± 93 mg/L) or hybrid (133 ± 129 mg/L). Within region, the variability could be higher: for example, in Almaty region, 201 mg/L on average in Bactrian vs 149 mg/L in dromedary.

The seasonal variation was similar for all the species. In winter, dromedary milk was richer than Bactrian milk reverse to other seasons. The values for hybrid milk were intermediate between dromedary and Bactrian all over the year. As the whole, the summer milk was richer (227 ± 110 mg/L) than in autumn (180 ± 62 mg/L) and winter (157 ± 58 mg/L). The spring milk contained lower vitamin C concentration (75 ± 59 mg/L).

All over the lactation period, vitamin C concentration in dromedary camel varied from 48 to 256 mg/L (mean = 184) and tended to increase all along the lactation period with an abrupt rise between week 5 and 7. A slight decrease was observed at week 14 (lactation peak) and the maximum was observed at week 31, i.e., according to calving season, in summer time. The colostrum contained less vitamin C than milk.

Key words: Milk, colostrum, vitamin C, camel.

Abstract # 61

Bioactive peptides derived from camel whey as high antioxidant status

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Whey proteins are a major source of bioactive peptides. These peptides can be produced *in vivo* during gastrointestinal digestion or *in vitro* through food processing using specific enzymes. The peptides obtained from enzymatic hydrolysis of milk proteins can act as an antioxidant. Peptides with antioxidant activity possess great potential for use as natural antioxidants in food products. Most of the studies on the bioactive peptides have been done on bovine's whey proteins, but bovine's milk allergy is by far the most prevalent food allergy especially in children because of β -lactoglobulin. Camel milk lacks this protein and is enriched with α -Lactalbumin as human milk.

In this paper we report the antioxidant activities and kinetic parameters for hydrolysis of camel and bovine whey proteins using chymotrypsin and obtained peptide fractions. The total antioxidant capacity (TAC) of whey proteins and their low-molecular-weight fractions were investigated using spectrophotometry ABTS-based method (reduction of the cation radical of 2,20-azinobis(3-ethylenebenzothiazoline-6-sulfonic acid)).

The results indicate the overall antioxidant activity of camel whey proteins and their hydrolysis were higher than bovine whey and peptide fraction between 5-10 kDa showed the highest antioxidant activity. Comparing to bovine, camel α -Lactalbumin showed higher digestion rate. It may conclude the camel whey proteins or their hydrolysates can be used as a novel ingredient for producing functional food with high antioxidant activity.

Key words: Camel whey proteins, antioxidant, α -Lactalbumin.

Abstract # 62

Evolution of microbial population in dromedary milk during storage: inhibition effect of PP3

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The flora of contamination evolution during storage process at a mean temperature of 30 °C enabled us to confirm the auto-purifying effectiveness aspect of dromedary milk. Indeed, the rates of euryhaline bacteria, enterobacteria and of coliformes decrease during the first three days of storing, whereas that of the lactic bacteria tends to increase. By the means of discs

method, the anti-bacterial activity showed that the component -3 of proteose-peptones (PP3) of camel "lactoserum", extracted by FPLC, has a strongly marked inhibition action towards euryhaline bacteria. However, the action is rather less pronounced towards enterobacteria, and even no action has been no towards indigenous camel milk flora.

Key words: Milk, dromedary, PP3, FPLC, antibiogram.

Abstract # 63

Algerian raw camel's milk: identification of dominant lactic acid bacteria and proteins analysis

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The chemical composition of Algerian raw camel's milk is slightly rich in fat 34.4 ± 2.8 g/l, proteins 33.1 ± 2.1 g/l, lactose 45.1 ± 3.1 g/l, ash 8.15 ± 0.15 g/l and total solids 122.6 ± 0.12 g/l. This composition varied by several factors such as feeding, breeds, milk yielding and the health of the animal. Our results showed that total casein proteins were higher than whey proteins. SDS-PAGE showed that casein proteins of camel's milk and cows' milk have the same molecular weight, about 24 kDa. The whey proteins of camel's milk were presented by 5 bands. Compared with cow's milk, camel's milk contents a little amount of β -lactoglobuline. The pH of raw milk decrease from 6.5 to 5.4 after 72 h of incubation at 30°C. The total count of lactic acid bacteria can reach 200×10^6 cfu/ml in MRS medium. Forty strains of lactic acid bacteria were isolated from camel milk. The mesophilic groups were represented by *Lactococcus lactis* subsp. *lactis* biovar. *diacetylactis* which is the dominant strain, *Lc. lactis* subsp. *lactis*, *Lc. lactis* subsp. *cremoris* and *Lc. lactis* subsp. *lactis* biovar. *diacetylactis* produce more than 100 mM of lactic acid after 24 h of incubation at 30°C. The thermophilic strains were represented by two species, *Streptococcus thermophilus* and *Enterococcus faecalis*. From a technological point of view, the camel milk can be used as a source of new starters in the development of the industrial manufacture of these strains.

Key words: Camel's milk, lactic acid bacteria, proteins, acidification.

Abstract # 64

Functional properties of camel milk whey proteins

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Heat stability, emulsifying and foaming properties of camel whey have been investigated and compared to that of cow's whey. Camel's whey is similar to cow's whey in composition but

deficient in β -lactoglobulin (β -lg), which is a major component of cow whey. Whether the deficiency in β -lg will affect stability and functional properties is not yet known. Substantial information on the functional properties of cow's milk whey proteins is available. However, there is little done on functional properties of camel's whey proteins. Therefore the objective of this study was to investigate the heat stability, emulsifying and foaming characteristics of camel's whey proteins. With regards to heat stability calorimetric studies showed no big difference between cow's and camel's whey proteins in liquid form. Upon drying, thermograms obtained indicate that the two proteins are different in composition and thermal stability. The difference is represented in the absence of β -lg and the occurrence of protein denaturation peak at relatively lower temperature in camel whey. The first marginal thermal transition in cow's whey appeared at 81°C followed by two other transitions at 146 and 198°C. For camel's whey, the first transition appeared at 139 and the second and third transitions appeared at 180 and 207°C respectively. The first marginal denaturation peak in cow's whey belong to β -lg which is essentially absent in camel whey while the second peak is due to the mixture of α -lactalbumin (α -la), serum albumin (SA) and possibly part of the partially stabilized β -lg structure during denaturation process. Since camel's whey is deficient in β -lg the denaturation peak at 139 °C must be due to the mixture of α -la, and camel SA. In both proteins, the highest thermal transition at 198 and 206°C belong to sugars such as lactose. The solubility study has shown that camel's whey is more sensitive to pH than cow's milk whey and that heat stability is lowest near the isoelectric point of the proteins at pH 4.5. The sensitivity to pH resulted in partial denaturation and increased tendency to aggregate which cause poor and unstable emulsion at pH 5. With regards to foaming, both cow's and camel's whey proteins have demonstrated good foaming properties; however, the magnitudes of these properties were considerably higher in cow's milk for all the conditions studied.

Key words: Camel milk, whey proteins, heat stability, emulsifying properties.

Abstract # 65

Effect of heat treatment on camel milk whey proteins

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Camel milk samples were collected from 9 early (2-3 months) lactating camels belonging to three different breeds and 3 cow milk samples procured locally. Milk samples were heated at different temperatures (63°C, 70°C, 80°C, 90°C and boiled) for 30 minutes. Whey was separated from the heated/ boiled and raw milk samples. Simultaneously, whey from the cow milk was separated. Average whey proteins concentration in raw camel milk were 0.90 ± 0.04 , 1.31 ± 0.01 and 0.95 ± 0.03 per cent respectively in Bikaneri, Jaisalmeri and Kachchhi camels. In cow milk it was found to be 0.44 ± 0.03 per cent only. Denaturation of camel and cow milk whey proteins was varied at different temperatures. In Jaisalmeri, Bikaneri, Kachchhi and cow milk samples, whey proteins denaturation at 63°C was 5.34, 18.89, 23.15 and 18.18 per cent respectively. At 90°C, highest whey proteins loss was observed in Kachchhi followed by Bikaneri and Jaisalmeri camels.

Key words: Camel milk, whey proteins, heat treatment.

Abstract # 66

How to improve the production of fermented camel milk

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Researches on camel milk are relatively scarce, especially those focused on microbiological aspect. The greatest amount of camel milk is consumed as a fresh or as a fermented milk made by natural lactic souring over several hours at ambient temperature. The consistency of this product is thin and resembles a flock rather than a precipitate. The use of starter culture could improve the quality of this product, but cultures of lactic acid bacteria (LAB) (yogurt culture, cheese culture) were less active in camel milk than in cow milk, possibly indicating the presence of growth-inhibiting factors in camel milk. To improve the production of fermented camel milk, research was performed to consider the microbiological composition (useful and undesirable bacteria) of frozen/lyophilised whole milk from different camels (Kenya) and to select some LAB to use as starters culture. The following bacteria were examined: contaminants (Total Bacterial Count, Yeast and Moulds), undesirable bacteria (Coliforms, Salmonella, *Staphylococcus aureus*, *Listeria monocytogenes*, *Escherichia coli*) and LAB (cocci and rods).

The microbiological analysis evidenced a good hygienic quality of milk samples. LAB were present at a low level (< 100 cfu/ml) or high level (> 1.000.000 cfu/ml), with prevalence of mesophilic cocci.

Identification of LAB (92 isolated strains) was carried out by the research of their capacities to use different carbon sources or substrates (API 50 CH system bio-Mérieux) for the simultaneous study of the fermentation of 49 sugars and sugar derivates. Genotypic identification was necessary to achieve good identification for some of the 92 isolated strains. The study of the metabolic characteristics (gas production, sugar fermentation, growth temperatures, caseinolytic, lipolytic, reducing and acidifying activities) was performed on a significant number of bacteria isolated. *Lactococcus lactis* ss *lactis* predominated. The pattern of fermented carbohydrates is sometimes unusual: 30% of the strains were able to ferment tagatose, a sugar utilised by few species. Wide biodiversity was found for the fermentative profile within the same species.

Lysozyme content was determined on *Micrococcus lysodeikticus*. Renneting properties was evaluated on samples with preservative by means of the thromb-elastograph (Hellige) technique.

The higher amounts of lysozyme found in camel milk are an advantage for natural preservation of milk in arid regions, but it can inhibits LAB too. The use as starter culture of LAB isolated from camel milk and lysozyme resistant can improve its poor rennetability by good fermentation. Thus an appropriate selection of these bacteria, and the creation of a culture collection of strains isolated from camel milk, and identified and typed for their metabolic activities, would provide improved production of fermented camel milk.

Key words: Fermented camel milk, microbiological composition, renneting properties.

Abstract # 67

Biodiversity of lactic acid bacteria responsible for spontaneous acidification of camel milk for the purpose of developing a defined suusac starter culture

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In East Africa, camel milk is consumed as untreated fresh or spontaneously fermented milk known as suusac. The objective of our project is to improve this existing and well accepted camel milk product through the development of an adapted starter culture for a controlled production of high quality and safe fermented camel milk products. The microflora of camel milk products was analyzed using 112 raw camel milk and suusac samples collected in Kenya and Somalia. Out of over 1100 isolated microorganisms (MO), 755 MO isolated from MRS, M17 and KFS media were phenotypically described as Gram positive and catalase negative. These isolated presumptive lactic acid bacteria were further genotypically typed. A rep-PCR assay using GTG5-primers was used to obtain bacterial fingerprints which then allowed grouping of the isolates at strain level. The 16S rDNA of selected isolates representing a dominant cluster was sequenced. The remaining isolates of a cluster were confirmed by genus and species specific PCR assays selected according to DNA-sequencing results. Thus, 62 *Lactococcus lactis* subsp. *lactis* isolates were identified, present in fermented camel milk samples at 5.3 log₁₀ to 8.7 log₁₀ cfu/ml and the rep-PCR banding patterns allowed grouping of 10 different strain cluster. Further dominant MO were identified as: 8 *Leuconostoc* ssp. (7.6 log₁₀ to 8.4 log₁₀ cfu/ml), 47 *Weissella* ssp. (4.3 log₁₀ to 7.9 log₁₀ cfu/ml), 25 *Vagococcus* ssp. (8.0 log₁₀ to 8.5 log₁₀ cfu/ml) and presumably 30 *Streptococcus thermophilus* (7.7 log₁₀ to 8.9 log₁₀ cfu/ml). Due to their close relationship with *S. salivarius* and *S. vestibularis*, presumable *S. thermophilus* isolates will require further analysis to confirm their taxonomy and non-pathogenicity. Interestingly, high cell counts of opportunistic pathogens such as *Enterococcus faecium* (70 isolates, 2.0 log₁₀ to 8.5 log₁₀ cfu/ml), *Enterococcus faecalis* (30 isolates, 3.3 log₁₀ to 8.2 log₁₀ cfu/ml), *Streptococcus* ssp. of the *S. bovis/S. equinus* complex (132 isolates, 5.4 log₁₀ to 8.6 log₁₀ cfu/ml) as well as *Streptococcus agalactiae* (33 isolates, 3.0 log₁₀ to 7.5 log₁₀ cfu/ml), were detected in raw milk and suusac - surprisingly as part of the dominant fermentative flora. These results indicate a need for a controlled fermentation process through the development of a dominant starter culture in order to increase the product quality and safety. So far identified *Lc. lactis* subsp. *lactis* strains along with *Leuconostoc* ssp., *Weissella* ssp., *Vagococcus* ssp. and presumable *S. thermophilus* should provide a solid basis for the development of such an adapted starter culture.

Key words: Camel milk, lactic acid bacteria, spontaneous acidification, starter culture.

Enumeration and identification of pathogenic bacteria and yeasts in raw and naturally soured camel milk in Kenya and Somalia

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Camel milk, consumed traditionally as either fresh or naturally fermented milk (*Suusac*), has played an important role in the nutrition of the population in arid zones of East African countries. As a prerequisite for starter culture and camel dairy development and marketing particularly in the more quality conscious urban markets, camel milk quality improvement is necessary. The objective of this study was to determine the microbiological quality of camel milk and milk products at different points in the informal market chain in Kenya and Somalia. Raw camel milk and *Suusac* from 4 and 2 major marketing sites in Kenya and Somalia respectively were investigated for total bacterial counts (TBC), staphylococci, enterobacteria and yeast and molds on selective media. A total of 217 presumptive *Staphylococcus aureus*, 160 presumptive *Enterobacteriaceae* and 150 presumptive yeast and mould isolates were selected based on colony morphology and purified by repetitive streak plating. Further characterization was done by testing for their catalase, Gram staining reactions and presence of clumping factor for *Staphylococcus aureus*. Presumptive *Enterobacteriaceae* and yeasts were identified by API 20E and API 20C AUX identification systems, respectively. *Escherichia coli*, which were the predominant *Enterobacteriaceae* detected by API 20E were evaluated for the presence of virulence genes *stx1*, *stx2* and *eae* by multiplex PCR and also for *rfb* O157, *rfb* O111 and *rfb* O113.

TBC in raw milk increased from the herd level ($<10^5$ cfum⁻¹), to the market intermediary (10^5 cfum⁻¹) to the final market (10^5 - 10^7). The range in yeast and molds, *Staphylococcus aureus* and *Enterobacteriaceae* counts in the sampled final market milk was, 10^2 - 10^3 , 10^4 - 10^5 , 10^4 - 10^6 cfum⁻¹, respectively. Range in TBC, yeast and molds, *Staphylococcus aureus* and *Enterobacteriaceae* counts in *Suusac* were 10^8 - 10^9 , 10^2 - 10^8 , 10^3 - 10^8 and 10^3 - 10^6 respectively.

Predominant yeasts identified were *Candida famata* (16%), *Trichosporon mucoides* (14%), *Rhodotorula mucilaginosa* (9%), *Saccharomyces cerevisiae* (9%), *Tricho. Cutaneum* (8%), *Candida guilliermondii* (7%), *Candida lusitaniae* (6%), *Candida inconspicua* (5%), *Cryptococcus laurentii* (5%), *Cryptococcus albidus* (4%), *G. klebahnii* (4%), *Candida krusei* (3%) and *Cryptococcus humicolus* (3%). Predominant *Enterobacteriaceae* were *Escherichia coli* (40%), *K. pneum. Pneumoniae* (29%), *Enterobacter sakazakii* (15%), *Acinetobacter spp.* (3%), *Kluyvera spp* (2%), *Leklercia adecarboxylica* (2%) and *Serratia ficaria* (3%). Coagulase positive *Staphylococcus aureus* were 46% of the total isolates with 23% and 21% of these being found in fresh camel milk and *Suusac* respectively. One *Escherichia coli* isolate with sequence *eae* was detected.

The high counts and diversity of pathogens imply need for improved hygiene practice at all levels in the marketing chain. The diversity of yeasts suggests that they are able to multiply in the milk and may result in spoilage or, conversely, in enhancement of the flavour of the fermented milk.

Key words: Camel milk, pathogenic bacteria, Kenya, Somalia.

Production of freeze-dried camel milk to expend its uses

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Breeding of dairy camels appears to become of great interest, because camel milk could be used in therapeutic and dietetic fields. Camel milk is a rich source of proteins with potential of antimicrobial and protective activity. The dromedary camel is a good source of milk especially in areas where the climate adversely affects the performance of other milk animals. Camel milk was produced in desert regions very eloigned from agglomeration, it transport is very difficult. One problem lies in the milk itself, which has so far not proved to be compatible with the UHT (Ultra High Temperature) treatment needed to make it long-lasting. However, the main contrain of this emerging milk market is the lack of milk processing technology. Then, dry-freezing camel milk is a good process to preserve their biologic characteristics and to prolong its conservation several months.

Camel milk samples were collected from five multiparous females. The pooled camel milk was divided in twelve flacons (300 ml by flacon), congelated at (-80°C) and the time of lyophilization was 48 hours. We determine the physico-chemical composition of raw milk and powder after lyophilisation and its rentability. The pourcentage of humidity was 3.78±1.63%. Different doses were performed to reconstitute the powder and compared physico-chemicaly and bacteriologically with initial camel milk and cow milk.

The reformed camel and cow milk keep same qualities (hygienic, physico-chemical and sensorial) criteria of the raw milk. However, we can keep refrigerated reformed camel milk during 48 h but it is preferable to consume it throughout the 24h after reformation. While reformed cow milk can be stored at the refrigeration temperature for only 24 h. Moreover, the method of freeze-dry is considered sufficient to ensure safety and adequate keeping quality of milk during a long time more than pasteurized milk. These criteria can be exploited to transport milk from zone of production to zone of consumption even for far distance.

As well as its high mineral and vitamin content, research has suggested that antibodies in camels' milk can help fight diseases like cancer and hepatitis C. A work is on-going to see whether it can have a role in reducing the effects of diabetes. Tapping the market for camel milk. Although freeze-dry can extend keeping milk safe, we can give camel milk to consumer even in the area which devoid of camels. Then, it is interest to use freeze-dryer of high capacity when raw milk is available.

Key words: Camel milk, powder, conservation, marketing.

Posters

Communications affichées

Products

Abstract # 70

Influence of cotton side cake on camel milk production

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Camel (*Camelus dromedarius*) rearing is one of the most important activities of pastoral communities in the northern regions of Mali (Gao, Tombouctou and Kidal). Feed shortage has been identified as the second major constraint of camel production. A feeding trial using cottonseed cake (CSC) was carried out with lactating camels in Tin –Hama in Ansongo district of Gao region. Twenty-six lactating camels of Talabatayatt breed were used. They were from five farms. In each farm, 2 to 3 animals were randomly assigned to one of two treatment groups. Group I was received 3 kg of CSC /head/day, and group 2 was the control. Camels were all grazing on the natural pasture during the day. Prior the start of the trial, animals were treated against helminthes and ecto-parasites with ivermectine and against trypanosomiasis with diaceturate of diminazene; then, they were also vaccinated against pasteurellosis, anthrax and black leg, and they had access to salt during three days. The trial lasted 74 days during which the following measures were made: intake of CSC, quantity of milk offtake by herder, chest size and hump height. The animals consumed all the amount of supplement provided, because remain was only 0.3%. In general, supplementation increased milk offtake by 3.5 times (6.62 ± 0.06 kg) for group 1 compared with the control group (1.9 ± 0.06 kg). The supplemented animals had a significantly higher milk yield ($P < 0.05$) than their counterparts in the control group, irrespective of the farm. At the beginning of the trial, there was no difference between the two groups regarding chest size and hump height, but by the end, the difference was significantly higher ($P < 0.001$) with the supplemented group compared to the unsupplemented one. In the control group, all the measurements were lower at the end of the experiment than they were at the beginning, indicating that the animals were losing weight during the experimental period. Supplementing lactating camels with cottonseed cake was very beneficial. The average net benefit was 1 141 F CFA (2.5 \$) per day and per camel. No health problem was encountered during the experiment.

Key words: Supplement, cotton side cake, milk production, camel.

Abstract # 71

Milk composition as affected by parity and stage of lactation in Kohi camel of Balochistan, Pakistan

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The camel milk is famous for its peculiarities especially for its health responsive aspects. Camel's milk having low and high contents of fats and protein respectively, which proves its

superiority. The Balochistan province of Pakistan places about (379,528 heads) 41% of the country's camel but rare work has been done especially on their various aspects of milk production and milk composition. This study was, therefore, conducted to know the chemical composition of the camel milk in northeastern Balochistan. Six multiparous camels regularly milking were selected for this study, and the milk was analyzed for two stages of lactation (2nd and 7th month of lactation). The study revealed that the Kohi camel milk contains average of fat, protein, lactose and ash contents as 2.63, 5.05, 4.01 and 0.70%, respectively. The parity affected the milk fat, protein, lactose and ash contents. The fat and protein contents increased with the advancement of the parity but to a certain level (parity 5). Stage of lactation also affected the milk composition and fat percentage was higher (2.70%) in the second stage of lactation than (2.57%) those of first stage. protein was higher in the first stage of lactation (5.56% and 4.15% respectively) than second stage of lactation (4.54% and 3.87% respectively). Lactose was higher in the first stage of lactation (3.67%) than second stage of lactation (2.55%), while the ash was higher in the second stage of lactation (0.73%) than first stage of lactation (0.68%). Average mineral profile of the milk samples was observed as Na (49.42 mg/100g), Mg (15.04 mg/100g), Fe (0.55 mg/100g), Mn (0.066 mg/100g), Cu (0.22 mg/100g) and Zn (1.42 mg/100g). All minerals except Na had showed a very minute variation among parities. An irregularity was found in the chemical composition of the camel milk based on the parity and stage of lactation. Not only the parity and stage of lactation but also the age of the animal, continuous herd's movement, nutritional management and the seasonal difference might have contributed in the cause of all irregularities.

Key words: Kohi camel, milk composition, parity, stage of lactation, Balochistan.

Abstract # 72

Effect of lactoperoxidase in preserving raw camel milk and its effect on some pathogenic bacteria

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The collection and transportation of milk to the processing centers are confronting many problems in the developing countries. Most of these countries exist in humid hot regions for most of the year, in addition to the poor hygienic awareness that led to the contamination of milk during collection and transportation operations. Therefore, this study was directed to the effect of lactoperoxidase system on *Escherichia coli* O157:H7 and *Staphylococcus aureus* at a contamination level of 10⁶ colony-forming unit (CFU)/ml.

Milk (cow and camel) samples were collected and transported under refrigeration to the laboratory within 3 hours of milking process, and the values of pH, acidity % and thiocyanate ion (- SCN⁻) were determined. Samples were divided into two groups: untreated and treated and the LPS was activated with a final concentration of thiocyanate ion of 14.5 ppm, with the addition of 8.5 ppm of hydrogen peroxide. Samples were incubated at 37 ± 1 °C and changes in bacterial counts, acidity were followed every 2 hours, in addition to the estimation of the concentration of residual thiocyanate.

The results of the statistical analysis (at P≤0.01) showed that the process of activation of LPS had significant effects on the growth of *E. coli* O157:H7 in both cow and camel milks. It was observed that the counts of this bacterium was declined from 10⁶ to 10⁴ CFU/ml in treated

cow milk after 10 hours of incubation at 37°C, while it reached 10³ CFU/ml in treated camel milk at the same temperature and incubation period. However, these counts increased after 24 hours of incubation to reach 10⁸ CFU/ml in both milk types. Concerning *Staphylococcus aureus*, the changes in its counts was unobservable during first two hours of incubation period, but the counts continued to increase until it reached 10⁸ CFU/ml in both types of milk after 10 hours of incubation at 37°C.

Key words: Preservation, raw camel milk, lactoperoxidase effect, *E. coli*, *S. aureus*.

Abstract # 73

Camel milk-properties and its products

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In the arid areas where other livestock finds difficult to survive, camel have the potential of milk production. Indian camel can produce milk up to 5-6 liters/day and have a lactation length of 14-16 months. The chemical composition of camel milk reveals higher pH (6.58 ± 0.03), protein (3.87 ± 0.17 %), casein (3.01 ± 0.14 %), fat (3.10 ± 0.15 %) and total solids (11.32 ± 0.36 %) in the late phase of lactation. The macro-minerals composition reveals higher levels of sodium (35.54 ± 0.88 mEq/l), potassium (71.96 ± 1.43 mEq/l), calcium (97.43 ± 0.56 mEq/l), phosphorus (47.21 ± 0.53 mEq/l) and magnesium (13.59 ± 0.32 mEq/l) in late phase of lactation. Trace minerals viz., iron (1.00 ± 0.12 mg/l), zinc (2.10 ± 0.02 mg/l), and copper (0.44 ± 0.04 mg/l) are high in camel milk compared to bovine milk. The vitamin-C content in camel milk (5.18 ± 0.36 mg %) is three fold higher compared to cow milk. Higher content of long chain fatty acids are present in camel milk. Camel milk can be stored up to 8 hours at room temperature. It exhibits hypoglycemic effect when given as an adjunctive therapy, which might be due to presence of insulin (30.71 ± 1.63 μ IU/ml) /insulin like protein. It can also be utilized as an adjunct/supplement among tuberculosis patients. Various camel milk products are prepared and commercialized at this research Centre viz. ice cream/kulfi with different flavors, flavored milk, fermented milk, tea and coffee. Recently, camel milk skin cream is developed and its evaluation for anti-wrinkling properties is under trial. Thus, camel milk possesses nutritive as well as medicinal properties and it can be one of the most valuable foods in arid and semi-arid areas.

Key words: Camel milk, chemical composition.

Abstract # 74

Contribution to optimisation of cameline cheese using gastric enzymes from dromedaries of different ages

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She-camel milk is singular by its vitamin C, niacin, and riboflavin contents. It is also known by its health allegations (anti-diabetic, anti-infectious, anti-stress, its effects against stomach-aches, etc.). However, its valorisation is still very limited. The particular composition of this milk makes its conservation and transformation very difficult. Investigation on the conservation possibilities of cameline milk, thus its transformation into derived products such as cheese so as the population gets benefit from its nutritional and therapeutic virtues, is undertaken. On the other hand, analyses have shown its weak coagulation propriety, which is the key of transformation. In order to remedy for this obstacle, a large variety of techniques have been proposed. Among these methods is the use of dromedary gastric enzymes. The results show that old dromedaries' raw gastric enzymes give better results than young's one. Optimisation of flocculation is obtained at coagulation conditions of cameline milk for a pH 5.8, a temperature of 30°C, a CaCl₂ concentration of 0.01M, and for an age of eight years (adult age > 5 years).

Key words: Dromedary, milk, cheese, gastric extracts, Sahara.

Abstract # 75

Production and consumption of camel milk in Khartoum State, Sudan

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A random sample of 30 camel herders (producers) and a sample of 30 consumers of three equal replications each were used for this study in Khartoum State during the period December, 2006 to April, 2007.

The producers characteristics showed that 100% were males due to the hard nomadic nature of the job. Of these, 69% were above 40 years of age and 15.4% had an age range of 30-40 years. The education level showed that 69% were either illiterates or of low educational level. Most of the owners herd their own camels. The most common breed types were the pack camels (*Arabi*) (69%), *Bishari* camels (15.4%) and the *Bishari-Annafi* cross (15.4%) as riding camels. 30.7% of the herds were composed of above 100 camels, 15.4% of the herds were composed of 60-70 camels, 23.1% of the herds had 30-40 heads and 30.8% had less than 30

heads. 46.2% of the male camels were kept for breeding, 15.4% were kept for sale as riding, 15.4% were kept for meat while 7.7% were kept for sale as racing camels. 53.8% of the lactating camels were found to produce 1.5 liter/day, 46.2% were found to produce a range of 5-10 liters/day. Milk consumption preference was 69.2% as fresh milk, 15.4% as fermented, 15.4% both fresh or fermented while none of the producers tended to process camel milk. For the general uses of camel milk, 7% used it as food, 30.8% as a source of income and 61.5% used it for both food and medication. The main uses of camel milk as a medicament were 30.8% for diabetes mellitus, 30.5% for gastro-enteritis, 15.3% for jaundice, 7.7% for malaria and 7.7% for leukemia.

The occupational career of the consumers was 43.3% as students, 20% as employees, 16.7% as teachers, 10% as housekeepers, 6.7% as workers and 3.3% as butchers. All respondents (100%) agreed on possibilities of processing camel milk and possibilities of raising camels in intensive farming system for milk and meat production. For investment, 50% preferred it's keeping for meat production, 36.7% for milk, 10% for racing and 3.3% for both milk and meat production.

The findings of the study indicated high possibility and feasibility of camel milk production and consumption in Khartoum State which hosts about 6 million inhabitants.

Key words: Camel milk, production, consumption, Khartoum State, Sudan.

Abstract # 76

Effect of palm oil supplementation on composition and milk yield in camel

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Nine she-camels were used to study the effect of palm oil supplementation on the milk yield and milk composition. Three diets were formulated according to percentage of palm oil added (D1, control 0%; D2, 1.5%; D3, 3%). Experimental design was factorial with repeated measurements. The studied traits were daily feed intake (DFI), daily milk yield and compositions (protein, fat, lactose and minerals; sodium, zinc, potassium, phosphorus, magnesium, ferrous, manganese, cadmium and sulfur).

Results showed that milk yield and DFI of D2 and D3 were significantly decreased than the control. Average of milk yield were 6.28, 5.99 and 5.53 kg/day for D1, D2 and D3, respectively. On the other hand, no significant effect due to adding palm oil in rations were found in most of milk compositions. Calcium concentration in milk was significantly increased for animals fed D2, and the values were 658, 691 and 671 ppm, for D1, D2 and D3, respectively. Also, copper concentration in milk was significantly increased for animals fed D3, and the values were 3.04, 3.31 and 4.76 ppm for D1, D2 and D3, respectively. Animals fed D3 tended to have higher fat and protein contents of milk but not reached the significant level.

Results concluded that adding palm oil to diets at tested levels did not affect significantly the milk quality, but decrease the milk yield and feed intake.

Key words: Camel, palm oil supplementation, milk yield, chemical composition.

Abstract # 77

Effect of udder health status on some milk constituents of camels in Riyadh Area, Saudi Arabia

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A total of 764 quarter-milk samples were collected from 47 camel herds (*Camelus dromedarius*) in Riyadh area, Saudi Arabia. Fore milk fractions (40-60 ml) were used in the study. California Mastitis Test was applied to all samples, and samples with negative or trace score were assigned as healthy quarters. Milk components were determined with a milk scanner (Lacto Star), and a pH meter was utilized to measure pH of the milk samples. Atomic absorption spectrometry was used to determine Ca, Na, and K values. A wide range of milking, breeding and feeding practices was observed in all herds. However, nomadic and transhumant systems were the most common rearing systems in Riyadh area. The proportion of affected quarters was almost one third of the total samples. The means of fat, protein, lactose, and solid non-fat % of healthy quarters were 2.91, 3.52, 5.13, and 9.40% respectively. The means of Ca, Na and K concentration of healthy quarters were 96.71, 36.12, and 90.81 mg/100g respectively. A significant decline of milk constituents was found in samples suspected of subclinical mastitis, except for the Na mean. Conversely, no significant effect of udder health status was found on fat percentage, whereas pH level was almost constant (6.42). These findings show an obvious and significant impact of the udder health status on camel's milk constituents in Riyadh area. Urgent programs of controlling mastitis on camel's herds should therefore be initiated.

Key words: Camels, udder health status, milk constituents.

Abstract # 78

A preliminary study of taxonomic enterococci isolated from dairy camel by using PCR based method

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Thirty of thirty-seven cocci isolates from traditional 36 h-old fermented camel's raw milk were characterised phenotypically and genotypically in order to assess the biodiversity within this wild microbial population. Selective SB media, genus and species-specific tests,

based on the manganese- dependent superoxide dismutase A encoding gene *sodA*, were used for the molecular identification of enterococci species. All 30 isolates were characterised at strain level and 28 of them could be identified as belonging to the genus *Enterococcus*. In addition, by using *Efm1/Efm2*, *Efs1/Efs2* and *Eh1/Eh2* primers, ten different genotypes were recognised. *Enterococcus faecium* was the dominant biotype followed by *Enterococcus faecalis*. The results suggest that wild bacterial populations should be preserved in order to protect the traditional lactic fermentation and for product innovation.

Key words: *sodA*, PCR, enterococci, genus primer, species-specific primer, fermented milk, *Enterococcus*.

Abstract # 79

Characterization of thermoresistant cocci from fermented milk in arid area and DNA identification of atypical enterococci and lactococci strains

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Lactic acid bacteria (LAB) are widely used in food industry and their growth performance is important for the quality of the fermented product. By combining results from conventional isolation methods and molecular investigation of 16S rRNA gene and lactococcal/enterococcal specific genes, we identify at species level catalase negative gram positive thermoresistant cocci isolated from traditional 'leben', a 24-h fermented milk in arid area of west Algeria, in order to isolate new strains of potential interest in milk fermentation and assess their diversity within the wild microbial population. 40 strains phenotypically related to cocci LAB could be identified as belonging to the species *Lactococcus lactis* ssp. *lactis*, *Enterococcus faecalis*, *Enterococcus faecium*, and other *Enterococcus* species, but no *Streptococcus thermophilus* strain was isolated. Ten different phenotype groups were recognised, and the species content of these groups were in some cases different from the expected features usually given in genus and species descriptions. In particular, 3 atypical lactococci, able to grow in 6.5% NaCl, at 42°C and showing a resistance to thermal stress were isolated. Selective SB medium was found to be a reliable technique, alternative to molecular techniques, allowing the discrimination of most enterococci from lactococci. New starter strains displaying unusual properties for their species could be isolated from traditional 'leben' produced in the desert area. Study of more strains of this type should provide starter strains for innovation product. This study proposes a reliable isolation method which could be used at a first level to isolate number of such strains in different geographical area.

Key words: Streptococci, thermotolerant wild lactococci, enterococci, indigenous lactic acid bacteria, arid area, 16S rDNA.

Abstract # 80

Interaction of lead and cadmium with lactic bacteria isolated from camel milk and shubat from Kazakhstan

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In Kazakhstan and some other countries from Central Asia, the production and the consumption of traditional fermented camel milk, called *shubat* is a common fact. These products are culturally very important and are typical of these countries. However in Kazakhstan, much environmental pollution, like polymetals industry, wind erosion, soil degradation by salinization, desertification and radio active contaminations are observed. The pollution of the grounds of certain areas by lead and cadmium is a danger to the health of the consumers of dairy products because these metals concentrate throughout the food chain. The camel's milk and shubat being touched by these contaminations, we measured lead and cadmium contents ranging lead between 0.26 and 0.33 ppm and cadmium 0.012 ppm for milk and *shubat* respectively. These values are largely above the limit threshold of the Kazakhs and international standards. The impact of the lactic fermentation of milk in *shubat* could make it possible to decrease the availability of these metals in the digestive tract of the consumers because lactic bacteria are able to adsorb heavy metals. A qualitative test assessing the capacity of 14 lactic wild strains isolated from camel milk in 2008 was achieved for their detoxification capacity. This test was carried out on solid MRS or M17 media. Fixing was revealed by the using of associated sodium sulphide and hydrochloric acid. On 14 wild lactic strains, 3 doesn't interact with these metals, 1 seems to interact with lead, 1 with cadmium and 9 with both metals.

Key words: Camel milk, pollution, lead, cadmium, lactic bacteria, Kazakhstan.

Abstract # 81

Production, handling, preservation and utilization of camel (*Camelus dromedarius*) milk in eastern Ethiopia

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Production, traditional preservation and handling practices, and utilization of camel milk by nomadic pastoralists in eastern Ethiopia were assessed. A total of 73 households were interviewed on various aspects of camel milk and camel milk products using a single-visit multiple-subject diagnostic survey. All the households interviewed owned camels and milk production was the primary reason for keeping camels in the area. All (100%) the respondents reported that camel milk is mainly consumed in its raw state; however, 80% of the informants indicated that they consume camel milk after it turns sour. Pastoralists claim that camel milk has therapeutic property against jaundice, malaria and constipation. *Dhanaan* (a naturally

fermented sour milk) is the major traditional product made from camel milk in the study area while butter and cheese are not traditionally made from camel milk in the area. Various traditional methods have been used to preserve camel milk in the area and the majority of the respondents reported that raw camel milk can be kept for about seven days. The major contributions rendered by dromedary camels in the study area were milk production and transportation, while the major constraints associated with camel milk production in the area were feed shortage and prevalence of disease. Camels in these areas feed on poor-quality natural vegetation mainly cactus and *Acacia* spp. and they were not given supplementary feed except salt and/or mineral soil. Camel milk has a number of unique properties and the camel is an important factor for the survival of pastoralists in eastern Ethiopia. Thus, in order to ensure food self-sufficiency in the arid pastoral areas much attention needs to be given to the camel by development planners.

Key words: *Camelus dromedaries*, Camel milk, Ethiopia, Therapeutic property, Traditional preservation.

Abstract # 82

Effect of salt level on some physico-chemical properties and acceptability of camel milk cheese

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The objective of this study are to investigate the effect of different salt level on camel milk cheese and to valuate the sensory characteristics of the camel milk for acceptability purposes..

The cheese was made from camel milk, using camifloc enzymes, then the cheese was treated with different levels of salt (0.0, 0.5, 0.1 % salt). Then the resulted cheese was stored for 4 days at refrigerator.

The cheese yield was estimated as 10.3 %, the mean of physico-chemical properties revealed that pH was 5.83, acidity was 1.03 %, total solids was 35.72 % and fat was 16.34 %, proteins was 16.12 % and ash was 1.74. %. Moreover there were significant ($P<0.05$) differences of the cheese treated with different levels of salt in pH, acidity, total solids content and fat content. On the other hand, there were no significant ($P>0.05$) differences in total proteins and ash percentages and no significant ($P>0.05$) differences in total bacterial, coliform, yeast and mouldt, and psychotropic counts. However, there were significant ($P<0.05$) differences during the storage period.

Sensory evaluation conducted showed that, the cheese made from camel milk containing 1% salt was more acceptable than cheese containing 0.5% salt, which was moderately acceptable, and the least one was the unsalted cheese

It was concluded that cheese made from camel milk could possibly be accepted by the consumers in Sudan, provided that suitable salt concentration (1%) is added.

Key words: Camel milk, transformation, cheese.

Abstract # 83

**Identification of minor proteins camel colostrums and mature milk
by two-dimensional electrophoresis**

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To further elucidate and understand cameline milk protein composition and its relation to bioactivity, we have investigated the cameline whey proteome by gel-based proteomic method (Two-dimensional gel electrophoresis (2-DE)).

The milk proteins were then separated by isoelectric focusing gel electrophoresis between pH 3 and 10. A great number of spots were detected in both colostrum and mature milk by silver staining after 2-DE. The distribution of individual proteins greatly differs between camel and bovine milk, and the distribution in camel milk is unique and particular. The presence of protein having electrophoretic mobility comparable with β -lactoglobulin seems to be present with low intensity. To determine N-terminal sequence of this spot could be very important to prove if camel colostrums and milk are devoid in this protein or its existence in low amount.

Key words: camel milk, 2-DE, β -lactoglobulin.

Abstract # 84

Physical and chemical properties of burgers manufactured with different levels of camel meat

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The objective of this study was to evaluate quality attributes of burgers manufactured with different levels of camel meat. Chemical composition, cooking loss, water holding capacity, objective color, PH, oxidative rancidity and sensory evaluation were determined. The meat was obtained from 5 mature camels and beef animals (3-4 years old). Five levels of camel meat treatments 0% (pure beef, control), 25%, 50%, 75%, 100% were used. Increasing the level of camel meat resulted in significant ($P < 0.05$) increase in moisture% while protein, fat and ash percentage decreased significantly ($P < 0.05$). PH, WHC increased slightly and significantly ($P < 0.05$) with increasing the level of added camel meat. With the exception of levels 0 and 100% cooking loss of burgers from manufactured with different levels of camel meat were not significantly different ($P > 0.05$). The control (0) showed the highest cooking loss and shrinkage% while the 100% level had the lowest cooking loss and shrinkage%. Color co-ordinates a-(redness) and b-(yellowness) increased not significantly ($P > 0.05$), Level (0) showed the lowest a-(redness) and b-(yellowness) values while the 100% level showed the highest a-(redness) and b-(yellowness). Oxidative rancidity (TBA-value) decreased significantly with increasing level of camel meat but this decreased was not significant between levels 50, 75 and 100% and also between levels 0 and 25%. The control showed the

highest TBA-value, levels 75% and 100% showed the lowest values. Sensory evaluation, panel scores for tenderness, flavor, juiciness and colour increased significantly ($P < 0.05$) with increasing the level of camel meat.

Key words: Camel meat, burger, physical, chemical, sensory properties.

Abstract # 85

Monitoring of private dromedary calves fattening units in southern Tunisia

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The dromedary meat is consumed traditionally in the cities and villages of the southern Tunisia near to camel breeding areas. Currently, dromedary meat is highly demanded almost all over the country which resulted in slaughtering of young males (8-18 month) with an average live weight of approximately 120-150 kg. However, the current regulation prohibited the slaughtering of male dromedaries not having reached 250 kg live weight. The fattening activity was developed during the last decade by the breeders or other actors. In this framework and in order to develop camel calf fattening in province of Tataouine (south-eastern Tunisia), the Prodesud project assisted in the establishment of 6 private fattening units during 2007/2008. Each unit includes 10 male camel calves, maintained in stalling, which was isolated from the herd at approximately the 7 months age. The diet is composed of wheat straw and concentrate for the first 3 units. The straw was replaced by the oats hay for the unit 4. For the units 5 and 6, half of the animals received the straw and other half received hay in addition to the concentrate.

In the first three units where the straw is only the used fodder, the mean initial live weight (ILW), was 132.2 ± 27.2 ; 157.9 ± 28.3 and 134.8 ± 15.1 kg, respectively. The mean final live weight (FLW) reached 249.8 ± 20.9 ; 247.4 ± 30.7 and 245.4 ± 15.6 kg respectively. Mean daily gain (MDG) was 465, 509 and 639 g in the same order during the fattening period 253, 176 and 173 days respectively. The ILW, FLW and MDG recorded in unit 4 were respectively 152.5 ± 30 ; 259.0 ± 29.2 kg and 540 g.

The results recorded concerning the ILW, FLW and MDG were respectively 112.3 ± 17.8 ; 259.6 ± 16.2 kg and 503 g (unit 5) and 108.9 ± 15.8 ; 262.6 ± 20.4 kg, 525 g (unit 6). For the total population, the MDG was not influenced ($P > 0.05$) by the type of fodder (straw or hay) probably because of the quality of the hay and the relatively high rate of the concentrate aliment in the ration. In all the units the MDG during the period of fattening exceeded 500 g and the live weight of calves reached or exceeded 250 kg. To reduce the cost of the food, it is recommended to use the straw or even to replace the breeding in stalling by a system based on the valorization of the pastoral resources, like the halophyte pastures, and a supplement of concentrate feed.

Key words: Camel calves, fattening, intensive system.

Abstract # 86

Evaluation of performance and carcass characteristics of camel-calves fattened with molasses

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Twenty camel-calves were employed in this feeding trial for a period of 98 days. Calves were stratified according to body weight into two groups, and then allotted randomly to two dietary treatments. Diet (A) consists of molasses feed while, diet (B) consists of sorghum grain feed. During the pre-experimental period (12 days), animals were maintained on sorghum stover diet, the experimental diets were introduced gradually until full replacement took place.

The results indicated that no differences ($P>0.05$) were observed in dry matter intake, rate of body weight gain and feed conversion ratio. No significant differences were found (in percentage) between the two groups; in head hide, four feet, intestine, stomach, mesenteric fats, kidneys, kidneys fats, liver, heart, lung, and diaphragm. Also, no significant differences were found between the two groups in hot carcass weight, cold carcass weight and dressing percentage.

This trial confirmed that no significant differences were found in chemical analysis, carcass colour, water holding capacity and cooking loss. This study was carried out to evaluate performance and carcass characteristics of camel-calves fattened with molasses that replaced sorghum grains; which is the basal diet of most Sudanese

Key words: Camel-calves, molasses, carcass characteristics.

Abstract # 87

Worsted yarn performances of dromedary hairs

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Spinning includes the process during which the discontinuous fibres are transformed into yarn or wire adapted to textile industry. There are two principal spinning processes; the cotton (short staple) system and the wool (long staple) system.

There are basically three different routes or systems used in the mechanical processing of wool type fibre (long staple), namely worsted, semi-worsted and woollen. The essential differences in the products of the three systems are the levels of short fibres and the alignment of the fibres in the yarn, the fibres in worsted yarns being far more parallel than those in either semi-worsted or woollen yarns, resulting in a far leaner (less bulky) and less hairy yarn.

The combed spinning process comprises a high number of steps (machines), thus a significant investment. However, the good quality of combed yarns is potentially required for high quality of apparel products. Because of their natural qualities and of their scarcity on the market, the animal hairs have a price more raised, thus it is more interesting where used in the production of good quality articles. Also, the worsted process manufacture provide a more fine yarn that possible with respect to the fibre number in the section, which can be regarded as an acceptable indicator for the textile potential evaluation of dromedary fibres.

The dromedary hair characteristics, in particular smoothness and length, allowed us to spun a worsted yarn. The produced yarns have a quality (regularity and mechanical properties) similar to that of wool and cashmere yarn.

Generally the dromedary hair worsted yarns (Nm 36, 30 and 20) were commercially of approvable quality. The regularity and the imperfections were similar according to characteristics' of industry and the yarn tenacity and elongation were acceptable.

Nevertheless, the combed process requires a great quantity of raw material. Indeed, an dromedary producers 1,5 kg of raw fibre which yields 356 g of fine down fibres and a knitted garment of 600 g means that the down from two dromedaries is required to produce the garment.

Key words: Dromedary hairs, dehaired fibres, yarn, worsted process.

Oral Communications

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*Farm Management Systems &
Development Aspects*

Abstract # 88

Camel's national development project in Tunisia

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With up to 80.000 female units, dromedary camel (*Camelus dromedarius*) occupies a dominating place in the exploitation of desert pasture of the arid and semi arid regions of Tunisia (1.25 million ha). Due to its socio-economic role in these regions, the Tunisian government settled up in 1993 an ambitious project for the development and rehabilitation of camel breeding in order to (1) promote camel specie in the eight departments of the center and south of the country, (2) increase camel livestock taking into account potentialities and realities of the concerned areas, and (3) improve herd performance by improving management and reproduction parameters. The main components of the project include identification of the livestock, basic infrastructure (watering place, zone of gathering, shelter for camel shepherd, thicket of shade), and herd management (health, breeding, calve separation for artificial milk feeding, milk production), technical assistance and support amongst creation of professional associations of camel owners.

A research program and cooperation agreement were designed with research institutions (ACSAD, IRA Médenine) in order to carry out research actions related to the identification of better calve fattening systems, valorization and use of skin (leather) and hair, mineral nutrition and needs, and genetic and morphologic characterization of potential dairy populations.

Prospects for sector development envisage the encouragement of investments, the development of applied research programs, the establishment of local camel milk industry, and the consolidation of popularization and technical assistance programs.

Key words: *Camelus dromedarius*, development, project, infrastructure, research, milk and meat productions.

Abstract # 89

Camel development in the Kingdom of Saudi Arabia

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The Arabian Peninsula is one of the most important areas that gave great attention to the one-humped Arabian camel (*Camelus dromedarius*). It is the home land in which this species of animal has been domesticated thousands of years ago, and then spreaded to different parts of the world. Among the Gulf countries the largest population of camels is found in the Kingdom of Saudi Arabia (830,000 head) and represent 20 % of the animal units. For these reasons a large specialized center for camel research has been established since 1982. In this center many research programs and projects targeted towards the improvement of camel breeding, nutritional requirements, production and health; have been implemented and gave promising and rewarding results related to this species which is the only species of domestic animal that can benefit from the scarce resources of arid and semi-arid lands.

In the camel and Range Research Center the age at first service and conception of female camels was reduced from 5 to 3 years, and the interval between two calving was also reduced from 24 to 16 months through nutrition improvement. Moreover, the average daily gain in body weight was 567-790 g. and in a fattening trial over 90 days the weight of one year old male reached 271.3 kg making an average daily gain of 800 g and dry matter intake of 5.18-5.80/kg increase in body weight.

Milk production contests were held in the Northern Region of the Kingdom. The daily milk production of the winning she camel in one of these contests was 27.4 kg (liter). This encouraged camel breeders to establish good farms for dairy camels in which the milk is pasteurized and marketed for triple the price of cow's milk.

The Camel and Range Research Center in Al Jouf is probably the first research center in the Arab world in which machine milking of camels is successfully practiced and extended to the private sector. In one of these farms which is considered as the largest dairy camel farm; only five camel attendants are allocated for machine milking of 260 she camels in three hours.

In addition to their work on other species of domestic animals; King Faysal University in the Eastern Region of the Kingdom is considered as one of the high ranking camel hospitals in the Arab World. The hospital is well equipped with electric lifts, large examination rooms and surgery theaters with hydraulic surgery tables to suit camels.

The Ministry of Agriculture is intending to establish a specialized hospital, research and diagnostic laboratories to provide services to camel breeders, extension and conduct research in all fields related to camels.

Key words: Camel, milk production, growth rate, calving interval, Kingdom of Saudi Arabia.

Abstract # 90

Camel livestock in Mena Region: Current situation and development perspectives

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In the Mena region, 60 to 90% of the land areas are classified as rangelands. These grazing lands are scattered over deserts, plains, valleys and mountains, but good rangelands constitute less than 8% of the total grazing lands.

Camel is one of the rare domestic species adapted to the hostile environment of arid zones. Its productions (milk, meat, hair) and its use for transport have permitted populations from the desert zones to adapt to the rigorous climate and live off the scarce resources offered by the environment. The camel represents a national wealth and source of income to the majority of citizens particularly in desert areas. There has been an increasing demand for camel meat and milk. Scientific knowledge on this animal has progressed a great deal in the last two decades and the number of publications has practically doubled since 1990. However, scientific and technical knowledge has not been made widespread by development agents and does not figure in animal production or health training programs.

After a critical analysis of data concerning camel population, production systems, breeds, reproduction and new breeding technologies, the feeding behavior and nutrition on rangelands and intensive farms, milk and meat (production, quality, processing and marketing), race and major diseases, the following development pathways are discussed:

- Establishment of specific system of identification and recording;

- Monitoring of the genetic resources and establishment of a programme for preservation, and selection according the production profile;
- Improvement of camel product trade by good processing and marketing of milk and meat;
- Control and fight against important diseases;
- Enhancement of research and development centres;
- Strengthening of capacity building and extension.

Key words: Camel, current situation, strategies of development, Egypt.

Abstract # 91

Husbandry practices of camel herders in Kababish home land North Kordofan State, Sudan

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The present work aimed to study husbandry practices of the camel herders in north Kordofan state, Sudan. A total of 122 farmers were randomly selected using questionnaire technique. The questionnaire was conducted between March and April (2007) in 4 different areas (Sodary, Jabra, Umgarfa and Almuwelih) which is dominated by Kababish tribe. The results showed that 59% of the interviewed camel farmers were owners, while 41% were shepherds, however, 48.6% of the owners were illiterate compared to 56% among shepherds. It was observed that high percentage of breeding females (74.2%) versus breeding males (25.2%) were kept in different herds. Camel herd size ranged between 50-100 heads which represents 54.9%, however, 71.6% of these herds were found in Sodary area. Sheep and goats were raised beside camels in the studied areas which was 14.8 and 36.1% for sheep, sheep and goats, respectively. Castration was practiced for fattening purposes by 40% of the farmers. The majority of the farmers practiced inbreeding and migrates seasonally to northern and southern parts of the state. Twelve diseases were reported in the studied areas; however, Trypanosomosis comprised the highest percentage (39%) among other diseases. Marketing of camels showed that most of the farmers (75.4%) use the money gained from selling of camels in other activities rather than adding new animals to their herds. Multivariate analysis allowed identifying 5 types of herd composition reflecting different strategy for herd management.

Key words: Husbandry practices, camel, Kordofan state, Sudan.

Abstract # 92

Indigenous camel calves management among the Gabbra and the Rendille camel keeping communities in Kenya

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Camels are increasingly recognised an important element of mobile pastoral production systems throughout the arid and semi-arid areas in afro-Asian dry lands. This is because they are better adapted to water and feed stress than other livestock species. World camel numbers have been steadily increasing over the past two decades and have reached over 19 million in 2001. Kenya host approximately 6% of the world camel population (*Camelus dromedarius*) and camel density in northern Kenya where camels are dominantly kept is 3.1 per km². Camels in Kenya were traditionally kept by four ethnic groups: the Gabbra, Rendille, Somali and Turkana. The four tribes keep distinct camel breeds resulting from reproductive and geographical isolation. The other breed of camel in Kenya is the Pakistan camel breed that was imported by the graziers in early 1990's. Pastoral camel keepers have wealth of traditional knowledge on the management of their camels that has sustained their respective population over the generations. Calf mortality in Kenya under pastoral management was reported to be in range of 35-50% mainly caused by diseases (ticks poisoning and mange infestation) and malnutrition resulting from milk competition with human beings. A survey was conducted to gather information on how the respective communities manage their calves. The result showed that the two communities have well defined management of calves starting from dam management three weeks to calving, parturition, colostrums feeding and diarrhoea management, placenta management, navel cord management, milk feeding (ratio of sharing milk with calves and household), introduction to forage and water and induced drying off at prolonged suckling. This study concluded that pastoralists are aware that calve survival is critical for sustained camel production i.e., calves are future replacement stock. Therefore, maintaining this knowledge with a view of integrating with conventional knowledge will enhance calf survival.

Key words: Camel calves management, Kenya.

Abstract # 93

Overview of the camel chains in East of Africa: Importance of gaps between the data and the apparent reality

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In East of Africa, the camel stock that counted around 11.8 millions of heads represented 62% of the world camel stock in 2006 (FAOSTAT, 2006). Less than 4.75% of this stock was slaughtered for the national consumption. The official annual exportation didn't exceed 41

thousands of heads. How to understand the gaps between the live capital and its economic development through the markets? The other socioeconomic functions within the pastoral systems are they sufficient to explain these gaps?

The crossed analysis of different sources of data reveals important gaps. For example, the formal market was around 5,030 of heads from Djibouti, Ethiopia and Somalia (FAOSTAT, 2004). The official data of exportation from the Berbera and Bossasso Ports registered 7,636 heads in 2004. But according to estimation of the capacities of holding areas in Ethiopia, around 57,000 camels could be exported. From personal survey conducted in 2007 in the Somali region of Ethiopia, the exportations were estimated around 37,000 heads with a profit margin for the exporters from 22-33 US\$. At the regional level, the official exportations would represent 10% of the potential.

All these gaps between the sources of data but also between the data and the apparent reality raise a number of questions related to camel economic development and the lack of reliable data on the camel activity may explain that the camel remain often to the stage of emblem or myth of pastoral area although the reality is quite different.

Key words: Camel chains, data, apparent reality, East of Africa.

Abstract # 94

Problems in keeping Llamas and Alpacas in Germany

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During the last 15 years the popularity of llamas and alpacas in Germany has increased substantially. Because of inadequate German-language information about husbandry, breeding, and specific behaviour, existing problems may not be recognized or may provoke new ones. Some of the most frequent problems resulting from missing knowledge concerning the selection and keeping of South American Camelids (SACs) are:

- Problems from incorrect conformation: In Germany llamas and alpacas are used as breeding animals, as companion animals, for production of fibre and in animal-assisted therapy. Frequent faults considering the conformation which will affect the well-being of the animals are soft fetlocks, sickle hooks, X-deviation of the carpus or tarsus, problems of the spine, malformation of the bite, malformation of the ears with reduced hearing abilities and possible deafness, and problems in the region of the eyes.
- Problems caused by inappropriate feeding: The stomach of SACs has three compartments. SACs should have access to grass, hay and minerals of good quality. Due to the owner's frequent desire to feed and by clever advertisement of the animal food industry, many llamas and alpacas receive supplementary food like fruit, vegetables and cereal mixtures, causing adiposis and hyperacidity of the stomach, entailing severe problems in the metabolism, even sometimes leading to death.
- Problems caused by parasites: Llamas and alpacas are frequently bought from different farms in different countries and are integrated into the existing flock without prior parasite control. SACs react quite sensitively to parasites in the stomach and the guts, and to liver fluke.
- Problems caused by environmental issues: Improper education or wrong environmental conditioning, and also the lack of selection of the breeding animals for companionable

character, may lead to dangerous situations for the animal owner as well as for the flock members. In addition, the keeping of stud groups or keeping of geldings, which have been castrated late, together with females, or keeping studs in female groups, is not unproblematic. All the problems indicated above will be addressed and possibilities will be discussed to avoid them.

Key words: Llamas, Alpacas, breeding, problems, Germany.

Abstract # 95

Alpacas (*Vicugna pacos*) in Sweden: a new challenge

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In South America, over 500 000 peasant families are rearing alpacas and llamas as their main source of income. Increasing numbers of alpacas are imported to various countries outside South America, for fibre (wool) production, breeding and/or as companion animals. This fairly recent phenomenon started with larger exports in 1983-84 from Chile to the USA. The western veterinary profession was taken by surprise by these new animal species, with unique anatomy, physiology and behavior, and different disease panoramas and reactions to pathogens compared to e.g. cattle and smallstock.

The first imports to Sweden occurred in 1995. Today there are over 500 alpacas in the country. A questionnaire to alpaca breeders, covering all aspects of animal husbandry and health, gave 86 % response rate. Forty breeders/herds comprising 544 alpacas responded to the questionnaire. The farms were geographically distributed over the whole country, from latitude 55° to 64°. The size of the herds varied between 2 and 72 animals, the median being 7 animals. A majority (85%) of the breeders started their alpaca rearing during the last four years (2005-2008). The alpacas are kept for various purposes: fibre production (75%), breeding (60%), grazing (63%), and as show (30%) and companion animals (38%). Ten % of the Swedish herds have imported their alpacas from Chile and Peru, 29% from Switzerland, 10% from Germany, 5% from United Kingdom and 2% from Austria.

The breeders complain of the lack of knowledge in veterinary and husbandry issues. Veterinary practitioners tend to regard alpacas as ruminants or horses, overlooking that diagnosis and treatment of camelids need special attention.

Skin diseases were reported by 45% of the herds and mange mites were the main concern followed by abscesses. Abortions had occurred in 18%, neonatal diseases in 15%, and lameness in 13 %. These findings can be compared to the very few important disease cases, e.g. the outbreak of *Corynebacterium pseudotuberculosis* in 2003 and infections and pathogens (ecto-/endoparasites) found affecting Swedish alpacas.

Prophylactic measures as vaccination against clostridiosis (57.5%) and use of anthelmintics (57.5%) were reported by the breeders. Prophylactics are available but not validated for alpacas.

On all the farms other animal species are present: 75% of the farmers have pets (dogs and cats), 35% have horses, 15% cattle, 8% sheep and 3% goats, no swine and 8% poultry. The presence of other species poses a threat of transmission of pathogens between these newly introduced species and the local livestock.

There is a high demand on extension services to alpaca breeders based on sound knowledge and experience.

Key words: Alpacas, breeding, Sweden.

Abstract # 96

Camel farming, an important contribution to the poverty alleviation in Niger

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With more than 1500000 camel heads in constant growth, i.e. 16% of the national herd, including all species, Niger is one of the main countries of camel farming in the world. At the moment, this species is present in all the country and its contribution to the national economy increased significantly through the exportation of live animals (25000 per year). This confirms that the camel production changed from margin to an essential part of the national animal resources. The present communication enlightens the role of camel in the poverty alleviation of Nigerian families. This role was underlined by services, incomes and products given by the camels to the smallholders. Indeed, the camel farming contributed to the safety of the families (feeding, incomes, and agricultural production). Only species able to resist in harsh conditions of Niger, the camel is the more safe investment of the farmers and the last stage of the capitalization. Camel farming allows also the farmers to be integrated economically and socially. However, the risks of pauperization of the camel herders are high and vulnerable camel farmers exist in the society.

Key words: Camel farming, poverty alleviation, Niger.

Abstract # 97

Dynamics of the camelid meat channel in Tunisia

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This study was within the framework of the project IRESA-GIVLAIT, “Reinforcement of the services of support to Agriculture” - Shutter: “Quality of the agricultural produce” Thematic “Meat”. The objectives of this study were to describe the dynamics of camel meat channel in Tunisia and to identify factors that impede its development. Fattening systems, circuits of purchasing young animals in Kebili, Médenine, Tataouine, Tozeur, Gafsa, Sidi Bouzid, Gabes, Sfax, Mahdia and Kairouan as well as meat marketing and consumer behaviour in the whole country were analysed. The intent was to touch all stages of channel: rearing, production, slaughter, meat conditioning and marketing. Investigations focused also on the links among the camelid channel components at different levels: starting with “camel trader” at the Gafsa cattle market to the consumer. Results showed that dromedary breeders encounter difficulties in the control of their herd; they sell very early males. They have no tradition of fattening. Indeed, the system breeder–fattener is practically non-existent. Only 32% of

marketed camels in the souk come from fatness system. Butchers require specific criteria on camel conditions, fatness state, price, conformation and sex to buy camels. Moreover, the analysis of the market camel meat revealed a continuous changes in price which is crucial for channel development. However, this profitability was not bound to the reality of the channel dynamic, especially to the losses of live animals to the marketed meat. In fact, 64 % of slaughtered marketed camels were managed by other actors and the direct transaction rarely existed between camel breeder and butcher. Concerning cutting, 83% of the butchers practise a standard cutting, to satisfy desires and tastes of consumers valorise camel portions that have good organoleptic quality. These changes could influence the dynamic of the whole channel with a decentralization of activities from urban to rural areas. In the urban cities, we find many categories marketed meat pieces. In others areas meat pieces are limited to two categories, with and without bone. Given that demand for camel meat in the country is increasing, a change is observed on the level of consumption. The Tunisian is ready to buy expensive of dromedaries. Indeed, 52% of the surveyed consumers, who live in cities with high living standards, seek this meat. The three actors, camel breeders, butcher and consumers play an important role in the development of a sustainable and modern camel channel.

Keywords: Camel, production, marketing, consumption.

Abstract # 98

Production and marketing of milk in Chad: the case of *Oualad Rachid Arabes* transhumants in Chad

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The 1983-1984 drought has forced a group of *Ouled Rachid Arabes* camel herders of the mid-region of Chad to move farther in the south in search of water and pasture. This exodus movement brought certain groups to the outskirts of N'djamena. They found the market for camel milk. Since then they practice a pendulous movement according to a north-southern direction where they spent four months (July, August, September and October) of the rainy season in Kanem and the rest of the time around the capital city to produce and sell their milk. Two-thirds of camel farmers practiced mix farming with goats. This type of farming is very well related to the main objective of the duration of their stay which is the marketing of milk ($P < 0.01$). The mean size of adult camels herd was 66 ± 26 heads and that of goats 44 ± 26 . The means of camels milk production were not significant ($P > 0.05$) whether or not there is association of species. Milking is done twice a day by most farmers and during the entire stay. One family of farmers produced on the average 22.89 ± 11.04 litres of milk a day corresponding to a revenue of 5700 F.CFA/day. Milk was sold in N'djamena by farmers spouses who went there everyday by bush taxi. Income derived from the sale of milk allowed them to provide for food and clothing needs of the family.

Key words: milk, camels, production, marketing, N'Djamena, Chad.

Camel dairy in Somalia: Limiting factors and development potential

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Camel's milk plays an important role in the nutrition of the population in arid zones of East African countries. More than 60% of the dromedary camel population is concentrated in the four North East African countries Somalia, Sudan, Kenya and Ethiopia. Somalia with over 6 million heads has the largest herd in the world. The camels produce more milk and for longer period of time than any other milk animal held under the same harsh conditions. Daily yields between 3 to 10 kg in a lactation period of 12 to 18 months are common. Camel milk is one of the main components of the pastoral community's basic diet, which contributes up to 30% of the annual caloric intake.

Traditionally the most common forms of consumption are either fresh or fermented. In the context of advancing urbanisation, camel milk is increasingly commercialized and consumed in urban areas. Indications from recent studies of market-oriented small holder dairying in peri-urban areas in East-Africa are that the benefits associated with dairying far out-weigh those from alternative traditional agricultural activities.

To comprehend the camel milk production potential and its present constrains, a survey was undertaken in Nugal region of Northeast Somalia. Due to the good grazing conditions, the region represents the heartland of camel population of Somalia, with a total human population of approximately 600,000 persons. A questionnaire was developed to gather quantitative data on herd structure, camel mortality, animal diseases and milk production.

A total of 204 pastoral households, locally named "Qoyis", keeping 16,177 camels were interviewed. The data were analysed with the Pivot-Table statistical feature of MS Excel.

Parallel to the survey a study on the hygienic quality of marketed milk was carried out in the same region. The total bacterial counts (TBC) in milk samples, taken along the whole chain of commercialisation – from the producer on up to the final sold product – were determined.

Due to the increased commercialisation of the products in urban areas, a better knowledge on the quantity available and the quality supplied was needed to be assessed. Through the survey, data on herd structure, animal health and milk production have been obtained and recommendations are given.

Key words: Camel, milk potential, quality, Somalia.

Abstract # 100

Intensification of milk production and machine milking of dromedary camels (*Camelus dromedarius*)

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In many arid countries, camels play a vital role in the milk supply of the rural population. Total camel milk production in the world is estimated to be 5.4 million tones per year. However, this milk is entirely produced by small farmers and pastoral people with hand milking. Camel milk and products usually do not reach the markets of urban areas. In order to develop viable camel milk industry, the husbandry and management of dromedaries, milk production and processing need to be improved.

There are several ways how milk production of dromedaries could be intensified. First, camels should be concentrated into larger farms and/or to a smaller geographical area (collection from small farmers). The general health status (infectious diseases) of all animals should be monitored and improved. Feedings should cover the requirements for maximum genetic potential. Appropriate milking technology with continuous maintenance and milking routine, need to be applied and adapted to the physiology of the camel. Data collection and recording systems should be developed that provide the base for future genetic selection. A food safety management system needs to be implemented throughout the entire production chain. Reproductive efficiency should be monitored and improved to maximise production potential of all dromedaries. Different biotechnological methods (mainly ET) should be applied to hasten genetic improvement.

The aim of our presentation/paper is to summarize data on milk production, management, general health and mastitis obtained at the first large-scale camel dairy farm. Dromedaries are milked twice a day in a 2x12 herringbone milking parlour. Quantity of milk is measured individually at each milking with an ICAR approved milk meter. At monthly interval, milk sample is taken from each animal for bacteriological evaluation (TVC, enumeration and identification) and SCC.

Over 600 dromedaries were trained for machine milking and no camel failed to accept the technology. Daily mean yield ranges between 5.2 and 9.3 kg. There is significant variation in milk production between individuals and months of the year (stage of lactation; $P < 0.001$). Few animals produce over 20 litres of milk per day and continue to lactate over 1.5 years. Time of the year influences the number of clinical mastitis cases. Most cases occur from October to April. Reproductive efficiency is not adversely affected by lactation and intensive management (end-of-season pregnancy rate $> 80\%$).

In conclusion, dromedaries are able to adapt well to large-scale management system that ensures maximum milk production and allows further genetic improvement.

Key words: Dromedary, machine milking, milk quantity and quality, management.

The impact of farming system on Sudanese camel calves growth rate

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This study aimed to investigate the effect of management system on Sudanese camel calves growth rate, twenty (20) camel calves (10 males and 10 females) at the first day of birth were selected, from the Sudanese Arabi (*Kababish*) bred. The camels-calves with their dams were maintained under semi-intensive and Traditional management system for 18 successive months. Calves in semi-intensive system in addition of their suckling of their respective dams they take supplementation diets (one kg of concentrate/head/day), *ad libitum* watering, health care and spraying weekly by *Gamatox* against ticks and external parasites. The live body weight of camel calves were obtained through direct weighing in 6 months interval, through four periods including birthday, 6 month, 12 months and 18 months.

The results indicated that there was non-significant difference ($P>0.05$) in Birth weight of calves raised under semi-intensive and traditional system. In both systems the male (39 ± 0.31 kg) is significantly ($P<0.05$) heavier than the female (36 ± 0.34 kg). The body weight of the calves under semi-intensive system during six, 12 and 18 months of age are 123 ± 2.21 , 221 ± 2.17 and 326 ± 2.40 kg respectively, on the other hand the body weight of the camel calves under traditional system during six months, 12 and 18 months are 96 ± 1.59 , 159 ± 2.35 and 208 ± 2.50 kg, respectively. The results showed highly significant difference ($P<0.01$) between systems of management, The over all mean daily gain of camel calves under semi-intensive and traditional system were 535 ± 9.83 gram and 317 ± 5.46 g, respectively. The average daily body gain from birth to six months, six – 12 month and 12 -18 month of age in semi-intensive system were 477 ± 10.94 , 542 ± 8.25 and 585 ± 8.37 g, respectively. On the other hand the results showed that the average daily body gain from birth to six months, six – 12 month and 12 – 18 months of calves managed under traditional system were 352 ± 10.55 , 272 ± 15.98 and 316.71 ± 5.46 g, respectively.

It would be concluded that the growth rate and daily gain of camel calves were highly significant effected by farming system.

Key words: Camel calves, growth rate, daily body gain, farming system, supplementary feeding, Sudan.

Abstract # 102

Factors influencing price of dromeary in Northwest Nigeria

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Data on prices and some selected attributes of dromedaries and marketing agents were collected during fortnightly visits to two weekly northern Nigerian livestock markets (Sokoto and Tangaza), over 12 months (January to December, 1995). Market supply, sex, age, ecotype and body conformation of the dromedaries was recorded. The results revealed that, in the absence of distinct breed classification of the dromedaries, the farmers and other buyers identified the animals mainly on the basis of body colour and conformation and some behavioural features. The commonly used names in identifying the four major ecotypes found in the markets were sand-brown, grey-white, dark-brown, and pied colour. Health condition of the animal is not judged by the visual symptoms only but also by the physique of the animal, the fat content of the animal traditionally playing a significant role. The two most numerous ecotypes were the grey-white type and the light-brown type. Data of 667 recorded sales were analysed using a price model based on GLM of SAS (version 6.12). The results, indicate that age group, sex, and body conformation of the animal, and the season of sales had, in order of importance, a highly significant ($P < 0.001$) influence on the price of dromedaries in northwest Nigeria. The ecotype, the types of buyer, and the location of market showed significant ($P < 0.05$) influences only in association with other factors. The price for male dromedaries (15655 ± 337) exceeded that for females (12403 ± 482) by 26%. Prices were highest (N16, 410 \pm 490) during the mid-dry season, and they declined significantly to N14, 870 \pm 480 in the late dry season, reaching their lowest level (N11, 780 \pm 670) during the rainy season. The prices of the sand-brown and the grey-white dromedaries were significantly different in the two markets. Prices of the sand-brown ecotype were 7% higher in Sokoto (14,790 \pm 480) than in Tangaza (13,790 \pm 380). On the other hand, the price of the grey-white was higher in Tangaza (14,030 \pm 380) than in Sokoto (13,080 \pm 540). Prices paid by merchants for the sand-brown dromedaries (15480 \pm 780) were 18% higher than the prices paid by butchers for the same ecotype. Prices paid by butchers (15480 \pm 780) for the pied dromedaries were 28% higher than the prices paid by farmers for the same ecotype. The behaviour of the marketing participants in the dromedary market showed some evidence of rational price determination which is based on the attributes of the animal where difficulties are bound in applying known standard price determinants. It is concluded that qualitative attributes of livestock can be relied upon as a means for valuation of livestock for a purposive market development planning.

Key words: Dromeary, price, Northwest Nigeria.

Abstract # 103

Strategies for improving the marketing of camel and camel products: a case study for the arid and semi-arid Northern Kenya

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Pastoral communities inhabiting arid and semi-arid lands of Kenya depend on livestock for livelihoods, camel being the most important due to its unique adaptations which enable it to produce and supply milk to pastoral households when other livestock species are hardly surviving. Camel meat on the other hand is an important product which serves as a source of food and income. Commercialization of both camel milk and meat in Kenya is on the rise due to the increasing urbanization trends in pastoral areas leading to increased demand. Despite these positive socio-economic aspects, camel milk and meat value chains in Kenya have been inefficient resulting to high poverty levels among pastoral communities. A survey to identify constraints at various levels of the chains was conducted with a view to designing practical interventions that would improve the efficiency benefiting players in the lower levels of the chain and also delivering safe, preferred camel milk and meat products to consumers. The study covered Tana River, Garissa, Wajir, Isiolo and Nairobi administrative districts of Kenya mainly involving the Somali community. The methods used to gather data included Participatory Integrated Community Development (PICD) technique, Focus Group Discussions (FGD), Key Informants Interviews (KII), Direct Observations (DO) and Informal Interviews (II). The PICDs involved 40 to 66 male and female respondents while those for KII ranged from 13 to 20 across the sites. Respondents for FGDs were in the range of 2 – 16. The data collected related to production, transportation, processing, value addition, marketing and consumption of camel milk and meat products. The results indicated that marketing of surplus camel milk during rainy periods and the meat in the study areas was inefficient due to poor transport, distant markets, limited value addition skills, increased milk and meat hygiene problems, public health risks and quality concerns associated with informal sales of particularly camel milk and poorly organized markets, among other factors. This often led to deterioration of quality and low prices. Proposed interventions to address these constraints included ; training the camel producers, milk bulking agents, market agents and transporters on milk hygiene and management of milk related diseases for improved milk marketing, training camel meat processing groups on hygiene management, packaging, storage and labeling for better market access, developing standards for processed camel meat particularly *nyirinyiri* (fried camel meat preserved in oil) in collaboration with the Kenya Bureau of Standards as a way of quality control, training selected milk and *nyirinyiri* selling groups on business skills, group dynamics and market organization , introducing simple value addition technologies, promotion of value added camel products, among others. Field testing of the intervention on milk hygiene at market level and *nyirinyiri* at processing level was carried out for a period of one year in Garissa and Bangali. Preliminary findings indicates reduced milk spoilage, increased volume of milk sold and increased profitability among test market agents. Reduced spoilage and increased profitability (up to 30%) was reported among *nyirinyiri* processors. In conclusion, there is great socio-economic potential in the camel that remains largely unexploited. However, this potential could be exploited by facilitating the adoption of

interventions proposed in this study. This would ensure that the camel benefit producers and all the other players in the milk and meat value chains more than is currently the case.

Key words: Camel, camel products, strategy of marketing, Northern Kenya.

Abstract # 104

Better future for camel keepers: Value addition of camel hides and marketing in Northern Kenya

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Livestock hides and skins contribute a significant proportion of domestic leather. They are also an important source of foreign exchange earnings for Kenya and other African countries. However, it has been observed that the full potential of camel hides have not been realised nor exploited in Northern Kenya. This has been attributed to low prices and poor quality of hides leading to low demand in both domestic and export market.

The study had three objectives namely; to establish the current status of camel hides in and the supply chain, to identify the key constraints in the supply chain, and to explore opportunities for overcoming the identified constraints along the camel hides value chain.

This study took place in five districts of Northern Kenya, namely Moyale, Marsabit, Isiolo, Garrissa and Wajir, whereby five hundred and thirty respondents were interviewed. The study applied various research techniques to collect data, which include; Semi-structured questionnaires, documentary information, key informants and direct observation. Data was analysed by the use of both qualitative and quantitative methods. Qualitative information was derived from group discussions, direct observations, documentary information and from key informants. Quantitative data was analysed through the application of SPSS software and it was presented in frequencies and percentages.

The study revealed that most of camel hides are used for domestic purposes. These uses include; building houses, making ceremonial dresses, ropes, beddings, milking bags and praying mats especially among the Muslims. The study revealed that camel keepers were not eager to take camel hides to the markets due to the low prices offered by the traders. The prices offered for camel hides were very low ranging from 50 – 100kshs for sun dried hides and 150- 300kshs for wet salted hides. Poor method of curing hides contributed significantly to low prices offered by the local traders. In areas such as North Eastern Kenya where camel hides were value added the prices of camel hides were four times better than the sun dried. This was so in Wajir and Garrissa districts of Northern Eastern Kenya. The study also indicated that Sociological attachment of camel to pastoralists hindered them from slaughtering many camels especially in some Districts of Northern Kenya.

Various constraints were identified as contributing to poor quality of camel hides which included sun drying, poor flaying, branding indiscriminately, and ecto-parasites damages.

Recommendations; It was observed that poor prices of camel hides discouraged pastoralists from selling their hides. This could be addressed by training pastoralists better methods of curing such as wet salt curing method which is simple, and affordable. There is also need to train camel keepers on proper methods of flaying, proper branding and prevention of skin diseases which are detrimental to camel hides.

There is need to provide camel keeper with market information on prices and existing market out lets for camel hides. There is also need to sensitise pastoralists on the importance of commercialisation of camel hides as an income generation strategy.

Key words: Camel keepers, current status, constraints, development opportunities.

Abstract # 105

The camel as a source of income to pastoralists

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A herd of 77 camels was established in 1996 at an average price of Ksh 10,000/- or US\$ 125.00 (where Ksh 80 = \$ 1.00). Initially they were used for the production and sale of milk, meat and live animals. After three years some male camels were trained to be ridden by tourists and a tourist camp established.

Income and expenditure were recorded on a monthly basis for twelve years. Towards the end of this period the herd had more than doubled and 90% of the animals were sold as one herd at an average price of Ksh 19,769/- or US\$ 247.00. The net profit from the business was Ksh 3.697 million or US\$ 46,212.00.

Had the original capital been invested at 10% compound interest per annum, there would have been a net capital gain of about Ksh 1.647 million in twelve years. Thus the investment in live camels was more profitable to the tune of Ksh 410,000/- or US\$ 5,125, while at the same time providing an average annual income of Ksh 143,632/- or US\$1,795.

Furthermore up to 12 herds men were gainfully employed and received a small amount of their daily diet in the form of milk from the camel herd.

The enterprise began to incur a loss about 15 months ago, which could not be turned around through income from tourism as the post election violence destroyed the demand for Kenya as a tourist destination. Meanwhile it is anticipated that some recovery may occur early in 2009, although this may be tempered with the effects of the current global recession.

Key words: Camel, income, pastoralists, Kenya.

Abstract # 106

Intrepreneurship in camel breeding

Ghazanfari SR

Intrepreneurship is a familiar term in management literature and providing new products and services. It is considered as the process of gaining benefits by composing new and valuable resources which is deeply based on innovation.

As schumpeter puts each of the following activities is considered intrepreneurship:

- 1 – Creating a new product
- 2 – Creating a new method for producing

3 – Opening a new market materials

4 – Opening a new source for providing the raw

Regarding the above mentioned activities and the fact that over 75% of the world's camel belong to Islamic countries, innovation in using camel by products could lead to suitable income for the people of regional countries, but use of traditional methods in breeding the camel does not produce considerable share in the gross national product. For example camel's milk in comparing with cattle is less, but it is full of vitamins such as B,C and the amount of ferrion (Fe) is ten times more than other cattle which could be processed to different materials. We can also produce new materials from camel milk and hump. There are different activities which can be worked on such as artificial fertilizing in camels, developing more than 30 plant species which in turn could be used by camels and camel racing.

All mentioned issues could be put into optimum use and make benefits by entrepreneurship. Consequently, it can lead to more jobs and suitable incomes.

Key words: Camel, entrepreneurship, new occupations.

Abstract # 107

Harnessing dromedary for land preparation in smallholder farming system in Northwest Nigeria

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Consideration of choice of animal, as a source of farm power, can however, not be more appropriate and rational decision than now. Dromedary seems to be gaining acceptability by sedentary farmers in north-west Nigeria. Economic realities, and ecological comparative advantage of the dromedary over cattle, seem to have contributed to the positive change of attitude toward integrating dromedary in mixed farming in the semi arid part of Nigeria. The objective of his paper is to examine the harnessing system of draught oxen and dromedary for agricultural field operations in northwest Nigeria. An on-station animal traction experiment was conducted at the University Farm at Dabagi, about 50 km south of Sokoto in Nigeria. Four pairs of oxen and eight work dromedaries belonging to farmers were used in 1995 and in 1996 cropping seasons. The conventional two-neck yoke harness system was used for the oxen. A single harness system, as practiced by the farmers, was adopted for dromedaries. The experiment was repeated during secondary land preparation. Each team pulled mouldboard plough to prepare 20 standard (100 M long) ridges on a moist sandy loam soil left fallow for three years. Records of speed of the animals at work, quality of work, temperament of the animals, behaviour of the plough man and depth of ridging were taken. Length of ridges prepared was measured using odometer while spring dynamometer, calibrated in kg force, was used to measure draught force. Live weight of each animal used was estimated based on body linear measurements taken, before the field operation. Descriptive statistical analysis of work performance parameters was carried out. Analysis of Variance (ANOVA) of effects of animal species, year, type of work and other parameters on work performance was conducted. Regression analysis was used to examine the relationship between live weight and sustainable draught force. The singly harnessed dromedary was on the average able to pull up to 19 % of its body weight, and could produce maximum

work output (1.04 kW) at a pull of 23.8 % of its live weight. Given the present economic and ecological constraints facing the smallholder farmers in Nigeria, this study shows that it would be more rational for a farmer, particularly in the semi-arid part of Nigeria, to manage one dromedary rather than a pair of oxen for draught power utilisation.

Key words: Harnessing system, dromedary, agricultural operations, Northwest Nigeria.

Abstract # 108

Between Arabs and camels a life story

Trigui S

The close relationship developed over many centuries between Arabs and their camels has given these extraordinary animals a special place in the culture and heritage of the entire Arab world.

Camels played an important role in the life of the Arabs who called them "the Gift of God" and "the Ships of the Desert". Camels could live where few other animals could even survive. They helped move the traders across vast deserts in caravans loaded with goods. They were the desert dweller's primary source of transport, shade, milk, meat, wool and hides. They worked on farms to plow the fields and turn water wheels that brought irrigation to the desert land. An Arab's wealth was often assessed on the basis of how many camels he owned as the camel was for the desert dwellers an alternative currency. Camels were even used in war and in recreation.

The Bedouins treated them as friends and loyal companions, especially on long, solitary journeys, ancient poets went to great length in describing the camel, and many similes, metaphors and parables revolve around it, and it is associated with things that were good and beautiful.

Although camel caravans are not common today, there are still some caravans that bring travellers to isolated places in the desert. Camel Rides are now available all over the deserts; tourists can join a camel caravan to relive history. On camel safaris, the distinctive landforms, the wildlife and the serenity, allow the tourist a unique opportunity to enjoy and understand the environment. Until now camels provide us with their meat, milk, and their hides and down are used in craft industry. Some camels are bred for camel racing, a popular sport in many Arab countries, and some are still used by farmers to turn water-wheels or to do other farm work as it was done long ago.

Key words: Relationship, camel, Arab.

Abstract # 109

New World threats for the Old World Camel

Van Straten M

Over the last 20 years the camel population in Israel has dropped drastically. In 1984, the population was estimated at some 20,000. The current unofficial estimation is between 2,500 and 3,000. The main reasons for this decline are limitation of grazing land combined with the rise in feed prices and the loss of importance of the camel as a means of transport and power unit in agriculture. Concurrently, governmental policies have led Bedouin to abandon their semi-nomadic way of life for modern-style life in villages. The small population of camels remaining in Israel is kept by the Bedouin population in the Negev Region for the purpose of household milk production and for cultural reasons, and by a few camel ranches specializing in camel tours.

As opposed to the situation in other livestock branches in Israel where most owners belong to influential professional organizations, camel rearing is not considered an official branch of livestock in Israel and no such professional organization exists. Camel owners are secluded and belong to a "non-existing" livestock branch that has no economical importance at national level.

To make things worse, camels have lately gained a bad reputation as "road killers". The number of fatal car accidents caused by camels straying on roadways has sharply risen over the last few years.

Due to this grave reality, camel well-being and existence in Israel are in serious threat. Traditional knowledge regarding management, nutrition and health is rapidly disappearing with the abandonment of the traditional way of life. Camel nutrition has worsened and severe lack of nutrients and vitamins due to lack of grazing, lack of knowledge and high feed prices is not uncommon. Changes in Bedouin lifestyle and urbanization have led to an attempt to "bovinize" the camel: camels are tied near home and fed a diet consisting poor quality roughage. This in turn has led to lack of exercise combined with poor nutrition which could be associated with the relative great number of cases of dystocia and periparturient diseases observed in camels in Israel.

Many of the processes regarding human and camel populations described here are taking place in other countries, albeit at a slower tempo. Therefore, lessons learned from the situation in Israel could be useful elsewhere. These include the need to recreate a significant economic role for the camel through promotion of eco-tourism, camel racing, quality camel milk and meat products and the utilization of potential medicinal properties of camel milk. To facilitate the achievement of some of these aims, it would be helpful to join camel owners in professional organizations. These organizations could promote the importance of camel rearing at governmental and public level through lobbying and education and help camel owners optimize camel health and nutrition under urban conditions by organizing workshops and other educational activities. Finally, such organizations could advocate and set quality standards for research that would help recreate the camel's economic role.

Key words: Camel, current situation, Israel.

Posters

Communications affichées

Farm Management Systems & Development Aspects

Abstract # 110

**Traditional milking, fostering and weaning techniques of the one-humped camel
(*Camelus dromedarius*) in the Horn of Africa**

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For virtually all pastoral cultures in the Horn of Africa the camel is the only livestock species capable to provide a livelihood that is independent from the unpredictability of weather. It is important to note that the irregularity of rainfall patterns will become a survival issue in the near future. Climate “warming” is not anymore a far fetched hypothesis and the predictions are that large areas of Africa will be “dramatically dry in the 21st century”.

The most important utilization of camels in the Horn of Africa is as milking animals. To fully utilize the milk production capabilities of the camel all various ethnic groups of the Horn of Africa have developed a series of complex husbandry practices to guide camel reproduction, to maximize milk off-take and to encourage early weaning of the calf.

Key words: Traditional techniques, milking, fostering, weaning, camel, Horn of Africa.

Abstract # 111

Situation of the camel breeding in Ziban region of Wilayat Biskra Algeria

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The goal of our work is to identify the camel breeding systems existing in the area of Ziban, for a possible revival of this farming, marginalized for long time, in spite of the remaining economic, social and cultural interest of camel. The investigation was achieved by monitoring camel herds belonging to 9 stockbreeders from 9 localities: Ouled Djalel, Short-nap cloth elmiaad, Besbes, Elchaiba, Bir elnaam, Oumache, Elhouche, Elfaid, and Zribet elouad. These zones were exploiting the dromedary and represented three types of breeding practice. Wandering types were dominating in the area of Ziban, locates especially in Elfaid, Zribet elouad, Elhouche. – Semi-nomad types were concentrate in Elchaiba, Besbes, Ras elmiaad where people usied a mixed mode of habitat (house hard, tries) – Fixed famers were located in Oumache, Bir elnaam, Ouled Djalel. The study emphasizes that among the three breeding systems identified, the semi-nomadism remained the most dominant form of exploitation of Ziban, which it is necessary to maintain and encourage.

Key words: System of breeding cameline, Ziban, nomadism, Algeria

Abstract # 112

Camel milk marketing: Challenges and constraints

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Before marketing of camel milk starts on a large scale several factors that will influence the business have to be considered. Taboos or prejudices as well as legal constraints might stop any project in the beginning. Nutrient and health requirements of the milk producing camels have to be fulfilled. Transportation, storage, hygiene and processing of the milk have to be organized. The needs and wishes of the market have to be figured out to make sure that somebody will buy what is offered. The presentation shows the factors that have to be taken into consideration before starting a milk marketing project in detail.

Key words: Camel milk, constraints, marketing.

Abstract # 113

Camel situation in Iran

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Iran is one of those countries where the camels' keeping returns to long before. There is no real evidence of camels in past, but in Zoroaster holy book (Avesta) it is mentioned 530 till 570 B.C. Camels were as a powerful symbol. The oldest documents in Iran show that the Korosh's victory (one of Iranian's king) in Lidiae war was as a result of camels' presence. At present 145600, *Camelus dromedarius* are in Centre and South of Iran. Ninety five *Camelus bacterianus* are in north of Iran. Very likely, *Camelus bacterianus* domesticated in a border region near Iran's neighbors region among Iran and china or Afghanistan in 2500 B.C. The major and important role of keeping camels is both for meat and carrying the loads, especially in sore tribes. Maternal flock is the camels breeding system. This flock, semi savage, life lives in salt deserts. Camels cauterize sign have showed owner. Camel intensive breeding do fattened in "Shotur khane"place. The major camel's races in Iran include Dromedary, Bacterian, Hybrid (dromedary with bacterian), Torkeman, Balochi, Bandari, Calkoi.

Key words: Camel, breeding, races, Iran.

Abstract # 114

Camels in Sudan and challenges faced their breeding and production

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Numbers and distribution of camels and their breeds at different locations of Sudan were illustrated focusing on the impact of their presence on the environment and social activities. Nutritional, genetics and diseases are among challenges faced camel breeding and production in Sudan.

The paper illustrated the scientific and traditional believes of utilization of camel milk and meat. It also has drawn the benefits of the usage of camel meat to improve the meat industry. Other economical values of camels were shown.

Key words: Traditional believes, utilization, milk, meat camel.

Abstract # 115

Job opportunities in camel breeding

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If the growth of population in developing countries is not accompanied by suitable prediction for occupation will be considered as an antidevelopment factor. Therefore the optimum use of resources and creating various occupations with suitable income are necessary in the process of development. According agriculture and animal husbandry including camel breeding could have important rules .Although Islamic countries have over 75% of the worlds camels breeding, but there aren't enough and suitable job opportunities based on camel breeding for these people. Consequently, breeding and according the internal grass product will be increased the unique characteristics in camel can create ground for different occupations such as clothing, foods, medicine and even tourism. Therefore by forming national and regional work groups such as (ISOCARD) involving related countries we can create different job opportunities by doing the following activities

- 1- Data collecting and analyzing the camel breeding conditions in the neighborhood countries.
- 2- Collecting the results of the researches and predicting suitable solution
- 3- Forming regional groups for new marketing
- 4- Developing the present jobs and creating new opportunities in tourism, and camel by products.

Key words: Camel, job opportunities, products.

Abstract # 116

Camels of Oman: management and diseases

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Between September 2006 to September 2008, a total of 45 camel herds (7 to 500 camels in each herd) in different districts of Oman were investigated in the present study. Camel management in each herd was recorded. Blood, faeces, and skin samples were collected from diseased camels and examined in the Veterinary Research Center, Ministry of Agriculture. Blood smears were prepared from each blood sample and stained. Camels slaughtered in Salalah slaughterhouse were also examined for the presence of any lesions. Tissues were fixed in 10% neutral formalin for histopathological examination.

Results indicated that in Oman three main camel breeds have been raised. The Omani breed is the most common and used mainly for lucrative racing. The Humer and the Huozami breeds are well suited for milk and meat production. Camel owners are usually keeping one male camel to each 30 to 40 female camels for breeding. The breeding season is extended from October to April. Further results of the camel racing, management and nutrition will be discussed.

Most common diseases of camels are: trypanosomiasis 12%, gastrointestinal parasites 37%, ectoparasites 68%, caseous lymphadenitis 13%, ringworm infection 3.4% and infertility 1.2%. Less commonly reported diseases are rabies and botulism.

Key words: Camels, management, common diseases, Oman.

Abstract # 117

Camel farming types and skin diseases in Morocco: preliminary results

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This work is subscribed in the framework of a retrospective inquiry in Morocco southern provinces during 3 months.

This inquiry aims to characterize the herd structure as well as camel farming types in the 11 studied provinces, to screen dominant skin diseases and to evaluate their importance in camel (*Camelus dromedarius*), species famous with its rusticity and capability to be adapted to unfavourable arid and semi-arid environment conditions. One hundred and sixty eight (168) herds were studied with 11426 animals, representing about 7% of camel numbers in this region. First investigations on collected data allowed to find that the herds mean size is 72 heads with 3 heads as a minimum and 256 heads as a maximum, to distinguish two big camel farming system characterised by the fact that more than half of the owners are practising

camels farming as a secondary activity. On 275 sampled animals 336 skin lesions have been diagnosed in an environment where sanitary and medical prophylaxis is almost absent.

Key words: Camel, skin diseases, farming system, Morocco.

Abstract # 118

How Kenya Camel Association is promoting the camel as a model species for sustainable development in ASALs of Kenya

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Kenya Camel Association (KCA) founded in 1995 articulate and lobby on issues relating to camel development in Kenya. Its objectives include enhancing delivery of services to camel keepers, sharing of information.

KCA uses various methods and approaches in achieving the objectives. These include annual Kenya camel Forum (KCF), regular planning meetings, regional representations, district contact persons, national and local radio stations, agricultural shows and trade fairs, Kenya Pastoralists Week participation, collaborative research and newsletter.

The association's milestones include mainstreaming camel development in government policy, establishing and strengthening linkage between animal health researchers, academicians, extension workers, service providers and camel keepers and traders, introducing camel keeping in new regions and Tanzania, development of camel training and extension manual with collaborators, and studies on camel milk, meat, utilization of ranch and feeding observation in relation to cattle under same environment.

Details of the activities, challenges, lessons learnt and future direction of KCA are discussed in the presentation.

Key words: Development, Camel, Kenya

Oral Communications

Communications orales

*Physiology, Pharmacology
& Biochemistry*

Abstract # 119

Normal values of some synovial fluid constituents in Sudanese camels (*Camelus dromedarius*)

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Thirty apparently healthy male Sudanese dromedary camels were used in this study. Synovial fluid was collected from the stifle joint immediately after slaughtering. The aspirated fluid was of normal color and viscosity. Normal values of some of its constituents were determined. The mean values were as follows: total protein = 6.80 ± 0.03 g/100ml, albumin = 3.76 ± 0.02 g/100 ml, urea = 29.5 ± 0.27 mg/100ml, uric acid = 4.16 ± 0.05 mg/100 ml, creatinine = 1.72 ± 0.13 mg/100 ml, glucose = 160.79 ± 2.93 mg/100 ml, ALT = 11.37 ± 0.3 , AST = 22.17 ± 1.78 , AIP = 78.83 ± 0.35 IU/L, Na = 118.07 ± 0.8 m.mol/L, K = 3.18 ± 0.03 m.mol/L, Ca = 5.59 ± 0.03 mg/100 ml, Fe = 46.40 ± 0.71 µg/100 ml and Mg = 2.38 ± 0.02 mg/100 ml. These values were discussed with other research reports in camels as well as with synovial fluid constituents of other domestic animals.

Key words: Sudanese camels, synovial fluid, biochemical profile.

Abstract # 120

The cerebrospinal fluid in the dromedary camel (*Camelus dromedarius*): sampling and composition

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This work aimed to perform the sampling of the cerebrospinal fluid (CSF) and to study its composition in the dromedary camel (*Camelus dromedarius*). Twenty seven camels of both sexes, aged between 8 months and 8 years, destined for slaughtering have been used. The CSF sampling was made by puncture of the cerebro-medullar cisterna at the atlanto-occipital location on animals without anaesthesia but kept tied on sitting position. The biochemical analysis were made using an automate machine based on dry chemical technique. The enzymes activity was evaluated using the colorimetric technique, while the cytological study was conducted using dried specimens on slides colored with May-Grunwald and Giemsa solutions.

The biochemical analysis of cerebrospinal fluid of the dromedary has shown that the concentration of minerals, sodium (111.25 ± 30.61 mmol/l), potassium (2.39 ± 0.63 mmol/l) and chloride (98.6 ± 27.92 mmol/l), and glucose (0.47 ± 0.18 g/l) only varies slightly in comparison to other species. The total protein content (0.27 ± 0.09 g/l) is similar to that reported in human and beef, while the concentration of urea (0.21 ± 0.06 g/l) is similar to that reported in human. The CSF of the dromedary also presents a low osmolarity (159.2 ± 45 mosm/kg) compared to that found in humans and beef. The analysis of CSF enzymes has revealed a low activity of alkaline phosphatase (ALP, 12.2 ± 3.02 U/l) which remains however significantly higher than that found in horses. The cytological study showed the presence of a few lymphocytes and monocytes as well as an abundance of part of destroyed cells.

Key words: The cerebrospinal fluid, sampling, biochemistry, histology, dromedary camel.

Abstract # 121

**Assessment of thyroid hormones (Tri-iodothyronine T₃ and Thyroxin T₄)
in Sudanese camels (*Camelus dromedarius*)**

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This study was conducted in North and South Kordofan State. Two hundred serum samples were collected from different age groups of male and female camels (*Camelus dromedarius*) during the period that extended from October 2004 to September 2005. The aim of the study is to assess Thyroid Hormones (Tri-iodothyronine T₃ and Thyroxin T₄) in the dromedary camel.

The results indicated that the T₃ and T₄ concentrations were higher in the blood of camels from North Kordofan. 100% of T₃ value and 74.6% of T₄ value in this study were below the previous reported values in the literature for the normal dromedary at Kordofan State. Sex was found to have no effect on T₃ and T₄ values in camels from both localities, whereas, camels aging <5 years from both localities of Kordofan exhibited higher T₃ and T₄ values compared to those aging >10 years.

Key words: Tri-iodothyronine, thyroxin, hormones, camels, Kordofan, Sudan.

Abstract # 122

**Immunohistochemical demonstration of Vimentin and Neuron-Specific Enolase in the
hypothalamo-neurohypophysal system of dromedary**

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The dromedary comparing it to the other mammals, presents a great capacity of adaptation to dehydration; essentially by reducing diuresis; which is due to vasopressin action on kidney.

We have hypothesized that the hypothalamo-neurohypophysal system (HNS) of this animal witch is the site of production and release of vasopressine; may present some peculiarities. The HNS is formed by magnocellular neurons (MCN) having their cell bodies in supraoptic and paraventricular hypothalamic nuclei and their terminal endings in the neurohypophysis. Knowing that this system is characterized by neuronal and glial structural plasticity, which is observed during chronic physiological stimulations such as dehydration and lactation; the aim of this work was to give some explanation of dromedary water deprivation ability by structural and immunohistochemical exploration of the HNS. The experiment was carried out on five adult male hypothalamic and neurohypophysal slices of 10 µm thickness of both Winter and Summer periods. Immunoperoxidase labeling was performed to investigate the antigenicity of these structures for vimentin and neuron specific enolase (NSE). These two proteins are respectively markers of plasticity and neuroendocrine cells. The results obtained reveal an immuno-reactivity for vimentin at the different levels of the SHN. It was present at: granulated cytoplasmic structures of MCN cell bodies and between these last; witch may correspond to glial cells processes. In neurohypophysis, vimentin was concentrated essentially out side the specialized structures containing terminal endings of MCN. NSE was expressed in neurohypophysis and revealed an occupation of all blood vessels area by terminal endings; witch may be a great activity of neurosecretion. These data indicate that this system may be easily stimulated to secrete vasopressin to reduce water loss, giving consequently the dromedary ability to maintain water balance.

Key words: Dromedary, hypothalamo-neurohypophysal system, vimentin, NSE, neurosecretion, vasopressin

Abstract # 123

A simple one-step purification of immunoglobulin G from camel blood plasma proteins in view of a possible colostrum substitute

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As in horses, cattle and sheep, protection from microbial or viral infection of the newborn camelid essentially relies on colostrum ingestion and functional activity of the neonatal Fc receptor. The absence of colostrum ingestion within the very first days of life could be partially compensated by administration of adult IgGs. The aim of the present work was to develop a simple technique to purify gram amounts of "classical" (IgG1) as well as "heavy chain only" (IgG2, IgG3) IgGs from blood plasma proteins of immunized camels. The paradigm was to use batch anion exchange purification. The first two experiments analyzed the effects of three molarities (100, 150 and 200 mM NaCl) and ratio of DEAE-Sepharose gel to protein plasma amount (1 ml and 2 ml gel per 2 ml origin plasma) on 1) purification rate and IgG yield measured by sodium dodecyl sulfate-polyacrylamide gel electrophoresis and image analysis and 2) binding activity of IgGs measured by radioimmunoassay. According to the parameters, the percentage of albumin was decreased from 38.4% (origin plasma) to 14.2-32.1% of total proteins and that of IgGs increased from 36.7 to 43.1-64.2% with an IgG yield

of 68.0 to 98.8%. The percentage of (IgG2 + IgG3) among total IgGs did not appear to be modified by purification parameters (origin plasma: 75.5%; purified preparations: 76.7-82.6%). The IgG binding activity was not altered by treatments. The third experiment showed that the chosen conditions resulting from the first experiments (150 mM, 1 ml gel per ml plasma protein) could be scaled up to 2500 ml of plasma and 95 grams of IgG in one step. It is considered that the technique could partially fit the initially fixed aims.

Key words: Camel, immunoglobulin G, purification, blood

Abstract # 124

Influence of gender on bone formation and bone resorption biomarkers in sera of racing dromedary camels

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The effects of gender on the concentrations of pyridinoline (PYD) cross-links, bone alkaline phosphatase (BAP) and osteocalcin were studied in the serum of racing dromedary camels. Twenty healthy adult racing camels (10 males and 10 females) were used in this study. Serum samples were collected of each camel at rest and immediately at the end of race (8 Km maximal. speed). ELISA was used to determine the concentrations of serum PYD, BAP and osteocalcin. A significant increase in the levels of PYD and BAP was observed after race in both sexes. However, the concentrations of PYD and BAP were significantly higher in females compared to males (16.6 ± 4.3 vs. 11.3 ± 3.1 nmol/L and 71.2 ± 12.2 vs. 54.7 ± 14.2 μ /L, respectively). Both gender and race did not affect ($P > 0.05$) the levels of osteocalcin (26.6 ± 9.3 vs. 30.4 ± 7.6 ng/mL). It was concluded that gender had no effect on the levels of bone resorption and bone formation in camels at rest, whereas after race, the levels of bone resorption and bone formation significantly increased in females compared to males.

Keys words: Racing dromedary, pyridinoline, bone alkaline phosphatase.

Abstract # 125

Observations on some aspects of milk letdown in the she-camel

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Behavioral changes displayed by both calf and dam following the introduction of the calf at milking time to initiate milk ejection reflex were monitored in 16 lactating she camels, belonging to the type Arabi- Lahwy between their third and fifth parity and at different stage of lactation, age and body weight randomly selected from a herd of a nomadic tribe in El shuwak area –Eastern Sudan. The herd is managed under transhumant migratory system; the

young calves were kept in isolation and allowed to their dams only at milking time performed twice a day in the morning and evening. Udder and teat measurements including udder depth (UD) udder horizontal circumference (UHC), udder size (US) teat length (TL) and teat diameter (TD) were monitored at monthly intervals and for six consecutive months. Just prior to milking and immediately after milking was finished. Milk yield, milking duration, milk flow rate and Lapse of milk ejection reflex after calf introduction were compiled daily throughout the six months experimental period. The data was analyzed by ANOVA to assess the effects of parity order, body weight and milking time in the Lapse of time necessary to initiate milk ejection reflex (TLMER). Pearson correlation was adopted to qualify the relationship between (TLMER) and milk yield, milking duration, milk flow rate, body weight and udder measurements. The result indicated a non significant effect of parity order on (TLMER). The time Lapse between calf introduction and initiation of the let down reflex were 116.4 ± 21.5 , 127.0 ± 42.8 and 109.8 ± 77 seconds in the 3rd, 4th and 5th parity groups, respectively. The maximum time lapse to evoke the milk ejection reflex decreased with parity order. Both Dam's body weight and milking time exerted non significant effect on (TLMER). The Dams of body weight < 500 kg, however took less time for initiation of (TLMER), (113.8 ± 18.2 seconds) compared to heavier dams of > 500 kg (118.9 ± 18.9 seconds). The udder measurements on the other hand showed highly significant ($P < 0.01$) changes at pre and post milking. Milk yield, milking duration and milk flow rate showed positive but insignificant correlation with TLMER while body weight secured a significant ($P < 0.05$) and positive correlation. Determination of oxytocin would have strengthened the results and is highly recommended in future studies.

Key words: Milk yield, udder measurements, milking duration, milk flow rate, Arabi-Lahwy camels.

Abstract # 126

Milk composition and enzyme profile of female camel (*Camelus dromedarius*) injected with oxytocin

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The experiment was conducted at Camel Breeding & Research Station, Rakh Mahni, Bhakkar, Pakistan. Lactating She camels (Mareecha) was used as experimental animals, one group was selected from early lactation (1-2 month) stage and second group was at the end lactation stage (12-14 month). Both groups were treated with oxytocin (5 IU.) intramuscularly for fifteen days. Milk sample was collected before and after treatment with oxytocin. The determination of milk composition included fat, density, protein, lactose and solids were estimated by using Milky Lab Analyzer. Alkaline phosphatase and acid phosphatase was measured after centrifugation of milk using commercially available kits. Milk fat (4.81%), protein (3.55%), lactose (5.24%) and solids (9.44%) were found to be significantly elevated in oxytocin injected females. The alkaline phosphatase (1.29 U/L) and acid phosphatase activity was also significantly ($P < 0.01$) increased in oxytocin injected females. Difference in composition and enzymes of milk being collected from early lactation and late lactation groups were also significantly different. There was a significant decrease in the %age milk fat, solids and protein irrespective of the group, as stage of lactation proceed. Alkaline Phosphatase and acid phosphatase activity decreased with the stage of lactation. The result

shows that repeated doses of oxytocin to camels in early and late lactation did change milk composition and enzyme concentration.

Key words: Oxytocin, milk composition, enzymes, camel.

Abstract # 127

**Effect of repeated doses of oxytocin on the lactoperoxidase system of milk in camel
(*Camelus dromedarius*)**

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The current study was executed at Camel Breeding and Research Station, Rakh Mahni, Bhakkar, Pakistan. Lactating She camels (Mareecha) were selected from early lactation (1-2 month) stage as 1st group and second group was at the end lactation stage (12-14month). Both groups were treated with oxytocin (5 IU) intramuscularly for fifteen days. Milk samples were collected before and after treatment with oxytocin. The lactoperoxidase and thiocyanite activity in milk was determined by using standard method and lipase activity by titration method. Milk lactoperoxidase (2.69 U/ml) and lipase activity (10.23 U/ml) was found to be significantly (P<0.01) elevated in oxytocin injected females. Phase of lactation has also affected the enzymes activity. Lactoperoxidase (1.73 to 2.21 U/ml), thiocyanate (4.67 to 6.24 U/ml) and lipase activity (9.04 to 9.77 U/ml) increased with the stage of lactation. Thiocyanite activity was significantly high (6.24 U/ml) in oxytocin treated females at 3rd sampling. In camels with end of lactation lactoperoxidase highest concentration (2.31 U/ml) was observed in oxytocin treated females at 4th sampling. In the conclusion, it was observed that the repeated injections of oxytocin to camels altered the enzymatic profile of milk.

Key words: Oxytocin, milk enzymes, *Camelus dromedarius*.

Abstract # 128

**Pharmacoclinical and residues studies of Cymelarsan[®] in Sudanese one humped camels
(*Camelus dromedarius*) infected naturally with *Trypanosoma evansi***

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The efficacy and residues of Cymelarsan[®] (Rhône Mérieux–France) in twenty-five Sudanese one humped camels (*Camelus dromedarius*) divided into 5 groups were studied. Twenty camels were infected naturally with *Trypanosoma evansi*, treated with single doses of 0.250, 0.625 mg/kg and 0.125 mg/kg for 3 weeks administered intramuscularly (I/M). Ten camels kept as control groups (positive & negative).

Many clinical signs were observed in infected untreated and/or treated camels such as lacrimation, nasal discharge which become purulent. After the first week, shivering, hypothermia ($33 \pm 0.02^\circ\text{C}$), decrease in the respiratory ($7 \pm 0.01/\text{min.}$) and pulse rate ($22 \pm 0.03/\text{min.}$), crying, kicking, and hyperesthesia, anxiety episodes of upward - backwards form, movement of the neck, loss of weight and loss of appetite. All camels showed swollen at the site of injection disappeared after 1-2 days. Animals in groups (3-5) regain the appetite and the weight gradually thereafter. Camels in group (2) showed enlargement of thyroid gland, spleen, kidney, lymph nodes, and flabby heart with observable hydropericardium, gelatinization of fat and muscles, congestion in brain, nasal cavity, lung, liver, kidneys, and intestine. Haemorrhages were observed in the heart, pleura, lung, liver, kidneys, intestines and emphysema, necrotic foci and pneumonia, hypotrophied and inflamed testes and splenomegaly. Camels under treatment in groups (3-5) either showed slight or absence of lesions mainly in lungs; kidneys, heart and spleen.

The residue of Cymelarsan[®] was measured in brain, heart, lung, liver, kidney, ovary, testes, urine and serum within the withdrawal period; found that kidneys, heart, site of injection record high values of $5\mu\text{g/ml}$ of arsenic and no arsenic was found in the third week in the other organs and fluids.

Key words: Camels, Cymelarsan[®], arsenic, clinical signs, gross findings and residues.

Abstract # 129

Florfenicol pharmacokinetics disposition after a single intramuscular administration in camel (*Camelus dromedarius*)

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Florfenicol, a fluorinated analogue of thiamphenicol, is of great value in veterinary infectious diseases that formerly responded favourably to chloramphenicol. In view of the treatment of respiratory infectious disease in camels, we studied its pharmacokinetics in plasma of six healthy male camels, 8 - 15 years old and ranging in body weight from 521 to 579 kg. They were individually stabled and were fed barley (2 kg/day each) and had free access to hay and water. After a single intramuscular dose of 20 mg/kg of body weight, blood samples (10 mL) were collected from the right jugular vein just before drug administration and at 10 and 30 min. 1, 2, 3, 4, 6, 8, 10, 12, 15, 18, 24, 36, 48, 72, 96, 120 and 144 h after administration. The plasma concentration of florfenicol was determined by a reverse phase high performance liquid chromatography (HPLC) with UV detection (224 nm).

Both compartmental and statistical moment approaches were used to analyze the time course of plasma concentration-time data for florfenicol in camels using a nonlinear regression analysis. The arithmetic mean and standard deviation were calculated for all parameters excepted for half-life values where harmonic means and standard deviation were calculated.

The maximum concentration in plasma of $3.67 \pm 0.3 \mu\text{g/ml}$ ($n = 6$) was reached in 3.04 ± 1.2 h. The decline of florfenicol in plasma fitted a one-compartmental model with elimination

half-lives of 22.68 ± 4.60 h. The blood florfenicol levels remained above the MIC of the most sensitive bacteria to florfenicol ($MIC_{90} \leq 0.5-1 \mu\text{g/ml}$) over a 48-h period. These results suggest a good drug disposition after an IM administration of 20 mg/kg dosing which could be effective against most sensitive bacteria to the florfenicol in this species.

Key words: Camel, florfenicol, pharmacokinetics.

Abstract # 130

The pharmacokinetics and pharmacodynamics of flumethasone in camels

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Flumethasone is a potent fluorinated synthetic steroidal anti-inflammatory drug which is recently introduced in United Arab Emirates market. The purpose of this study was to evaluate the pharmacokinetics (PK) of flumethasone after intravenous administration in camels and to evaluate its pharmacodynamics (PD) applying PK/PD modelling using cortisol, circulating lymphocytes and plasma glucose as biomarkers for PD evaluation. The pharmacokinetics and pharmacodynamics of flumethasone were evaluated in six healthy camels after single intravenous bolus doses of 5 ug/kg body weight. Plasma flumethasone and cortisol concentrations were measured by validated liquid chromatography/mass spectrometry methods (LC-MS/MS). Plasma flumethasone versus time concentration were fitted by nonlinear regression and were best described by a two compartment model. The pharmacokinetic parameters (mean \pm SEM) were as follows; terminal elimination half-life was 10.45 ± 0.65 h, total body clearance was 115.8 ± 7.99 ml/h/kg and volume of distribution at steady state was 1631.6 ± 116.03 ml/kg. The PD parameters showed that flumethasone is a very potent steroidal anti-inflammatory drug as reflected by the estimated low IC_{50} of flumethasone for cortisol and lymphocytes. It is concluded that flumethasone in camels with a long elimination half-life, slow clearance, large volume of distribution and low IC_{50} for cortisol could still remain effective as an anti-inflammatory agent long before administration even when the plasma concentration is in the sub-nanogram levels. Its use therefore for this purpose is highly likely and very sensitive screening LC-MS/MS methods should be used to save guard its misuse in camel racing.

Key words: Pharmacokinetics, pharmacokinetic parameters, flumethasone, camels.

Abstract # 131

Isolation and identification of lidocaine and prilocaine and their metabolites in camel urine samples after subcutaneous injection

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Lidocaine (LID) and prilocaine (PRL) are amide type anesthetic agent that are widely used in equine and camel medicine. Although they are approved for use in horses and camels, the association of racing commissioners international (ARCI) and Abu-Dhabi camel racing commissioners regard their presence in post racing samples as doping which can result in significant penalties. The following study was therefore planned to isolate and determined the drugs and their metabolites in post-administration camel urine after single subcutaneous administration.

A single sc dose of LID and PRL of 1 mg/kg body weight was administered to 8 camels. Blood and urine samples were collected at zero (pre-administration) time and after 2 h. LID and PRL and their metabolites were isolated by solid phase extraction method (SPE) and were determined with gas chromatography mass spectrometry (GC/MS) as well as with liquid chromatography tandem mass spectrometry (LC-MS/MS) techniques.

In camels, LID was rapidly metabolized. The main metabolites were *s* hydroxylidocaine and monoethylglycinexylidie which were excreted mainly as glucuronide conjugates. While in camel the metabolism of prilocaine was the product of hydrolysis and hydroxylation resulting in deacetylated hydroxylated prilocaine metabolites and was also excreted mainly as glucuronide conjugates.

Keys words: Lidocaine, prilocaine, metabolites, camel urine.

Abstract # 132

Preliminary pharmacological investigation of camel urine

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Pharmacological effects of Camel urine, its protein precipitant and chloroformic extract were investigated. The protein precipitant inhibited the spontaneous movements of the isolated rat duodenum at a dose rate (0.1 µl/bath.) Diluted female Camel urine(0.4 µl/bath.) or its protein precipitant(0.8 µl/bath) on rat fundus and rabbit jejunum revealed serotonin like effect which was antagonised by serotonin blocker cyprohoptadine (0. 2 µl/bath.). In addition crude female Camel urine produce transient relaxation in rabbit jejunum followed by increased contraction on first washing. chloroformic extract produce no effect on rat duodenum, fundus and rabbit jejunum, whereas rabbit and chick rectum showed slight changes in the frequency and amplitude contractions.

Key words: Camel urine, pharmacological investigation.

Abstract # 133

No effect of Can-Insulin as adjunct to camel milk to treat alloxan – induced-diabetic dogs

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This study was performed to follow the effect of Can-Insulin treatment in addition to camel milk to treat Alloxan-induced diabetic dogs.

Three (3) groups of selected diabetic dogs were used in this trial; group 1: 4 diabetic dogs receiving camel milk; group 2: 4 diabetic dogs treated simultaneously with camel milk and Can-Insulin and group 3 composed of 4 diabetic dogs treated simultaneously with Can-Insulin and cow milk. Caninsulin® (Intervet) was injected as indicated in the notice: subcutaneously with (1IE/kg of body weight + 3IE) at drinking milk (500 ml for each dog daily during 30 days). All dogs were housed individually in cages and provided a pellet diet (350 -400g/ animal/ day) in addition to beef.

Dogs from group 1 showed, since week 3, a significant decrease of blood glucose levels (from 10.88 ± 0.55 mmol/l to 5.77 ± 0.44 mmol/l; $P < 0.05$), cholesterol (from 5.99 ± 0.15 mmol/l to 4.4 ± 0.62 mmol/l; $P < 0.05$) and total proteins concentrations (from 80.06 ± 2.11 g/l to 63.56 ± 3.16 g/l). The same variations of all analyzed parameters were illustrated in the dogs treated simultaneously with camel milk and Can-Insulin. A non significant difference between the two groups (1 and 2) was shown by statistical analysis.

By the end of the experiment, a steadiness in blood glucose, cholesterol and total proteins levels was demonstrated and healthy state of the animal from groups 1 and 2 was shown (all analyzed parameters were in the normal range).

A significant ($P < 0.05$) decrease of blood glucose in group 3 has been observed since the first week of treatment (from 10 ± 0.27 to 7.77 ± 0.44 mmol/l). This regulation of glycemic balance was momentary (during the treatment with insulin and cow milk).

In conclusion, it is obvious in this project that camel milk has a therapeutic effect on alloxan-induced diabetic dogs and addition of Can-Insulin to camel hasn't any potential effect in this property of camel milk. This may be to a remedial effect of camel milk in alloxan – induced diabetic dogs.

Key words: Camel milk, cow milk, dogs, alloxan, diabetes, Can-Insulin.

Abstract # 134

Preliminary studies of common parameters hematological and biochemical serum dromedary in Algeria

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The purpose of this study was to determine reference hematology and serum biochemistry values from dromedary (*Camelus dromedarius*) in Algeria and to evaluate potential sources of physiological variability such as the sex, age, reproduction stage (140 dromedary), season (40 dromedary) and breed (48 dromedary) on blood data.

The results demonstrate:

* Values which agreed with literature. Significant statistically differences (variance test, $p < 0.05$) depending on:

1 -the sex for number of erythrocyte and leukocyte Ca, P, glucose, TG, cholesterol, urea, creatinine, LDH, CK, , PAL and GGT

2 -the age appears to be the main determining factor studied constant change in blood for neutrophils lymphocyt; hematocrits, hemoglobin, Ca, P, K, glucose, urea, TG, ASAT, CK, LDH, ALP and GGT

3 - the reproduction stage for erythrocyte and leukocyte, hematocrits, hemoglobin Ca, P, Na, urea, creatinine, TG, cholesterol,ASAT, LDH, CK, ALP and GGT

4- the season for the rate of erythrocytes, the percentage of lymphocyt and basophils, and triglycerides (high during the rainy season and cold) and osmotic fragility, VGM, TCMH, the percentage of neutrophils, glucose, urea, creatinine, phosphorus and calcium (high during the hot season)

5 -The influence of race is not significant.

These reference ranges for hematological and serum biochemical analysis can be used for metabolic and nutritional disorders early detection in dromedary in Algeria

Key word: Hematology, biochemistry parameters, dromedary serum, Algeria.

Abstract # 135

Effect of camel milk on blood glucose, cholesterol and total proteins variations in Alloxan – induced diabetic dogs

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To evaluate, the efficacy of camel milk on glycemic control, proteins and lipids profile in alloxan-induced diabetic dogs, 12 healthy mixed-breed dogs were equitably divided into three groups (1, 2 and 3). Dogs in group 1 and group 2 were injected by alloxan dose inducing diabetes, whereas, those in group 3 were kept health and served as control. Diabetic dogs, received daily 500 ml of camel (group 1) and cow (group 2) milk. Group 3 (healthy dogs) was getting camel milk. Milk was daily given to all dogs after drawing blood samples and before feeding. Water was available to all dogs during the entire study.

After five weeks of trial, dogs in group 1 was deprived of milk and those in group 2 were given camel milk during the same period.

After five weeks, group 1 showed statistically significant decline in blood glucose levels (from 10.88 ± 0.55 mmol/l to 5.77 ± 0.44 mmol/l; $P < 0.05$), in cholesterol (from 5.99 ± 0.15 mmol/l to 4.4 ± 0.62 mmol/l; $P < 0.05$) and in total proteins concentrations (from 80.06 ± 2.11 g/l to 63.56 ± 3.16 g/l). Weekly variations of all analyzed parameters showed a non significant difference since week 3. Unlike group 1, group 2 showed a constant high level of blood glucose (8.00 mmol/l), an increase in cholesterol (from 5.99 ± 0.58 to 7.13 ± 1.25 mmol/l) and in total proteins concentrations (from 79.18 ± 6.07 to 84.33 ± 0.56 g/l). This diabetic state was confirmed by Intravenous Glucose Tolerance Test (IGTT).

Group 3 which constituted on healthy dogs- showed homogenous levels for all analyzed parameters which are usually in the normal range.

In the last month of trial (group 1 deprived of milk, group 2 supplemented with camel milk), group 2 showed a non significant difference in blood glucose levels (from 9.83 ± 0.72 mmol/l before drinking milk to 7.83 ± 0.88 mmol/l in week 4; $P = 0.31$). A decrease in total proteins and in cholesterol levels was shown too and it was slower than the one observed in trial 1. Dogs from group 1 showed healthy state illustrated by a normal blood glucose levels (5.16–6.5 mmol/l), cholesterol (4.14–5.51 mmol/l), TG (0.51–1.21 mmol/l) and total proteins concentrations (60.77–69.18 g/l).

In conclusion, hyperglycaemia could be repressed by drinking camel milk in Alloxan induced diabetic dogs. Moreover, it can be considered that this milk could support the treatment of the disease by hypocholesterolemic effects.

Key words: Camel milk, alloxan, diabetes, dog.

Glucose tolerance and insulin tests in camel (*Camelus dromedarius*)

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This study was conducted to investigate the glucidic metabolism in dromedary, a species characterized by a high glycemia (about 7 mmol/l) in comparison to other ruminants.

Animals originate from the Farm of OTD El Alam, Kairouan are kept under a semi extensive management mode. Camels were acclimatized during 3 weeks and samples were carried out in sternal recumbency. Six males, 3 years old, with an average weight of 312 kg are selected. Two dynamic tests are used: the intravenous glucose tolerance test and the insulin test. Induced hyperglycemia was carried out at a dose of 0.5 mmol/kg (glucose hypertonic solution (30 %), 0.3 ml/kg, 54.36 ml/min). The intravenous insulin tests were set at 0.2 IU/kg then at 0.5 IU/kg.

The blood samples are carried out through a catheter fixed in the jugular vein at the following times: t₀, t₁₅, t₃₀, t₄₅, t₆₀, t₉₀, t₁₂₀, t₁₅₀, t₁₈₀, t₂₁₀, t₂₄₀, t₂₇₀, t₃₀₀, t₃₃₀, t₃₆₀, t₃₉₀, t₄₂₀, t₄₅₀, t₄₈₀, t₅₁₀, t₅₄₀, t₅₇₀ and t_{600min}. At each time, 10 ml of blood are withdrawn on dry tube (without anticoagulant), 2 ml are decanted in a tube with fluoride-oxalate for glucose measurement and the 8 remaining ml are kept in the dry tube to determine the plasmatic levels of insulin, cholesterol, triglycerides and enzymes (ASAT, CK, LDH). Dromedary welfare has also been monitored during experimentation.

Our findings show that:

- the basal glycemia and the basal insulin concentrations are respectively 7.84 ± 0.74 mmol/l and 6.47 ± 1.95 μ IU/ml,
- animals remain hyperglycemic during more than 10 hours after an intravenous load of glucose at a dose of 0.5 mmol/kg,
- respective peaks of glycemia and the insulin concentrations, after this intravenous glucose load are 17.54 ± 1.56 mmol/l at t_{15 min}. and 13.25 ± 2.97 μ IU/ml at t_{30 min},
- insulin, even at 0.2 IU/kg and 0.5 IU/kg has a little effect on kinetics of glycemia which returns to normal level at t_{150min},
- the glucose elimination rate (k₁) is 0.242 ± 0.033 %/h after an insulin dose of 0.2 IU/kg and 0.361 ± 0.039 %/h after a dose of 0.5 IU/kg,
- the glucose distribution rate (k₂) is 9.67 ± 1.33 %/h after intravenous glucose test,
- triglycerides and cholesterol concentrations do not vary significantly even after glucose tolerance or insulin tests.

In conclusion, the high level of glycemia in dromedary could be explained by a low basal insulin level and/or higher gluconeogenesis. The mechanisms underlying this phenomenon need to be further investigated.

Keywords: Camel, glycemia, insulin, glucose tolerance test, insulin test.

Abstract # 137

Intestinal disaccharidase activities in camel (*Camelus dromedarius*): comparison with true ruminants

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Dromedary is characterized by a higher glycemia in comparison to other ruminants which can be explained by a high neoglucogenesis and/or a great capacity of intestinal absorption of disaccharides.

The aim of this study is to determine the level and the distribution of the disaccharidase activity in the small intestine of camels and its comparison with true ruminants such as cattle, sheep and goats.

For each species intestines were recovered from animals (n=13) in a slaughter-house near Tunis. Animals were aged: 7-12, 16-24, 12-16 and 9-12 months for respectively dromedary, cattle, sheep and goats. The disaccharidase activity was determined according to the conventional method of DALQHVIST which enable the quantification of the lactase, maltase and saccharase activities in homogenates of mucosa recovered by stripping different intestinal portions (duodenum, jejunum and ileum).

Results show that in all these species, disaccharidase activity was maximum in jejunum with a predominance of maltase activity.

The maltase activity (IU/g mucosa) was higher ($P < 0.05$) in camels' intestines (68.39 ± 19.07) compared to goats (53.47 ± 12.13), sheep (52.97 ± 4.16) and cattle (48.73 ± 6.71).

The saccharase activity (IU/g mucosa) was higher ($P < 0.05$) in cattle (5.97 ± 1.24) compared to sheep (2.59 ± 0.49), goats (2.19 ± 0.3) and camels (1.03 ± 0.2).

Lactase activity (IU/g mucosa) was lower ($P > 0.05$) in camels (0.88 ± 0.48) compared to sheep (2.34 ± 0.39), cattle (1.88 ± 0.35) and goats (1.12 ± 0.35).

In conclusion, dromedary intestine are equipped with a greater maltase activity than other ruminant's species but lactase and saccharase activities are lower. These differences in enzymatic potential are certainly related to the nature of diet and probably to adaptive mechanism of each species. Current studies in camels are investigating the intestinal absorption of disaccharides by the Ussing chamber.

Keywords: Dromedary, cattle, sheep, goat, disaccharidase, saccharase, maltase, lactase.

Posters

Communications affichées

Physiology, Pharmacology & Biochemistry

Relationship study of mineral status with reference to soil, water, serum, urine and faeces at different physiological stages in camels (*Camelus dromedarius*)

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The importance of the minerals in the productive as well as the reproductive performance of the animals is well documented. But regarding the mineral profile of the camels the studies are scarce. A study was conducted to develop a relationship between the electrolytes and trace elements profile in the serum, urine and faeces of the camels in the different physiological conditions with reference to the mineral status in the soil and water. Thirty six animals were selected at the Camel Breeding and Research station, Rakh Mahni, Bhakkar, Pakistan. Four groups were made as male breeder, non pregnant non lactating, pregnant non lactating and non pregnant lactating camels having nine animals in the each group. Among the electrolytes sodium, potassium, calcium, magnesium was estimated. Iron, copper, zinc, selenium, manganese and chromium were determined as trace elements. The flame photometer and atomic absorption spectrometer was used to determine the mineral profile. Analysis of soil reveals the significantly high concentration of Na, K, Zn, Mn and Cr in the soil watered by the tube well-1, while Na and Cr were also high in the Tubewell-6 watered soil. In the water analysis of the two tube wells only Mn was significantly high in the Tube well-1 water. Maximum K, Ca, Cu and Zn were observed in the serum of male breeder group as compare to others. Na and Mn was highest in the serum of pregnant non lactating, while iron was maximum in the lactating non pregnant. In the urine mineral analysis Na, k, Mg, Zn and Mn was found to be highest in pregnant non lactating group, iron in the lactating non pregnant, while Se and Cr was highest in the male breeders. The concentration of the Na, k in the faeces of non pregnant non lactating, Se in the lactating non pregnant while Mn and Cr was significantly high in the pregnant non lactating group. The variation in the mineral status under different physiological conditions reveals that there is an immense relationship of the soil, water and the body mineral status which could be different in different climates and even within a climate.

Key words: Mineral status, physiological stages, *Camelus dromedarius*.

Abstract # 139

Effect of thiopentone on osmotic fragility of erythrocytes in camels

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The study was conducted in six adult clinically healthy domesticated camels with the objective to know about the osmotic resistance of erythrocytes during thiopentone anaesthesia. Thiopentone sodium (5% solution) was administered intravenously 'to effect'. The mean dose of thiopentone was 10.35 ± 0.642 mg/kg. The erythrocyte fragility test was done before thiopentone administration and then at peak effect of thiopentone, recovery, 24 hours, 48 hours and 72 hours after recovery by using saline solutions having concentrations of 0.00, 0.10, 0.20, 0.25, 0.30, 0.35, 0.40, 0.45, 0.50, 0.55, 0.60, 0.65, 0.70, 0.75, 0.80 and 0.85 per cent. The per cent haemolysis of erythrocytes was observed at different time intervals. The results showed that there were no significant ($P > 0.05$) variations in haemolysis pattern before, during and after thiopentone anaesthesia.

Key words: Thiopentone, osmotic fragility, camel.

Abstract # 140

Preliminary chemical screening and thin layer chromatography of camel urine

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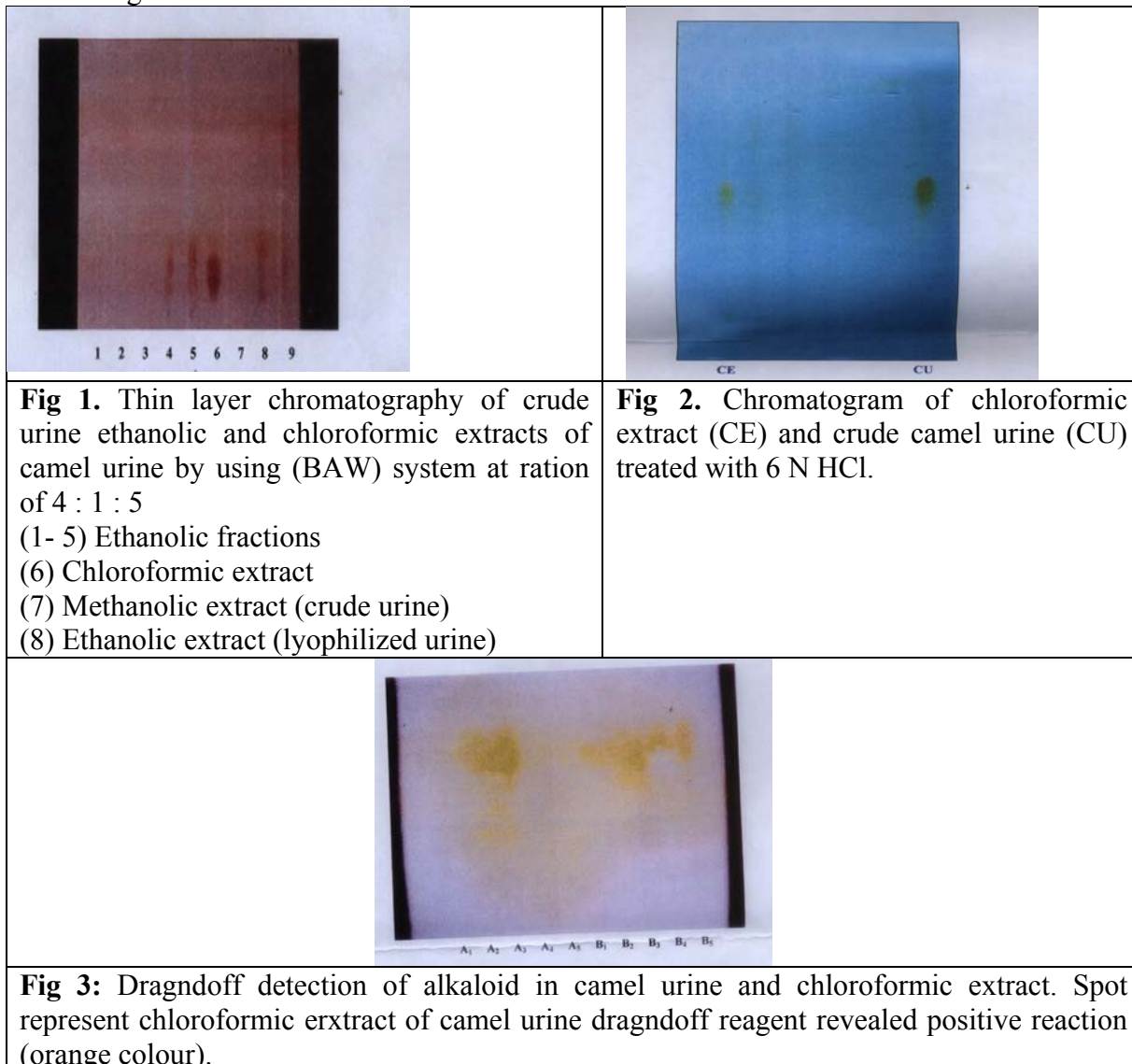
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General screening of 10 camel urine samples was carried out to verify camel urine major chemical constituents which are extremely valuable information for detecting new drugs of natural origin. Used samples were crude, ethanolic, and chloroformic extracts urine and lyophilysed crude urine. Thin layer chromatography of butanolic chloroformic methanolic and ethanolic extract was realized. The chloroformic extract and crude urine were hydrolyzed by 6 N HCl then chromatographed on silica gel using propanol and water 70:30. Camel urine contains alkaloids and triterpene (table 1, figure 3).

Table 1: Yield recoveries and tested groups in the different urine extracts.

Treatment	Yield recovery	Test		
		Unsatislared	Triopene	alkaloids
Ethanolic extract	80 ml	-	+ (purple + pink colour aradd off)	+ (Mayer's reagent)
Chloroformic extract	0.5 g	-	-	+ minhydrium and (Diagudoff reagents)
Protein precipitate	0.003 g	-	-	+

The spots appeared in figure 1 indicate that different extracts contain the same compounds. One spot of each was read with R_F 0.81 and 0.79, respectively. These spots are clear in the chromatogram of chloroformic extract (CE) and crude camel urine (figure 2) The chloroformic extract chromatogram using methanol in ammonia water 100:1.5 revealed one spot of orange colour after dried off reagent and potassium iodinate vapor as shown in Fig. 3. The orange colour indicates that there is alkaloid substance.



Key words: Camel urine, extraction, Thin layer chromatography, alkaloid substance.

Abstract # 141

Milk partitioning in the udder of Tunisian Maghrebi dairy camel (*Camelus dromedarius*)

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Six multiparous (10 ± 3.4 yr of age; 463 ± 25 kg BW) Maghrebi dairy camels were used to study the milk partitioning in the udder of dairy camel. Milk partitioning between cisternal and alveolar udder compartments was studied on 6 test-days at late lactation (380 ± 16 DIM; 1.60 ± 0.90 L/d) during the period of once-a-day milking (24 h milking interval). Camel were randomly nominated and moved individually to a restraining pen (unfamiliar surround) in order to reach a stressful situation thus preventing spontaneous milk letdown during udder manipulation. Cisternal milk was collected by hand milking. Nevertheless, alveolar milk was collected by sequential machine milking after an i.v. injection of oxytocin (10 IU/camel). Milk samples of each udder fraction were collected and processed immediately after milking for physical parameters or stored at 4°C for chemical analysis.

At 24-h milking interval, cisternal milk and alveolar milk camel averaged 331 ± 193 and 1250 ± 804 ml, respectively, which give ratio between cisternal and alveolar milk approximately 1:4. Alveolar milk was less dense (1.0229 ± 0,001 vs. 1.0266 ± 0,002, P< 0.05) and more acid (20.04 ± 2.27 vs. 17.80 ± 2.15°D, P<0.05) than cisternal milk. Fat content in alveolar milk was markedly greater (53.52 ± 12.66 vs. 18.72 ± 9.58 g/L, P<0.01) than in cisternal milk. Protein content in alveolar milk was also greater (32.08 ± 7.27 vs. 28.01 ± 7.51 g/L; P< 0.05) than in cisternal milk. Ashes content in alveolar milk was less (8.88 ± 0.41 vs. 9.25 ± 0.45, P< 0.05) than in cisternal camel milk.

In conclusion, evaluation of cisternal udder size in dairy camel is important to understand the effect of milk stored in the udder on milk secretion rate.

Key words: Camel, cisternal milk, alveolar milk.

Abstract # 142

The pharmacokinetics of salbutamol in camels

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Salbutamol is a short-acting β₂-adrenergic receptor agonist used for the relief of bronchospasm in conditions such as asthma and chronic obstructive disease. It is used as a bronchodilator in human and veterinary medicine. In human sport its use is allowed as an aerosol where as any application is prohibited. In horse, camel and dog competition salbutamol is prohibited and is regarded as doping. The present paper describes the pharmacokinetics of salbutamol in camels. The pharmacokinetics of salbutamol were

evaluated in five healthy camels after single intravenous bolus doses of 12.5 ug/kg body weight. Blood was collected before drug administration and at reasonable intervals after drug administration. Salbutamol in plasma was extracted by solid phase extraction using a mixed mode functionality of C8 and a cationic exchanger. Pharmacokinetic analysis for plasma salbutamol for each animal was performed using least-squares nonlinear regression analysis program (WinNonlin, USA). Plasma salbutamol concentrations were measured by validated gas chromatography/mass spectrometry methods (GC-MS/MS). Plasma salbutamol versus time concentration were fitted by nonlinear regression and were best described by a two compartment model. The pharmacokinetic parameters (mean \pm SD) obtained were: the terminal elimination half-life was 5.1 ± 2.15 h, total body clearance was 42.3 ± 25.9 ml.h/kg. The volume of distribution at steady state was 9.0 ± 3.8 l/kg, the volume of the central compartment of the two compartment pharmacokinetic model was 1.2 ± 0.3 l/kg. The method validation and the pharmacokinetic analysis of the data will be discussed.

Keys words: Pharmacokinetics, salbutamol, camels.

Abstract # 143

**Normal concentration of some cerebrospinal fluid constituents in Sudanese camels
(*Camelus dromedarius*)**

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Thirty clinically healthy male Sudanese dromedary camels were used in this study. Cerebrospinal fluid (CSF) was collected immediately after slaughter, through puncture of the cerebellomedullary cistern. On physical examination the CSF was clear and its viscosity was comparable to that of water. Normal concentrations of some of the CSF constituents were determined. The mean values were as follows: total protein = 6.61 ± 0.03 g/100 ml, albumin = 2.63 ± 0.02 g/100 ml, urea = 17.93 ± 0.27 mg/100 ml, uric acid = 2.17 ± 0.04 mg/100 ml, creatinine = 1.38 ± 0.02 mg/100 ml, glucose = 167 ± 2.09 mg/100 ml, ALT = 7.37 ± 0.18 , AST = 21.13 ± 0.29 , AIP = 76 ± 0.36 IU/L, Na = 121.67 ± 0.49 m.mol/L, K = 3.53 ± 0.07 m.mol/L, Ca = 5.65 ± 0.02 mg/100 ml, Fe = 48.30 ± 0.6 μ g/100 ml and Mg = 2.28 ± 0.02 mg/100 ml. These values were discussed with other research reports in camels as well as with cerebrospinal fluid constituents of lamas and other domestic animals.

Key words: Sudanese camels, cerebrospinal fluid, biochemical profile.

Abstract # 144

Study of the treatment effect of camel's urine and milk on liver and kidney of rats carcinogenic by carbon tetrachloride in comparison with chemotherapy (cytological, histological & ultrastructural studies)

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The present research was performed to study the effect of camel urine and milk on hepatic and nephritic toxicity of male rats treated with carbon tetrachloride. Rats were divided into four groups, first group: rats were treated with pure water, and kept as control, second group: rats were treated with 0,1 ml/ kg of ccl4 (every other day) for tow weeks, third group: rats were treated with 0,1 ml/ kg of ccl4 (every other day) for tow weeks and were then treated with 0,1ml/ kg of doxorubicin injected every (21) days for three months. Fourth group: rats were treated with 0,1ml/ kg of ccl4 (every other day) for tow weeks and were then given 1 ml/kg of camel urine and milk orally for three month daily. Histopathological changes were showed in second and third group animals liver and kidney where as in the fourth group the changes were positive masked by camel urine and milk. The fourth group showed even better improvement than the second and third group. From this study it was found that carbon tetrachloride caused toxic effects in the liver whereas the camel urine and milk reduced these effects.

Key words: Camel, urine, milk, liver, kidney, carcinogenic rats.

Abstract # 145

Level of antioxidant enzymes and peroxidation products in camel (*Camelus dromedarius*) blood at lower altitude at the Dead Sea (-400m)

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Fifteen camels were involved in this study. Eight were residing the area of dead sea at low altitude (-400 m) below sea level, seven camels were residing Al-Ramtha area at 700 m above sea level. Blood samples were collected from their jugular veins and tested for the thiobarbituric acid reactive substances (TBARS) the final product of lipid peroxidation process. The antioxidant enzymes Glutathione peroxidase, superoxide dismutase and catalase, and reduced glutathione were also determined. No significant differences seen between camels resides at the two altitudes. Activity of the antioxidant enzymes, glutathione peroxidase, superoxide dismutase and catalase were higher in camels at lower altitude. Reduced glutathione was higher at lower altitude.

Key words: Camel, antioxidant enzymes, lipid peroxidation, altitude.

Abstract # 146

Biomarkers of health and minerals status in pregnant camels (*Camelus dromedarius*)

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Blood samples of pregnant (n = 10) and non pregnant (n = 10) camels were collected from Camel Breeding and Research Station Rakh Mahni, District Bhakkar, Pakistan. These animals were dependant on grazing pasture available there with no any supplementation of any feed. All these camels were in the last stage of gestation. Serum was used to determine total oxidant status, total antioxidant status, homocysteine, paraoxonase activity, arylestrase, ceruloplasmin, and macro and micro minerals. The total oxidant, antioxidant, homocysteine, paraoxonase, arlyesterase and ceruloplasmin are health markers. Total oxidenat status, total antioxidant status, homocysteine, paraoxonase and ceruloplasmin were measured with spectrophotometer while macro and micro minerals were determined with flame photometer and atomic absorption meter. Total oxidants status (0.78 $\mu\text{mol H}_2\text{O}_2$ equiv./L) was high (P<0.05) in female pregnant while total antioxidants status (0.51 mmol Trolox equiv./L) declined significantly. Serum homocysteine did not differ (P>0.05) between groups. Paraoxonase (239.76 U/ml/min) concentration was low (P<0.05) in female pregnant camels while arylesterase (123.98 kU/L) increased significantly. Ceruloplasmin (118kU/L) was also found to be high (P<0.05) in pregnant camels. Samples analyzed for macro and micro minerals did show a significant increase in sodium (1105.00 mg/L) zinc (14.97 mg/L) and manganese (0.73 mg/L) while magnesium (12.56 mg/L) and iron (16.03 mg/L) were (P<0.05) low in pregnant camels.

Key words: Camel, biochemical, pregnant.

Abstract # 147

Vitamin A and vitamin E: she-camel's serum concentrations and state of transfer before and after colostrum intake

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Thirty four she-camels and their products were used to establish serum vitamin A and E concentrations at parturition, their evolution during the first two days of age of the new-born camel (before and after the colostrum intake) and to determinate the correlation between mother's and product's serum vitamin A and E concentrations.

High Performance Liquid Chromatography (HPLC) was used.

The study results show:

- Mean concentration of serum vitamin A and E in she-camel at parturition were 0.25 $\mu\text{g/ml}$ and 1.14 $\mu\text{g/ml}$ respectively.

- Slow evolution of new-born camel's serum vitamin A concentration and a rapid evolution of the vitamin E concentration.
- Absence of correlation between mother's and new-born camel's serum vitamin A and E concentrations.

Key words: Vitamin A, vitamin E, she-camel, new-born-camel.

Abstract # 148

Contribution to the study of blood glucose in the dromedary in the region of Kairouan (Tunisia Central)

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The authors used for the determination of glucose a herd of camels living in semi liberty in a public domain Oueslatia in the governorate of Kairouan consisting mainly of camels of various ages and various stages physiological as well as young male puberty.

The determination of blood glucose was performed by enzymatic method (technical glucose oxidase).

The results were analyzed from a statistical point of view then compared with those of literature.

The authors determined the influence of the season, age and physiological stage.

Key words: Dromedary, blood glucose.

Abstract # 149

Blood lipid profile of camels in Tunisia and physiological changes

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Blood samples were conducted during January and August on two herds healthy regions of Medenine and Kairouan. The samples were taken by puncture of the jugular vein without prior tranquilizers in the morning before leaving to pasture. The purpose of this work was to study the influence of the season, geographical location, gender, reproductive status and age on biochemical parameters following:

- Triglycerides,
- Cholesterol,
- High density lipoprotein (HDL)
- Lipoproteins low density (LDL)
- Lipoproteins very low density (VLDL)

The results are presented as mean \pm standard deviation.

The statistical interpretation was made at the threshold of 5% using the SPSS software.

Statistical analysis showed that the parameters are significant variations.

Key words: Dromedary, lipid profile.

Oral Communications

Communications orales

Nutrition & Behaviour

Abstract # 150

Foraging behaviour of dromedary camels in the mountainous of the Punjab , Pakistan

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The purpose of this study was to determine the browsing behaviour and dietary preferences of the dromedary (*Camelus dromedarius*) camel and to establish a relationship between the animals and the vegetation. The study was conducted at the Barani Livestock Production Research Institute, Kherimurat, Punjab (Pakistan) on 15 animals of different age groups (*viz* adults, young stock and sucklers) over a 30-day period. The animals were monitored for their preference shown for different vegetation in terms of percentage time (devoted to grazing) of the total browsing time (0900-1600). Predominant vegetation in the area included Pholai (*Acacia modesta*), Kandair (*Alhaji camelorum*) and Kao (*Olea ferruginea*) trees and some local grasses like Palwan (*Olea cuspidate*), Chitta (*Cymbopogon distance*) and Sariala (*Heteropogon contortus*). Adults, young stock and sucklers spent 68.04, 66.33 and 60.80 % of the time respectively in displaying the behaviour. The rest of the time was spent in miscellaneous activities *e.g* rumination, urination, defecation including time to and from the browsing area. Adults, young stock and sucklers spent approximately 31.96, 33.67 and 39.20 % of the time respectively in exhibiting the miscellaneous activities mentioned above. Adults spent the largest percentage of the time (25.55 %) browsing on Pholai and least amount of the time (0.09%) browsing on Sariala. The young stock, on the other hand, spent 31.86 % of the time browsing on Kao and 0.21 % of the time on Kikar (*Acacia nilotica*). The sucklers spent 26.14 % of the time browsing on Pholai and spent the least amount of time browsing on Kikar. The young stock, on contrary to both the adults and sucklers preferred Kao. Irrespective of age groups, Pholai, Kandair and Kao were the most preferred plant species, where as Sariala grass and Kikar were the least preferred. This study has not only provided basic behavioural information that would help in designing studies in camel ethology in the future, it has also collected information on the behavioural ecology of the species which could prove imperative in identifying areas best suited for camel rearing.

Key Words: Camel, foraging, behaviour, Pakistan.

Abstract # 151

Grazing behavior of camels and the nutritive value of some selective range plants in the Libyan Rang

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The objectives of these experiments were to study the nutritional value of some range plants, which are selected and preferred by camels over other plants found in the rang of Libya, and to study the grazing behavior of camels in three different locations; Assa Range, New Heishe Range, and Owshtata Range. Bites/hour, bite time in seconds and bite weight (g DM/bite) were measured for sixteen individual female camel aged between 6 and 13 years. The

digestion coefficient (DC) and total digestible nutrient (TDN) were measured using faeces collection bags specifically designed for camels. In this experiment twelve males aged between 22 and 28 months were selected randomly from a flock of 150 camels. An area of 100 meters square was given to each camel during the experimental period. Animals were randomly divided into three groups of four, and *Acacia cyanophylla*, *Atriplex halimus*, and *Traganum nudatum*, were offered fresh in door to group 1, 2, and 3, respectively, and that was after an adaptation period of 14 days. Data were analyzed using complete randomized design (CRD). Plants were classified and split into three groups according to the protein percent; low, medium and high, 7.6%, 9.27%, and 17.50, respectively. Grazed camels showed non-significant difference in the bite weight (g/bite), rest time (min/day), but a significant difference was found in bites numbers among groups. The average day matter intake (kg/head/day), the average of faeces excreted daily (kg/head/day) were differed significantly ($P < 0.01$) between *Traganum nudatum* from one side and *Acacia cyanophylla*, *Atriplex halimus* from the other side. Total digestible nutrient (TDN, g/kg, %) was differed significantly ($P < 0.01$) between groups fed on *Atriplex halimus* and the groups fed on *Acacia Cyanophylla*, and also between group offered *Traganum nudatum* and *Acacia cyanophylla*, and that as a result of the significant difference in the DC among plants. Therefore, it is concluded that TDN in the plants fed to the camels was enough to cover only about 50% of the TDN of the requirement. The correlation between the bite number and bite time, and also between bite weight and bite time can give an indicator about the condition of the grazing area.

Key words: Camel, grazing behaviour, *A. cyanophylla*, *A. halimus*, *T. nudatum*, nutritive value, Libyan Rang.

Abstract # 152

Forage intake and diet digestibility in Maghrebi milking camel under oasis conditions

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In order to satisfy the increasing demand of camel milk in Tunisia, some intensive breedings were installed closer to the southern urban centres where stockbreeders could bring and sell their product. They also could improve the individual productivity of camel by improving the feed conditions. However, the data relating to the ingestion and the digestibility of diet in an intensive system are scattered.

Two trials were carried out to study ingestion and digestibility in mid lactation milking dromedary. In trial 1, 6 milking females individually received *ad libitum* alfalfa hay, 5 kg of fresh alfalfa and 2 kg of concentrate. In trial 2, 8 another females individually received 5 kg of alfalfa hay, 8 kg of fresh alfalfa and 3 kg of concentrate. During this trial camels also received oat hay *ad libitum*. In the two trial water was offered *ad libitum*. The digestibility of the dry matter was determined by method AIA.

In trial 1, total dry matter intake averages 13.60 ± 1.04 kg/day, in which fodder represents 86.7%. This quantity accounts for approximately 3% of the live body weight of camel. Dry matter digestibility of the ration was $68.6 \pm 8.7\%$. In trial 2, total dry matter intake averages 10.90 ± 1.03 kg/day, in which the quantities of oat hay, alfalfa hay, fresh alfalfa and concentrate were 2.57 ± 0.61 , 3.85 ± 0.60 , 1.81 ± 0.59 and 2.67 ± 0.03 kg, respectively. In this trial, fodder constitute 75.5% of the total dry matter intake but it remain less than that observed in trial one.

In conclusion, the quantity of dry matter intake in dairy camel could be improved by good quality of fodder like alfalfa than by the increase of the quantity of concentrate in diet. The distribution of good quality fodder can improve the quantity and quality of the produced milk in camel. The alfalfa species, which is available in the oasis, seems an excellent fodder for females in lactation and in particular for camel.

Key words: Ingestion, digestion, milking camel.

Abstract # 153

**Feed intake, in situ degradation and ruminal fermentation in camels
(*Camelus dromedarius*) during water deprivation and rehydration**

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Four dromedary camels were exposed to water deprivation for 6 days in summer (August) to study changes in feed intake, *in situ* degradation of dry matter and ruminal fermentation before, during water deprivation and during rehydration. Animals were offered 4 kg of vetch-oat hay and 200 g concentrate/day/head. Six days of water deprivation depressed dry matter intake by 48% but increased volatile fatty acids (from 97.7 mmol/l to 135 mmol/l) and ruminal ammonia concentration (from 85 mg/l to 99.1 mg/l) in the forestomach of camels. The water deprivation affected the composition of protozoa population. While the number of *Entodinium* increased, *Epidinium* and *Eudiplodinium* numbers decreased. There were no major significant effects on rumen pH and *in situ* degradation of dry matter. After rehydration, the most studied parameters returned progressively to basal values. It can be concluded that although during water deprivation animals significantly reduced feed intake, functions of the forestomach can be maintained sufficiently.

Key words: Water deprivation, fermentary parameters, digestibility, intake.

Abstract # 154

Effect of feeding *Atriplex halimus* to pregnant and lactating camel on milk yield and calf performances

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Two groups of pregnant camels (*Camelus dromedarius*), at the last quarter of pregnancy period, were used in this study. The first group (16 she camels, control) was fed berseem hay *ad libitum* while the second group fed on *Atriplex halimus ad libitum*. The two experimental groups were supplemented with ground barley grins as source of energy at level of 100% of energy requirements for pregnant camels. The experiment lasted until weaning the calves at

age 10 months. Thereafter, a digestibility trial was conducted, using 4 calves of every group, to determine the nutritive value of the experimental diets. The results showed that there was no significant effect of dietary treatments on dry matter intake (DMI) during the different physiological stages (late gestation, suckling and after weaning). Nevertheless, camels fed *Atriplex* had higher ($P<0.05$) body weight than those fed berseem hay during all the physiological stages. Although camels group which fed *Atriplex* diet had higher ($P<0.05$) overall body weight than those fed hay diet, they lost more ($P<0.05$) weight comparing with camels group fed hay diet throughout the suckling period. Feeding she camels on *Atriplex* diet increased ($P<0.05$) milk yield as compared with feeding on hay diet. Means of milk production were 3.85 and 4.90 kg/day for camels fed hay and *Atriplex* diets, respectively. The dietary treatments did not affected ($P>0.05$) birth weight, weaning weight and growth rate of camel calves. Regarding the performance of growing calves, fed the same diet of their dams, the results indicated that feeding *Atriplex* decreased ($P<0.05$) DMI and TDNI (2.07 and 1.26 vs. 1.84 and 1.09 kg/100kg body wt. for camels fed hay and *Atriplex* diets, respectively). However, digestible crude protein intake (DCPI, kg/100kg body wt.) of camel calves fed *Atriplex* diet was higher ($P<0.05$) than that of calves fed hay diet. Digestibility coefficients of OM, CP and CF for *Atriplex* diet were lower ($P<0.05$) than those for hay diet. As for the nutritive value of the used experimental diets, DCP% of the *Atriplex* diet was higher ($P<0.05$) than that of hay diet. However, an opposite result was observed for TDN% of the tested diets. Growing camels fed *Atriplex* diet retained more ($P<0.05$) nitrogen than those fed hay diet (22.40 vs. 16.80 g N/day respectively) and subsequently, had higher ($P<0.05$) daily gain (560 vs. 420.8 g N/day, respectively). Feed conversion was better ($P<0.05$) for growing camel calves fed *Atriplex* diet than that of calves fed hay diet, (11.61 vs. 15.44 Kg DM/Kg gain, respectively).

In conclusion, this study revealed that *Atriplex* (saltbush) could be utilized as a good source of roughage in the diet for feeding pregnant and lactating she camels and their calves in arid and semi-arid areas.

Key words: Camels, saltbushes, suckling, milk, growth, digestibility.

Abstract # 155

The protozoan community of the foregut of the dromedary camel

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The rumen protozoa were first discovered in the nineteenth century. In general, the protozoa population in the camel is similar to that in true ruminants with only few species differences. The rumen ciliates contribute to digestion and stability of the rumen environment. However, little information is available on the diversity of foregut protozoa of the dromedary camel and their impact on productivity. The aim of the present study is to investigate the diversity of the foregut protozoal population using traditional microbiological methods. Twelve foregut contents samples were taken from dromedary camel post mortem, fixed with formalin-saline solution and the different species of protozoa were identified using light microscopy. The predominant species of foregut protozoa were *Entodinium* sp., *Diplodinium* sp., and

Epidinium sp. with mean percentages of 92.6%, 4.4%, and 2.6% respectively with 0.4% of the protozoa unable to be properly identified to genus level. The total mean density of protozoa in this study were 6.7×10^2 cell/ml. The numbers were relatively lower than expected and this may be due to the prolonged period of fasting prior to slaughter. Samples of foregut contents from the same animals are to be analysed using molecular techniques to provide detailed information on the diversity of the ciliate protozoa and the different species present.

Key words: Protozoal population, *Entodinium* sp., *Diplodinium* sp., *Epidinium* sp., camel foregut.

Abstract # 156

DNA profiling of the bacterial community in the foregut of the dromedary camel

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The dromedary camel is known for its ability to efficiently utilize the vegetation of arid and semi-arid lands. Under desert conditions, camels browse on a range of forage plants that are of little nutritional value or are not palatable to true ruminants and other herbivores. Australia has the world's second largest area of arid and semi-arid lands and the largest population of feral dromedary camel populations. In Australia, feral camels are fed mainly on tannins-rich shrubs and trees, which contain anti-nutritional compounds that can cause illness in other ruminants (i.e. cattle, sheep). In contrast, camels thrive well and increase in numbers suggesting the ability to break down these anti-nutritional compounds and to alleviate their effect.

The present study was aimed at investigating the bacterial community of the foregut of the dromedary camel using culture-independent techniques. Foregut contents from 12 feral dromedary camels were collected post mortem and genomic DNA was extracted. The hypervariable region (V3) of the 16S rRNA was amplified by PCR and analyzed by denaturing gradient gel electrophoresis (DGGE). A total of 20 different bands, some common to all camels, as well as those restricted to individual camels, were excised, PCR amplified, cloned, and sequenced. A total of 39 clones were obtained from the 20 bands. Eleven clones were recognized as the nearest neighbour to *Pseudomonas* sp., five clones were related to *Clostridium* spp., four clones were related to *Burkholderiaceae* bacterium, three clones were related to *Eubacterium* sp. and *Bacteroides* sp., and the rest were related to *Streptococcus* sp., *Butyrivibrio fibrisolvans*, *Ruminococcus* sp., and *Lachnospiraceae* bacterium. Work is underway to establish a 16S rRNA library, which once constructed will provide detailed and accurate analysis of the bacterial community represented by the genomic DNA obtained from the original foregut samples.

Results of this study will enhance our understanding of the taxonomy and function of the poorly studied camel microbiome.

Key words: Dromedary camel, 16S rDNA, DGGE, bacterial community.

Abstract # 157

Selenium review in dromedary camels (*Camelus dromedarius*): Selenium status, GSH-Px activity, hair and organs distribution and excretion

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Camel has developed a whole of remarkable physiological, biological and metabolic peculiarities to survive into the desert constraints, which are not supported by other ruminants. Trace mineral particularly selenium requirement in camels are not known. Camel selenium supplementation is a common practice to facing several cardiomyopathy often attributed to the selenium deficiency. Nowadays the use of selenium in animal foodstuff is well implicated and needs a further investigation of its metabolism (ingestion, dynamic of storage-destocking, excretion) in camel species. According to previous comparative study on the basis of serum selenium concentration, it appears that the camel showed a different metabolic profile compared to cow, from which the concept of our present study was held with the objective to explore the selenium metabolism (serum selenium levels, glutathione peroxidase activity (GSH-Px), organs and hair distribution, urinary, faecal excretion) of supplemented camels with inorganic form (sodium selenite). This study carry out (i) the potential variations factors (sex, age, breed and the physiological status) on selenium level of non supplemented camels, (ii) effect of Se supplementation (0,2 and 4 mg/day) on serum Se status of non pregnant and non lactating camels, (iii) the effect of moderate Se supplementation (0 and 2 mg/day) on pregnant camels at the last stage of pregnancy, lactation period and on new born (up to 3 months), (iv) tolerance of young camels to Se supplementation. These studies lead to recommendations practice in terms of complementation in camel which proves its relative sensitivity to excess Se intake at lower levels compared to cattle. The maximal tolerable dose is 8 mg and the recommended dose is ranged between 2 and 4 mg.

Key words: Camel, selenium- GSH-Px- metabolism.

Abstract # 158

Maternal transfer of selenium by blood and milk in camel

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Ten pregnant female camels divided into two groups received after a 2 weeks adaptation period, an oral selenium (Se) supplementation (0 and 2 mg respectively) under sodium selenite form for 6 months from the three last months of gestation up to the three first months of lactation. Feed intake was assessed daily. Blood samples and body weight were taken on a bi-weekly basis, both in dams and their camel calves after parturition. Milk was

collected at birth (colostrum), then on a bi-weekly basis. The Se concentration in serum increased significantly in the supplemented group and was threefold higher than the concentration compared to the control group, respectively 305.9 ± 103.3 ng/mL and 109.3 ± 33.1 ng/mL. Blood values in camel calves were similar to those of the dams. In calves, Se values were 106.3 ± 26.5 and 273.2 ± 48.0 ng/mL in the control and treated groups respectively. The selenium concentration increased in similar proportion in milk (86.4 ± 39.1 ng/mL in the control group vs 167.1 ± 97.3 ng/mL in treated group). In the colostrum, Se concentration was higher in the both groups, but with similar difference: it was threefold higher in treated group with a mean value 302 ± 94.60 vs 108.2 ± 43.9 ng/mL. The glutathione-peroxidase (GSH-Px) activity in dams varied between 18.1 ± 8.7 in control group and 47.5 ± 25.6 IU/g Hb in treated group but decreased after parturition in both groups. At parturition, the camel calves born from supplemented dams had GSH-Px values threefold higher than the control calves: 73.8 ± 2.9 vs 25.0 ± 3.2 IU/g Hb ($P < 0.001$). Vitamin E did not change significantly and was on average 1.17 ± 0.72 ng/mL and 1.14 ± 0.89 ng/mL in the control and treated group respectively. The mean value for camel calves in the control group was 0.65 ± 0.49 vs 0.82 ± 1.08 ng/mL in the treated one.

Significant correlations were reported between mother serum Se, camel calf serum Se, milk Se and GSH-Px both in dams and calves. The results confirm the sensitivity of camel to Se supplementation with an important increase of selenium in serum and milk, allowing protection of camel calf against Se deficiency, commonly observed in Emirates.

Key words: Camel, glutathione-peroxidase, milk, selenium, vitamin E.

Abstract # 159

Camels behaviors and habits

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Whoever lives with camels and gets to know their amazing habits wishes never to part with them. He or she even gets pleasure from dealing with them because they are faithful to their owner and have natures that are similar to those of man such as their compassion for and association with one another, recognition of their owners' voices and figures and strong compassion for their newborns. They are very intelligent and are able to know water resources and places of rainfall. In this communication we will describe some of their behaviors and habits. Most important of these unique behaviors are:

- Protectiveness and Revenge,
- Motherly Passion
- Longing for the place of birth
- Faithfulness
- Intelligence
- Intimacy and Affection
- Submission and Obedience
- Entertaining Behavior
- Grazing behavior and preservation of the environment
- Movement Behaviors

Key words: Camel, behaviors, habits.

Abstract # 160

Relation of coexistence between camels and wild animals

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Livestock, especially small ruminants and camels are commonly considered as disturbing factors that negatively affect the abundance and distribution of wild animals in desert areas. We investigated this hypothesis by testing whether the occurrence of two emblematic species, the Dorcas gazelle (*Gazella dorcas*) and Houbara bustard (*Chlamydotis undulata undulata*), in south-eastern Tunisia was affected by camel abundance. Data used were collected during March and April 2004. The study area was divided into 32 sample units (unit: 20 km x 20 km) distributed over a regular grid. Within each square, five sampling sites were randomly selected along a line transect, separated from one another by three km. Each sampling site was visited once for a single 30-minute survey session.

Using Multivariate GLM (MANOVA), we found that areas occupied by these two wild species were characterised by a significantly higher number of camels than unoccupied areas. Moreover, logistic regression analyses showed that the occurrence probability of these species was positively correlated with the number of camels. These results may be explained by the fact that Dorcas gazelle and Houbara bustard share similar habitat requirements with camels. The three species coexist in open areas and seem to avoid urbanised and agricultural areas. Our results also suggest that camels are not perceived as a disturbing factor by both Gazelle dorcas and Houbara bustard. Camels generally consume poor-quality plants that are generally unpalatable and indigestible for these two species and do not seem to compete for food with them. Moreover, camel herds seem to be used by both Dorcas gazelle and Houbara bustard as to assist awareness of predators, such as the Golden jackal (*Canis aureus*). Furthermore, symbiotic interaction probably exists between camels and Houbara bustard which can use camel-parasites like ticks.

Future investigations of vigilance behaviour of these two wild species in relation to camel presence/absence should tell us more about this issue.

Key words: Camels, Dorcas gazelle, Houbara bustard, South-eastern Tunisia, coexistence.

Posters

Communications affichées

Nutrition & Behaviour

Abstract # 161

Pastoral productivity of Niger arid regions and their valorisation by dromedary

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The arid areas are characterized by an annual rainfall less than 150 mm/year. Beside this very low quantity, rain is irregular in time and space. In these conditions, the pastoral productivity is very low in some places and absent in others. The extensive production systems, in particular the dromedary production system, present in these areas are adapted to this situation. This study was undertaken in Agadez (Niger), to evaluate the total forage production of pasture as well as the quantity consumed by dromedary. The pastoral productivity was determined by the method of "Integral Collect" of the grass contents in "Small Square" laid out through the surface sampling. Tree biomass production was estimated by the Ickowicz (1995) "Allometric Regressions" established for tropical trees. Feed ingestion on pasture was determined indirectly by chemical analysis of faeces in 8 she camels which was used to estimate the contribution of ingested rations and the nutritive elements were estimated on the basis of chemical composition which is the reflection of the botanical composition of the regime. The ponderal performance was evaluated monthly by weighing the calves (n = 7) with an electronic balance Type AG 500 and by barymetrics measurements. The assessment of these fodder resources showed an annual production of 382 ± 82.9 kg DM/ha which represented globally 213.1 ± 36.3 UFL/ha and 11.2 ± 1.5 kg of DNM/ha. The ingestion of the dry matter (DM) on pasture varies from 1.2 to 2.2 kg of DM/100 kg of body weight (BW) with an average of 1.6 ± 0.3 kg of DM by 100 kg of BW. Despite the low productivity of pasture, the dromedaries recorded a very appreciable daily body gain varying from 277 g to 374 g.

Key words: Pastoral productivity, dromedary, ingestion, body gain.

Abstract # 162

Some trace minerals profile in natural pasture and blood serum of camel in Butana Region, Sudan

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This study was performed to assess some trace minerals concentrations of grasses from Butana area in addition to determine the level of some trace minerals of blood serum of camel was grazed in same area. Samples of mixed grasses were collected from natural pasture and Samples of blood serum were obtained from preslaughtered camels. Samples were analyzed used Atomic Absorption Spectrophotometer.

The results were showed that trace minerals levels were variable in mixed grasses. Iron level of mixed grasses was 770.7 ± 299.7 mg/kg, copper level was 8.62 ± 1.2 mg/kg and zinc level was 19.73 ± 1.7 mg/kg. Accordingly, the mixed grasses were contained considerable amount of iron. Furthermore, iron level of serum was 169.3 ± 209.9 μ g/dl, copper level of serum was 60.74 ± 20.6 μ g/dl and zinc level of serum was 24.5 ± 15.8 μ g/dl. The results revealed that camel serum from Butana area was exhibited adequate level of iron, where copper was present within normal level. Also these results indicated consequence of copper status in grasses pasture. Whereas camel serum contained low level of zinc, that coincided with zinc level in grasses.

The most levels of some trace minerals of the camel serum in present study were within the safety levels for camel health, as well as within the appropriate limits in natural grasses.

Key words: Camel, trace minerals, serum, pasture, grazing.

Abstract # 163

Spatial and seasonal variation of chemical composition of desert plant and camel faeces

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To study the nutritive variability in camel farming system face to spatiotemporal fluctuations of the fodder offers in Saharan range lands, the part grazed by the dromedary of 21 vivacious plants composing the various types of Saharan rangelands was harvested. Besides 13 faeces samples of dromedaries were collected in the same rangelands, during four seasons to analyze their chemical composition, including: Mineral Matter (MM), Organic Matter (OM), Total Nitrogen Matter (MAT), Crude Wende Cellulose (CWB), Neutral Detergent Fibber (NDF), Acid Detergent Fibber (ADF) and Acid Detergent Lignin (ADL). The spatiotemporal study of the chemical composition of the camel faeces confirms us the obtained results for different plants grazed by this animal. Indeed, in general, the obtained values reflect very well the general trend of the chemical composition of plants, with values very low in nitrogen (going from 3.56 to 18.04% of the MS for the species and 3.62 to 11.53 % of the MS for the faeces) and relatively high in membrane constituents (going from 21.47 to 74.83 % of the MS for the species and 16.6 to 62.06 % of the MS for the faeces). However, a significant seasonal variability was observed in plants ($P = 0.001$) contrary to faeces where no significant seasonal differences was reported ($P = 0.058$). This shows that the dromedary, by its particular feeding behaviour, applies a strategy of adaptation to nutrient fluctuations, caused by the seasonal climatic variations, and can ensure a relative stability of its annual nutrient contribution.

Keywords: Chemical composition, vivacious species, faeces dromedary, Saharan rangelands.

Abstract # 164

A comparative study of ruminal fermentation, protozoa population, *in vitro* fermentation and *in situ* degradation in camels, sheep and goats

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This study was conducted to study rumen environment, protozoa population, *in vitro* fermentation and *in situ* degradation in camels, sheep and goats offered two diets. Diet 1 consisted of 100% vetch oat hay and diet 2 consisted of 50% vetch oat hay and 50% concentrate.

Diets had no effect on ruminal pH and total and individual volatile fatty acids. However, compared with diet 1, diet 2 reduced the *in situ* degradation of vetch oat hay and resulted in elevated number of ciliate protozoa. Rumen ammonia nitrogen (NH₃N) level of camels was lower (P<0.05) than goats and sheep while ruminal pH was higher for camels (P<0.05) and ranged from 6.1 to 6.8. Camels had higher (P<0.05) total volatile fatty acids concentration but a lower (P<0.05) number of ciliates. Protozoa of the type B (*Epidinium* and *Eudiplodinium*) were observed only in camels and goats but the type A (*Polyplastron*) was only present in sheep. The *in situ* degradation of vetch oat hay was lower in sheep, while camels and goats had similar *in vitro* and *in situ* dry matter vetch oat hay degradation.

Key words: Ruminal fermentation, protozoa, *in vitro* fermentation, *in situ* degradation, camels, sheep, goats.

Abstract # 165

Selenium toxicity in dromedary camel (*Camelus dromedarius*)

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It is well known that dromedary camels are adapted to the harsh condition of arid and semi-arid zone. Previous studies showed its sensitivity to mineral imbalance, selenium (Se) is an essential trace elements for animal nutrition that plays a vital role in physiologic processes. Selenium deficiency in dromedaries is widespread; many cases of white muscle disease have been confirmed. For prevention and treatment as well farmers supplement with selenium, the requirements of dromedaries in selenium are extrapolated from those of other species, but excess consumption of selenium can result in selenium intoxication. No references on selenium toxicity in camels were reported. The objective of the study reported here was to investigate the effect of excess selenium (sodium selenite) supplementation (8, 12 and 16mg/day) on serum selenium level, glutathione peroxidase activity (GSH-Px), toxicity

symptoms and histopathology findings. Selenium concentrations in serum increased significantly in treated groups with an average value of 321, 23 ± 140, 5; 443, 18 ± 231, 06 and 298, 04 ± 212, 13 ng/ml. The glutathione peroxidase activity varied between 26, 85 and 174, 16 IU/gHb. Serum selenium concentration was highly correlated with GH-Px ($r = 0.70$; $P < 0.001$). Remarkable toxicity symptoms occurred within 2 weeks of supplementation. Degenerative changes were observed in kidney, heart, liver and muscles

Key words: Camel, selenium, GSH-Px, toxicity.

Abstract # 166

Calculating camel dietary requirement compare to cattle NRC requirement

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The camel exhibits certain characteristics that enable it to survive food shortage, thirst and drought. It is the only animal that could efficiently digest and utilize fibrous, dry, low nutritive value fodder and remaining flora, and yet produce milk and meat for human nutrition.

In order to improve the dietary rations of camels for higher milk production, an attempt was made to calculate the dietary requirements for dairy camels, and compare them to Dairy Cattle NRC Requirement.

DMI for camels is calculated as 1-2% compare to 2.5-4.32% for cattle.

ME requirement for camel maintenance was found to be in range of 75-104 kcal ME/KgW^{0.75}. Maintenance energy for camels increased during the first lactation by 20% and 10% during the second lactation, while that for cattle was 133 kcal for cattle.

ME requirement for milk production in camels was found to be 1.2 Mcal ME/kg milk while it was 1.15 Mcal ME/kg milk (3.5% fat) for cattle.

Protein requirement is calculated as 1g DCP for each 37.5 Kcal ME, and for each Kg milk requires 1.2 Mcal ME, 56 g DCP, 2.7 g Ca and 1.8 g P. Salt should be added at a rate of 1.5% of the concentrate ration.

More research work on energy and protein requirements for dairy camels in various environments and at different level of production is needed.

Key words: Dietary requirement, dry matter intake, metabolic energy, camel.

Abstract # 167

Fecal liquor as microbial inoculum source for *in vitro* (Daisy^{II}) technique to estimate the digestibility of feeds for camels

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The objective of this study was to evaluate the camel fecal liquor as the microbial inoculum source for *in vitro* (Daisy^{II}) technique in order to estimate the digestibility of different fodder species browsed by camels at pasture in an arid region of Southern Tunisia.

The more represented plants collected in the pasture were: *Atriplex halimus* L., *Salicornia arabica* L., *Salsola tetragona* Del., *Salsola tetrandra* Forssk, *Suaeda mollis* (Desf.) Delile, *Aeluropus littoralis* (Gouan) Parl., *Imperata cylindrica* L., *Reaumuria vermiculata* L., *Tamarix gallica* L., *Nitraria retusa* (Forssk) Asch, *Zygophyllum album* L., *Artemisia campestris* L., *Frankenia thymifolia* Desf., *Limoniastrum guyonianum*, *Limonium pruinosum* subsp. *alleizettei* (Pau) Maire, *Retama raetam* (Forssk.) Webb & Berthel and *Stipa tenacissima* L. All feed samples were analyzed for dry matter (DM), crude protein (CP), ether extract (EE), ash, ADF (acid detergent fiber), NDF (neutral detergent fiber) and ADL (acid detergent lignin). Faecal samples were taken from mature camels in optimal health status condition. The Daisy^{II} incubator was used to evaluate nutrient digestibility coefficients of forages using camel fecal liquor as microbial inoculum source. Filter bags containing the feed samples were added to the four incubation vessels along with their respective inoculum. Vessels were incubated with samples taken at 48 h. Filter bags were used to determine DM, CP, NDF, ADF, ADL and organic matter (OM) digestibility. There was a significant relationship between estimates, indicating that fecal liquor method has the potential to be used instead of rumen fluid for estimation of *in vitro* digestibility of forages. It is suggested the method for determination of *in vitro* digestibility of nutrients using fecal liquor was appropriate for batch operation with precision and efficiency. These results would, therefore, indicate that the combined use of the Daisy^{II} incubator with a smaller sample size incubated in camel fecal inoculum provides a valid and accurate estimate of total tract DM digestibility in the camel.

Key words: Camel fecal liquor, *in vitro* (Daisy^{II}) technique, digestibility.

Oral Communications

Communications orales

Reproduction

Abstract # 168

Early postpartum breeding: a practical approach to reduce calving interval in dromedary camel

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In traditional camel husbandry practices, the inter-calving period is generally 2 years resulting in economic losses. Efforts were made to explore the possibility of breeding the females during the early post-parturient period prior to end of breeding season with and without ascertaining follicular status by ultrasound examination.

During three breeding seasons adult pluriparous lactating camels were examined on day 30, 45, 60, 75 and 90 days postpartum for ovarian status by transrectal ultrasonography (Scanner-200, Pie Medicals, India)- (i) No dominant follicles (≥ 1.0 cm) could be observed between 34 & 70 days (mean 56 ± 3.37 days) in nine out of seventeen animals (52.94%). Four out of nine females conceived and calved after mating. (ii) Nine out of eighteen females were found to possess follicle of >10 mm. Five out of nine conceived and calved after mating with virile stud (iii) twenty three out of 37 females were found to possess follicle of >10 mm. Eleven out of twenty three conceived and ten calved after mating with virile stud.

In order to mimic the breeding practice of ordinary camel farmer the ovarian examination by ultrasound was not attempted in the next breeding season. A male camel was paraded before post-parturient camels for 30 min on alternate days. The females were mated at 30 days of parturition with virile studs. Only few camels (when found non-pregnant) could be given subsequent mating at 50 and 70 days of parturition before the end of breeding season. Six out of eighteen conceived after mating with virile stud.

This practice of breeding in early post-parturient period has resulted in reduction of around 300 days of inter-calving period in each of pregnant females as compared to female camels subjected to traditional system of mating.

Key words: Camel, postpartum breeding, ultrasonography, conception.

Abstract # 169

Clinical prevalence of reproductive disorders in dromedary camel (*Camelus dromedarius*) under field conditions

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This paper is based on clinical records maintained in the reproductive wing of central veterinary laboratories Abu Dhabi municipality between April 2002 to May 2007. A total of 2,000 female camels and 50 bulls were examined. Among different reproductive disorders in she camel the most common was the endometritis, 30% (n = 600), followed by cystic ovarian degeneration 10% (n = 200), vaginitis 5.25% (n = 105), prepartum vaginal prolapse 4.75% (n = 95), uterine prolapse 4.50% (n = 90), retention of fetal membranes 4.25% (n = 85), hydrobursitis 2.25% (n = 45), vaginal adhesion 1.75% (n = 35), and cervical adhesions 1% (n

= 20). In bulls the incidence of balanoposthitis was 20% (n = 10) followed by phymosis 16% (n = 8), orchitis 10% (n = 6), testicular degeneration 12% (n = 8) and altered semen picture 36% (n = 18).

The present study provides the basis for initiation of strong sexual health program for camels under the existing conditions of field management.

Key words: Camel, reproductive disorders and field conditions.

Abstract # 170

Clinical and histological investigation of the post-partum in the female dromedary

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Reproductive efficiency is the main driving force in camel production systems. Intercalving interval, a major measure of reproductive efficiency is primarily determined by uterine involution and return to normal ovarian activity uterine postpartum. Contrary to Southern American Camelid, ovarian activity is delayed by suckling in camels. Advancing postpartum sexual activity can be achieved by early weaning however the uterus should be well involuted in order to carry a new pregnancy.

The objectives of the present research are to characterize uterine involution both clinically as well as histologically in postpartum dromedary camels. Twenty four (24) healthy mature dromedary females were used in the experiment. All females had a normal parturition at the term of normal pregnancy. Each female was examined by transrectal palpation and ultrasonography followed by endometrial biopsy sampling at 3, 7, 15, 21, 30, 45 and 60 days post-partum.

The uterus was completely retractable within the pelvic area by the 4th examination (21 days postpartum) in all females and the histological evaluation at the same stage was consistent with normal repair of the endometrial mucosa. The microcaroncules regressed progressively during the first 10 postpartum and disappeared completely by the 15th day post-partum in all females. The lamina propria was œdematous on days 3 and 7 post-partum. The edema regressed progressively and disappeared by day 15 postpartum. Infiltrating of the lamina propria of the endometrial mucosa by inflammatory cells (lymphocyte, macrophage, PNN and PNE) was a constant finding in the first 3 weeks postpartum and ranged from moderate to intense.

By 21 days postpartum the regeneration of the epithelial surface was complete. Uterine gland regeneration and increase in number and size was observed as early as 7 days post-partum.

We conclude that gross and histological uterine involution and repair of the endometrium is complete by 20 days postpartum. This suggests that if the ovarian activity is stimulated by early weaning, camels may be able to return to sexual activity and rebred as early as 3 weeks postpartum. The effect of early weaning and nutritional management of the postpartum period and their effect on fertility are under study.

Key words: Dromedary, uterine involution, endometrial, histological, uterine biopsy.

Abstract # 171

**Pregnancy rate following synchronization of estrus and natural mating in camels
(*Camelus dromedarius*)**

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The study was designed to compare the efficacy of treatments intended to induce estrus at the beginning of the reproductive season in non lactating camels and to determine the effect of these treatments on pregnancy rates after natural mating and on the conception rate of the following season. The females were treated with: (1) saline (control, n = 10); (2) Progesterone Release Intravaginal Device (PRID) (1.9 g natural progesterone) for 17 days (n = 10); (3) approximately 2000 I.U. FSH (eCG) and injected 48 hours with 2000 I.U. of LH (Pregnal) (n = 10); or (4) Progesterone Release Intra-vaginal Device (PRID) for 17 days + FSH at PRID removal and injected with post PRID removal LH (n = 10). The ovarian response was monitored by trans-rectal ultrasonography. The intervals from treatment to follicular wave emergence and to the day of showing estrus were not the same (P<0.05) between the females of the different groups. A single natural mating was permitted for each female showed estrus (when a female set down to be mated by a male) in the first 5 days post PRID removal. Conception rates significantly differ among groups (0.0%, 10%, 30%, and 60%, respectively). In conclusion, using PRID+ FSH+LH treatment was most effective for inducing fertile estrus in the treated camel females. Conceiving and calving at early time of the reproductive season did influence the conception rate in the next reproductive season. No significant differences were found among groups with regard to gestation period which averaged 373 days. Eighty percentages of the females within treated groups delivered their calves during the daytime. Additionally, seventy % of the newborns were females. In this study, estrous synchronization reduced the calving period to be around 13 days.

Key words: Camels, estrus induction, natural mating, estrus and pregnancy rates.

Abstract # 172

Effect of estradiol on maternal recognition of pregnancy after embryo transfer in Lamas

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It has not yet been possible to develop an embryo transfer (ET) protocol in llamas that has comparable results to those obtained in other species. The corpus luteum (CL) has a half life of 8-9 days (Aba et al., 1995) thus limiting the period necessary for transferring embryos to the uterus and for maternal recognition of pregnancy (MRP) to maintain the CL viable. In a previous study we observed that maximum pregnancy rates were obtained when transferring the embryo to the left uterine horn in the presence of an ipsilateral CL; these results decreased

when the embryo had to migrate to carry out MRP (Trasorras et al., 2008). Prior to implantation the blastocyst produces estradiol and hence the exogenous administration of this hormone can maintain and extend luteal production of progesterone (Palomino et al., 2006; Powell et al., 2007) indicating that the estradiol produced plays a role in MRP and in early support of the CL. **Objective:** Determine the effect of exogenous estradiol during MRP and extend the life span of the CL in recipient females. Eleven females were used as embryo donors and 23 females as recipients. Recipients were randomly divided into 2 groups: control group (n = 10) and treatment group (n = 13). In both groups ovarian dynamics were monitored by rectal palpation and transrectal ultrasonography and when a dominant follicle was observed in the left ovary a single dose of 8 µg of buserelin was administered IV (day 0). Ovulation was confirmed by transrectal ultrasonography, and transcervical ET was carried out on day 6 after buserelin administration. Embryos were recovered by flushing the uterus on day 8 after the first mating of the donor. Once the embryos were washed and evaluated, those apt for transfer (Tibary and Anouassi, 1997) were loaded into 0.25 ml straws and transferred to the left uterine horn of the recipient females. On days 8 and 9 after buserelin administration the treatment group received 0.2 mg of estradiol benzoate (EB) IM. Visualization of the embryo vesicle 13 days after ET confirmed pregnancy and heartbeat 3 days later confirmed viability. Fisher's exact test was used for statistical analysis. Embryo size varied within a range of 0.3-1.2 mm in diameter. Pregnancy rate was 50% (5/10) and 30.7% (4/13) for control and treatment groups respectively. No significant differences were observed between groups (P = 0.4173) with the dose of 0.2 mg of EB. Nevertheless, Powell et al. (2007) used 10 mg EB daily during 7 days after inducing ovulation in non-pregnant females and were able to maintain progesterone levels high during days 14 to 17. Thus administration of higher doses of estradiol seems to prolong the luteal phase and increase progesterone secretion over the period in which luteolysis should occur. So, more research is needed to determine if this dose increases the luteal phase in ET recipients and if it helps the embryo when inducing MRP in llamas.

Key words: *Lama glama*, estradiol benzoate, embryo transfer, maternal recognition of pregnancy.

Abstract # 173

Glycosaminoglycans in the alpaca reproductive tract

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Camelid semen has low concentration and motility of spermatozoa, and is highly viscous, limiting its processing for artificial reproductive technologies. It is not known if the characteristics of camelid semen are affected by season, plasma testosterone levels or nutritional status. Furthermore, the relationships between semen parameters such as viscosity and motility of spermatozoa have not been fully documented. An understanding of the semen characteristics of alpacas and the relationships among them will enhance the development of reproductive technologies in camelids.

Ejaculates (n = 265) were collected from 11 alpacas approximately once weekly from March to October 2008. The times taken to mount and mate the mannequin were recorded. Semen was assessed for volume, colour, viscosity, pH, and concentration and motility of spermatozoa. Body condition score and the weight of each animal were assessed at the time of collection and blood samples were collected for plasma testosterone analysis.

Mean mating time was 26 ± 0.88 min and declined from March to October ($P < 0.001$). The average time to mount the mannequin was 44 ± 3.6 seconds and also declined from March to October ($P < 0.001$). Mean semen volume was 1.7 ± 0.11 ml and increased as mating time increased ($P < 0.001$). Semen viscosity increased as pH increased ($P < 0.001$). Motility was negatively correlated with semen viscosity ($P < 0.001$) and pH ($P < 0.001$). Plasma testosterone concentration, weight and body condition score did not affect mating parameters or semen characteristics and there was no change in testosterone concentrations from March to October. Semen volume, mating time and time to mount the mannequin were similar to those described previously. The decline in mating time from March to October is unlikely to be caused by decreased libido, as time to mount the mannequin also decreased during this time suggesting an increased interest in the mannequin. It is possible that mating time and libido are under seasonal control, but are not affected by testosterone concentrations which did not differ from March to October. The relationship between semen pH and viscosity has not been previously documented and suggests that a basic protein may be responsible for seminal plasma viscosity in alpacas. The decline in sperm motility with increased semen viscosity suggests that the development of methods to reduce viscosity may advance the application of reproductive technologies in camelids.

Key words: Alpaca, semen, testosterone.

Abstract # 174

Effect of different mucolytic agents on viscosity and physical characteristics of dromedary camel semen

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Elimination or even semi-liquefaction of viscosity in ejaculated camel semen is essential to improve judging of its raw physical characteristics and to improve homogeneity after its dilution for freezing. Five different mucolytic agents solutions; namely: α -amylase (25%), α -chymotrypsin (0.5%), trypsin (25%), sodium hydroxide (N 0.1) and bromhexine hydrochloride (0.2%) were tested for removal of viscosity in camel ejaculates. Semen samples were collected by using El Hassanein Camel Dummy Technique from 6 camel bulls of averaged 10 years age during the mid-rutting season. Raw samples having 13.45 ml. mean volume, 296.3×10^6 /ml. mean sperm concentration, 64.16% mass motility [livability], 23.04 % individual forward motility, 96.67% intact acrosome, 5.08% primary abnormalities and 8.08% secondary abnormalities were used in this study. After collection, each ejaculate was allocated into six portions for dilution in a Tris-Lactose glycerolated extender containing one of the five mucolytic agents at 50 μ l/ml of extender and one portion diluted in extender free from mucolytic agents (control). Seminal viscosity, sperm motility and acrosomal integrity were precisely assessed post-dilution (0-time) and after 240 minutes of incubation at 5°C (equilibration).

Amylase superiorly eliminates seminal viscosity in all samples and significantly improves sperm individual motility (47%) post-dilution compared to the control samples (25%) and samples treated with the other mucolytic agents (32-35%). However, amylase had a

significant ($P < 0.05$) deleterious effect on sperm acrosomal integrity after 240 minutes of equilibration (12% detached acrosomes).

Although chemotrypsin partially liquefied about 60% of samples post-equilibration, it significantly ($P < 0.05$) improved sperm individual motility (46%) and significantly ($P < 0.05$) minimized acrosomal detachment after 240 minutes of equilibration (7.5%).

In conclusion, although some mucolytic agents may eliminate viscosity in camel semen and overcome semen viscosity problems during cryopreservation, yet these mucolytic agents may have a deleterious effect on sperm motility and acrosomal integrity after equilibration period for 4 hours prior freezing.

Key words: Dromedary camel, semen, mucolytic agents, viscosity.

Abstract # 175

Transvaginal ovum pick-up in super-stimulated dromedary camels (*Camelus dromedarius*)

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Studies were conducted to optimize the ultrasound guided transvaginal ovum pick-up in dromedary camels after ovarian super-stimulation. Mature female dromedary camels ($n = 24$) were super-stimulated with a combination of 2500 IU eCG, given as a single intramuscular injection on day 1, and 400 mg pFSH (Folltropin; Vetrepfarm, Ireland) injected twice daily in declining doses of 2×80 mg, 2×60 mg, 2×40 mg, 2×20 mg over 4 days. The ovaries of all the donor camels were scanned on day 4 after the start of treatment, and thereafter at intervals of one or two days until the majority of follicles had grown to between 1.3 and 1.8 cm in diameter. They were given a single intravenous injection of 20 μ g of the GnRH analogue, buserelin, one day before the ovum pick-up was scheduled. For the aspiration of cumulus oocyte complexes (COCs), the animals were made to sit in sternal recumbency, sedated with 0.7-1 mL of Domosedan (Detomidine hydrochloride 10mg/mL, Orion Pharma, Finland) and the transducer (Aloka UST-994P-5) was guided through the vulva into the cranial most portion of the vagina, while the free hand was placed in to the rectum to position the ovary against the vaginal wall over the face of the transducer. A 17-gauge, 55 cm single-lumen needle was placed in the needle guide of the ultrasound probe and advanced through the vaginal fornix and into the follicle. Follicular fluid was aspirated using a regulated vacuum pump set at a vacuum pressure of 55 mm of Hg into tubes containing embryo-flushing media. Aspirates were searched for COCs using a stereomicroscope, which were then denuded of the cumulus cells by hyaluronidase and repeated pipetting. The denuded oocytes were classified as mature (with a visible polar body), immature (with no visible polar body), activated (with divided or fragmented ooplasm) and others (degenerated and abnormal). Overall an average of 12.12 ± 7.9 COCs (range of 2 to 30) were aspirated per animal with the oocyte recovery rate from the aspirated follicles of about 70%. The majority (>90%) of the collected COCs were with loose and expanded cumulus cells. The proportion of mature oocytes obtained at 28-29 h (91.2 ± 4.1) and 26-27 h (82.1 ± 3.4) were higher ($P < 0.005$) when compared to those obtained at 24-25 h (40.4 ± 16.3) after GnRH administration.

In conclusion, ovarian super-stimulation with a combination of eCG and FSH was efficacious in inducing multiple follicle growth for transvaginal ultrasound guided ovum pick-up in

dromedaries. A high proportion of mature (M-II) oocytes (80 to 90%), which can be directly used for assisted reproductive techniques, can be collected 26-28 h after GnRH administration from such animals.

Key words: Camel, mature oocytes, ovum pick-up, ovarian super-stimulation.

Abstract # 176

Embryo transfer in dromedary camels using asynchronous recipients

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Embryo transfer offers the chance to greatly increase the productivity of female animals and thus increase the rate of genetic improvement. In camels, embryo transfer is particularly useful to increase the number of progeny from desirable genetic combinations whether it be for racing, milk, meat or transport.

In the dromedary camel methods for the collection and transfer of fresh, hatched Day 7 blastocysts are well established. However, as all camelids have a relatively short luteal lifespan of only 8 – 10 days, the time window for transferring embryos into the uterus of recipient camels before luteolysis occurs is short. Results of previous embryo transfer studies have shown that the best pregnancy rates were achieved if the embryos were transferred to recipient camels on day 6 after ovulation, but was dramatically reduced if the level of synchrony between the donor and recipient increased to +1 (embryo transferred to a recipient on day 8 after ovulation) or –3 (embryo transferred to a recipient on day 4 after ovulation) days. However because camels are induced ovulators synchronization of large groups of animals poses a problem owing to the absence of a cyclical CL. This means that the more conventional methods of synchronizing cattle by giving 2 injections of PGF2 α 11 days apart cannot be used for camels. Pregnancies can be achieved however, by transferring embryos into non-ovulated, progesterone treated recipients that receive 150mg of progesterone daily, but daily intramuscular injections for the complete 13 month gestation period due to the absence of a CL, are not very practical.

The purpose of this study was to investigate whether it was possible to establish pregnancies in ovulated, asynchronous, progesterone-treated recipient camels and to see if the embryo could maintain the CL thereby negating the need for continued exogenous progesterone therapy throughout pregnancy. The uteri of 5 mated donor camels were flushed non-surgically 7 days after ovulation and 24 embryos recovered. Sixteen embryos were transferred non-surgically to recipients at Day 3 after ovulation that had received 75 mg of progesterone-in-oil i.m. daily from Days 1 to 6 after ovulation. The progesterone dose was then reduced to 50 mg on Day 7 and 25 mg/day on Days 8 and 9 after ovulation before being discontinued. Nine of 16 (56%) recipients became pregnant compared with 0/8 controls that were also at Day 3 after ovulation at the time of embryo transfer, but had not received progesterone. In conclusion, this method reduces the need for tightly timed synchrony between donor and recipient as it increases the time window for embryos to be transferred into the uterus.

Key words: Camel, embryo transfer.

Abstract # 177

Nuclear transfer in dromedary (*Camelus dromedarius*) using in vitro matured oocytes and two donor cells sources: adult fibroblast and granulosa cells

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Somatic cloning may allow maintain/expand the population of camels with the highest potential for milk-production or those having the best racing performances. Until now no reports have been published on embryonic or somatic nuclear transfer in camel. The aim of this study was to produce dromedary embryos by nuclear transfer using in vitro matured oocytes and two somatic cells donor sources (adult fibroblast vs. granulosa cells). A total of 58 adults females were superovulated with a single dose of eCG (3500 IU). Ovaries were collected postmortem 10 days after stimulation. Cumulus-oocytes-complexes (COCs) were aspirated from follicles and matured in vitro for 30 h. Value-male camel fibroblast and granulosa cells from slaughtered animals were used as donor karyoplasts and injected into matured enucleated dromedary oocytes.

The cleavage rate was higher ($P < 0.05$) for reconstructed camel embryos with fibroblast cells (59%) vs granulosa cells (45%). However, there was no difference between the two groups when the proportion of cloned embryos reaching the blastocyst stage (fibroblast: 14% vs. granulosa: 15%) or those hatching (fibroblast: 10% vs. granulosa: 12%) was compared. The viability of reconstructed dromedary embryos from the two sources of donor cells (Fibroblast; $n = 5$ vs. Granulosa; $n = 7$) was examined by transfer to synchronized recipients. Two females (fibroblast: 1/5; 20%, granulosa: 1/7; 14%) were confirmed pregnant by ultrasonography at 15 and 25 days following transfer. Later on, the pregnancies were followed by pregnancy empiric-symptoms. These two pregnancies were lost between 45 and 60 days follow transfer respectively.

In conclusion, the present study shows for the first time that the development of dromedary NT embryos derived from either adult fibroblast or granulosa cells can be obtained in vitro and the transfer of these cloned embryos to recipients can result in pregnancies.

Key words: Nuclear transfer, dromedary, vitro matured oocytes, fibroblast, granulosa cells.

Posters

Communications affichées

Reproduction

Abstract # 178

Seasonal variation of reproductive behaviour and hormone concentrations in dromedary camels in Al-Qassim region of Saudi Arabia

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The objective of this experiment was to characterize the reproductive season in the dromedary (*Camelus dromedarius*) in Al-Gassim Region of Saudi Arabia. Blood samples were collected bimonthly from 20 adult females and 5 males for 12 consecutive months. Samples were drawn into heparinised syringes from the jugular vein in the very early morning. Plasma was separated and stored at -20C° until hormonal analysis. Concentrations of each of estradiol, progesterone, FSH, LH, and thyroxin were determined by ELISA. Semen was evaluated during December, January and February.

Reproductive behaviour in males varied with respect to the beginning and the length of their reproductive season. In general, the reproductive season started at the beginning of September when significant changes in the concentration of pituitary and ovary hormones were observed. The concentration of testosterone was less than 7.5 ± 0.69 ng/ml in summer months. Semen volume, sperm motility, and sperms concentrations, which were affected by the change of reproductive hormones, averaged 4.8 ml, 55% and 8.6×10^6 sperm/ml, respectively. In addition, the male exhibit full rut signs.

Female camels exhibited pronounced reproductive activity (estrus signs) during winter months. However, changes in the concentrations of FSH, LH, and estradiol increased at the beginning of September and remained high until the end of April. The concentrations of FSH, LH, and estradiol in September were significantly elevated ($P < 0.01$), they averaged 22.12 ± 4.23 ng/ml, 7.75 ± 2.30 ng/ml and 130.63 ± 21.87 pg/ml, respectively. There was no evidence of variation among months in the concentration of thyroxin. The concentration of progesterone was low during the breeding season and decreased during the non-breeding season even though Female camels were not mated nor inseminated.

Key words: Dromedary, reproduction, semen, hormones, Al-Qassim Region, Saudi Arabia.

Abstract # 179

Peripheral levels of estradiol-17 β and progesterone in Chaambi dromedary camel during the beginning of the sexual season

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In Algeria, reproduction was found to be one of the major constraints to the development of camel rearing. In fact, camel is a seasonal breeder occurring from December to April. In order

to characterise the endocrinology bases of the sexual activity of this species, 5 adult (BW = 250- 400 kg; Age = 6-10 years, post partum period = 10-11 months), non pregnant and healthy Chaambi dromedary camels (*Camelus dromedarius*) were used to study the peripheral levels of progesterone and estradiol-17 β . Study started at the end of October 2006 and finished in the beginning of January, 2007. Dams were reared in pen and daily received 25 kg oat hay, 2 kg barley, 1 kg waste dates and 2.5 kg of *Stipagrostis pungens*. Water was available *ad libitum*. One mature sire was introduced in pen during the last month to mating dams. Blood samples were taken (3 times a week before introduction of sire and daily during the last month) in 10 ml Venoject tubes without anticoagulant and centrifuged (3000 tr/min, 15 min) and serum was stored at -20°C until analysis.

Progesterone and estradiol-17 β concentrations were determined by radioimmunoassay method (DIASORIN Kits) and calculations were made on RIA SMART software.

The estradiol-17 β secretion profile reveals a weak concentration during the study period and concentration had never reached the values reported in the literature.

After the introduction of sire, three camels had permanently low concentrations of estradiol-17 β (<0.5 pg/ml) and progesterone (<1 ng/ml). The other two females, which were heavier, showed signs of ovarian activity and ovulation with progesterone levels over than 2 ng/ml.

Although the concentration of estradiol-17 β remains weak, dams in good body condition score could be mated and ovulate in the beginning of the sexual season. The result of this research needs to be confirmed using more dams.

Key words: Chaambi dromedary, estradiol-17 β , progesterone.

Abstract # 180

Ovarian steroid levels in female dromedary camel (*Camelus dromedarius*) after male parades during the non breeding season

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The reproductive season of the dromedary camel in Tunisia is relatively short, lasting from late November to mid March. Calving camels often are not mated until the subsequent breeding season, giving an intercalving period of two years or longer. In the last decades many different researches are carried out because of the greater economic importance of camels than other domestic animals in desert areas, but little is known about their reproductive endocrinology in spring-summer period. The aim of this study was to evaluate, out of the breeding season, the effects of male parades on ovarian steroid levels and on sexual behaviour in female dromedary camels. Six adult pluriparous, non pregnant, healthy females (4 with suckling calf) were selected in 2007 from the herd of the Livestock & Wildlife Laboratory (Medenine, Tunisia) and included in a protocol, developed from May 14th to June 20th. Male parades (once a day) started from June 1st and lasted until the end of the study. Blood sampling were taken from the jugular vein, 11, 8, 4 and 0 day before the beginning of the male parades and 3, 7, 10, 14, 17 days after. Behaviour observations in both sex, were recorded. Plasma progesterone (P₄) and 17- β Estradiol (E₂) concentrations were measured with

Progesterone E.I.A. kit (Radim S.P.A., Italy) and 17- β Estradiol E.I.A. kit (DiaMetra S.R.L., Italy). Sexual behaviour was not very evident in male as well as in females. They showed only an interest to the male rather than a real “oestrus behaviour”. As resulted from hormonal analysis, in three lactating females, one, probably, spontaneously ovulated and the other two showed high P₄ (>6 ng/ml) and E₂ levels (>26 ng/ml) before the male parade. In the other camels (two non lactating and one lactating), male parade induced few improvement of 17- β Estradiol but levels were lower than those reported in oestrus females during the reproductive season by Skidmore et al. (1996). These results indicate that low male libido, probably, was not enough to stimulate female to produce adequate oestrogen levels. Better results could be achieved in further experiments using the “male effect” to induce oestrus in female camel out of the breeding season, by increasing male libido with GnRH and/or carrying out male parades twice a day.

Keys words: Camel, male parade, non breeding season.

Abstract # 181

**The dilemma of the left horn predominance in the camelid pregnancy:
uterine contractility**

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Full exploitation of the camel's production of milk and meat will only be possible when the reproductive performance is improved. However, the reproductive physiology in camelidae is still not well understood and further research needs to be conducted in several areas. It is well documented that certain reproductive characteristics are markedly different between camelin and other domestic animals. One striking difference is the predominance of the left horn in camelin pregnancy. Although multiple ovulations is common in camelin, up to 50% of embryos do not develop to fetuses. This could be ascribed to environmental changes in the uterus. Any attempts to elucidate these changes could help in the improvement of camel fertility. Uterine activity is essential for semen transport for the non-pregnancy state and for carrying the conceptus during pregnancy. The objectives of this study were to report the previous studies which have been performed on camel uterine contractility. The only report in the literature dealing with measuring uterine contractility in the camel is for Al-EknaH et al. (1993), who recorded the intra-uterine pressure changes of the left and right uterine horns in three parous, non-pregnant camels. Balloon-tipped catheters have been implanted in both horns of camels under general analgesia. The pressure changes were recorded using a pressure transducer connected to a three channel recorder. Recording was performed with the animal in sternal recumbency. The frequency of contractions was quantified on an hourly basis and the amplitude was calculated in kilo Pascals. The recorded frequency of contractions in both horns varied from zero to a maximum of 90h⁻¹, whereas the amplitude of contractions varied from zero to a maximum of 3.5 kPa throughout the experimental period. They have postulated that the frequency of contractions in the right uterine horn always followed that of the left horn, but at a lower level.

Key words: Left horn predominance, camelid pregnancy, uterine contractility.

Abstract # 182

Monitoring the testosterone and Luteinizing hormone with relative to puberty in growing male Shami camels (*Camelus dromedarius*)

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This study was conducted at Shami Camel Research Station in Dier Al-Hajar, Animal Wealth Research Administration (AWRA), General Commission for Scientific Agricultural Research (GCSAR).

Twenty five growing and mature Shami camel males divided equally into 5 groups (G1, G2, G3, G4 and G5) according to their age (1 to 5 years) were used to measure hormonal concentration of testosterone and Luteinizing hormone (LH) and to determine the puberty age and seasonal variations. Blood samples were collected weekly, at early morning and before feeding from the jugular vein for one year in EDTA-containing tubes. Samples were centrifuged at 3500 rpm for 15 min. Plasma was separated and transferred to 2- Eppendorf vials (1.5 ml). Each vial was coded, stored at -20 C° and specified for Ts or LH analysis using Biochem Personal Lab for Enzyme Linked Immune Sorbent Assay (ELISA), available at AWRA.

Analysis of variance indicated highly significant effects ($P < 0.01$) for the age, season and their interaction on hormonal concentrations. Testosterone and LH were detected in the blood of growing male Shami camels during their first year of age with a progressive increase occurred in the older animals, especially in the rutting season. Concentration of testosterone averaged 1.41 ± 0.24 , 3.48 ± 0.13 , 4.51 ± 0.28 , 5.83 ± 0.34 , 6.75 ± 0.29 ng/ml in G1, G2, G3, G4 and, G5, respectively. LH concentration was 0.65 ± 0.04 , 0.90 ± 0.06 , 1.06 ± 0.07 , 1.30 ± 0.08 , 1.45 ± 0.06 ng/ml, in G1, G2, G3, G4 and, G5, respectively. Many peaks of secretion of these two hormones with a largest shift, 245% for testosterone and 138% for LH occurred at the beginning of second year of age of G2.

It was concluded that growing male Shami camels reach puberty age at 2.5 years old based on the relative changes of hormonal concentrations and the rutting season. The winter has a significant positive effect.

Key words: Male Shami camel, puberty, testosterone, LH, rutting season.

Abstract # 183

Morphology of the testes of one humped camel (*Camelus dromedarius*) in relation to the testosterone profile and epididymal sperm content

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The current study was carried out on the testes of 101 mature one-humped camels collected from the main Giza abattoirs over a period of one year. The testicular weight was minimal during summer, while the maximal weight was reached during the coldest months from November till March. Average testosterone concentration started increasing during October and November. It continued to increase during December, January and February. During March, the mean levels of testosterone started declining and the rest of the year. A correlation was established between testicular weight, concentrations of testosterone and epididymal sperm contents and consequently the testicular functions on the one hand and the season of the year on the other hand.

In conclusion, this investigation confirmed that the camel starts its reproductive activity in September and October then it is rutting during November, December, January and February with a drop in March and following months.

Key words: One humped camel, testes morphology.

Abstract # 184

Effect of GnRH test on scrotal surface temperature in Alpaca

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Three trials were conducted to evaluate the variations of scrotal temperature in alpaca treated with gonadotropin releasing hormone (GnRH). Five adult males (4 Huacaya, 1 Suri) were tested to evaluate the testicular functionality through the GnRH test (basal blood testosterone level- GNRH administration- stimulated blood testosterone level 1 hour after). An infrared camera was used to perform thirteen thermographic scans during the test time for each male (1 every 5 min). In Trial 1 (T1), males were completely isolated from females 2 months before; in Trial 2 (T2), males were exposed to females without mounts (3 weeks; two times each week for 15 min); in Trial 3 (T3), males were exposed to females with mounts (3 weeks; two times each week). Scrotal temperature decreases depending on the trial (T1: -2°C; T2: -0.65°C and T3: -0.95 °C) (P<0.05). Blood testosterone levels variations (DT) increase with the female effect (P<0.05) (T1: 93.8 ng/dL of DT; T2: 120.86 ng/dL of DT; T3: 241.46 ng/dL of DT). Individual scrotal surface temperature patterns were observed during the three trials and could be used as monitoring factor for breeding soundness examination.

Key words: Scrotal temperature, GNRH test, testosterone, alpaca.

Abstract # 185

Assessing the effects of preservation on Camelid sperm: the full picture

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Many decades have been devoted to the preservation of semen from domestic animals, and in recent times it has become apparent that cryopreservation affects sperm structure and functional integrity, specifically motility, membrane status, respiratory activity and DNA quality. Increasing our understanding of the effects of preservation on sperm function and integrity by thorough assessment of sperm parameters such as motility, acrosomal and plasma membrane integrity, viability and morphology are paramount if the correct picture of these effects is to be elucidated. Moreover, elucidation of these effects, will lead to the development of methods which minimise the deleterious effects of preservation, thereby increasing the efficiency of semen preservation in camelids.

Generally, procedures for the thorough assessment of sperm are thought to require high levels of technology, training and equipment. Therefore, many studies have not employed more than one or two types of sperm assessment pre or post-preservation and may have gained an incomplete picture of the effects of preservation on sperm. However, a battery of readily available low-tech methods to assess sperm can alleviate this and provide the full picture of the effects of preservation on sperm.

This paper will review the various types of semen and sperm assessments which do not require high levels of technology or training and are easy and cheap to implement in the daily running of the laboratory. Moreover, they provide highly valuable information in designing the appropriate methods for semen preservation in camelids. Furthermore, these low tech/cost methods require only basic laboratory equipment such as a phase contrast microscope and waterbath, and readily available chemicals or stains. They include methods such as the subjective assessment of motility (total motility, forward progressive and oscillatory motility), viability assessment by dye exclusion, the hypoosmotic swelling test (HOS), and assessment of sperm morphology. By implementing this 'battery' of tests, researchers working to develop reliable semen preservation and AI methods in camelids will generate highly accurate and valuable data, and can make more informed decisions regarding methods to preserve camelid semen, which will in turn speed up the process of commercialising semen preservation and AI in camelids.

Key words: Sperm, evaluation, Camelid.

Abstract # 186

Biophysical and biochemical characteristics of Maghrebi dromedary semen

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Seminal characteristics were investigated in Maghrebi dromedary (*Camelus dromedarius*) during the sexual season in Southern Tunisia from December 2002 to March 2003. Ejaculates were collected once a week using a modified bovine artificial vagina from three mature camel bulls. Sires (BW: 520-600 kg; Age: 8-9 years) were housed individually and offered daily 2 kg of concentrate and 4 kg of oat hay. The biophysical and biochemical parameters including time for ejaculation, volume, pH, color, spermatozoa concentration, mobility and abnormalities in spermatozoa were determined.

In total 25 complete ejaculates were collected. The mean time for semen collection was 8.7 ± 3.0 min. The volume of semen averaged 5.8 ± 2.9 ml with a range varying from 1.5 to 13.5 mL. The majority of semen samples were milky in color and consistency. The pH of semen was slightly alkaline (7.6 ± 0.6).

Microscopic examinations of semen revealed that spermatozoa are densely clustered and entrapped. Initially, they are not free to move. Sometimes later, they can oscillate progressively. The mean concentration of spermatozoa was 679×10^6 cells/mL, varying from 300×10^6 to 1250×10^6 cells/mL. The percentage of spermatozoa with abnormalities was 24% (15.2% to 35%). Spermatozoa in life averaged 70.0 ± 8.6 % and mobility was 56.3 ± 11.7 %.

Key words: Maghrebi, dromedary, semen, cells.

Abstract # 187

Semen characteristics in the Alpaca

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Camelid semen has low concentration and motility of spermatozoa, and is highly viscous, limiting its processing for artificial reproductive technologies. It is not known if the characteristics of camelid semen are affected by season, plasma testosterone levels or nutritional status. Furthermore, the relationships between semen parameters such as viscosity and motility of spermatozoa have not been fully documented. An understanding of the semen characteristics of alpacas and the relationships among them will enhance the development of reproductive technologies in camelids.

Ejaculates (n = 265) were collected from 11 alpacas approximately once weekly from March to October 2008. The times taken to mount and mate the mannequin were recorded. Semen was assessed for volume, colour, viscosity, pH, and concentration and motility of

spermatozoa. Body condition score and the weight of each animal were assessed at the time of collection and blood samples were collected for plasma testosterone analysis. Mean mating time was 26 ± 0.88 min and declined from March to October ($P < 0.001$). The average time to mount the mannequin was 44 ± 3.6 seconds and also declined from March to October ($P < 0.001$). Mean semen volume was 1.7 ± 0.11 ml and increased as mating time increased ($P < 0.001$). Semen viscosity increased as pH increased ($P < 0.001$). Motility was negatively correlated with semen viscosity ($P < 0.01$) and pH ($P < 0.001$). Plasma testosterone concentration, weight and body condition score did not affect mating parameters or semen characteristics and there was no change in testosterone concentrations from March to October. Semen volume, mating time and time to mount the mannequin were similar to those described previously. The decline in mating time from March to October is unlikely to be caused by decreased libido, as time to mount the mannequin also decreased during this time suggesting an increased interest in the mannequin. It is possible that mating time and libido are under seasonal control, but are not affected by testosterone concentrations which did not differ from March to October. The relationship between semen pH and viscosity has not been previously documented and suggests that a basic protein may be responsible for seminal plasma viscosity in alpacas. The decline in sperm motility with increased semen viscosity suggests that the development of methods to reduce viscosity may advance the application of reproductive technologies in camelids.

Key words: Alpaca, semen, testosterone.

Oral Communications

Communications orales

Surgery & Anatomy

Abstract # 188

Udder morphometry and milk yield of Lahween Camel (*Camelus dromedarius*)

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Data were obtained on 16 camels (Arabi-lahwee) of different age and parity order, maintained at Al-Khalifa Agric. rain feed scheme in El-Showak (Eastern Sudan). The purpose of this study was to determine the udder morphometry of Lahween camel and to find out their correlation with daily milk yield. The result of this study showed that milk yield was 2.7 ± 1.4 liters/day. Udder depth, circumference, vertical semi circumference and size scored 16.9 ± 2.5 cm; 91.4 ± 10.0 cm; 52.0 ± 5.6 cm. and 1559.5 ± 388.3 cm³, respectively and they were positively correlated with daily milk yield. While udder height in fore and rear quarters and udder levelness were 110.9 ± 7.1 cm; 109.9 ± 7.6 cm and 1.6 ± 1.6 cm., respectively, and they were negatively correlated with daily milk yield. Length of fore and rear teats and distance between right teats and that between left teats were 4.3 ± 1.4 cm; 4.4 ± 1.5 cm; 3.1 ± 1.8 cm and 3.0 ± 1.5 cm, respectively and they were positive and significantly correlated with daily milk yield ($P < 0.05$; $r = 0.340, 0.355, 0.649$ and 0.341 , respectively). Milk vein length and diameter were 88.0 ± 7.7 cm and 1.8 ± 0.5 cm., respectively, and positively correlated with daily milk yield ($P > 0.05$). Morphologic change in the measurements of udder depth, udder height, teat diameter and distances between teats before and after milking were statistically significant ($P < 0.01$) and may indicate to greater milk secretion potential of Lahween camel.

Key words: Lahween camel, udder teat, milk vein, morphometry, milk yield.

Abstract # 189

Histomorphometric variation of thyroid gland of the dromedary (*Camelus dromedarius*) according to age, sex and season in Tunisia

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This histomorphometric study was carried out on 120 camels (60 males and 60 females). Thyroid glands were recovered during summer and winter seasons. For each sex, the animals were classified in three age groups; less than three, 3 to 5 and superior or equal to 15 years. The results show that the activity of thyroid gland of the dromedary (*Camelus dromedarius*) is variable according to age, sex and season.

In relation to age, the thyroid activity was higher ($P < 0.05$) in the second age group compared with the first and the third age groups. In this respect, the smallest follicular surface was observed for animals in the second age group (4912.5 ± 467 μm^2) while the highest follicular surface was observed in animals of the third age group (6873.7 ± 669.6 μm^2). Animals of the first age group had an intermediate follicular surface of 5650.2 ± 385.5 μm^2 ($P < 0.05$). Conversely, the highest epithelial cells were observed in animals of the second age group

($11.5 \pm 1 \mu\text{m}$) while the lowest figure was recorded for animals of the third age group ($8.5 \pm 0.7 \mu\text{m}$). Height of the thyreocytes in the animals of the first age group was of $10 \pm 1.1 \mu\text{m}$ ($P < 0.05$).

Average follicular surface was greater ($P < 0.05$) for females in comparison to males being 6048 ± 985.5 and $5576.3 \pm 879.5 \mu\text{m}^2$, respectively. The epithelial cells are higher ($P < 0.05$) in males ($10.5 \pm 1.6 \mu\text{m}$) than in females ($9.5 \pm 1.4 \mu\text{m}$). Finally, average follicular surface is greater ($P < 0.05$) in summer ($6117.3 \pm 881.8 \mu\text{m}^2$) than in winter ($5506.9 \pm 943.4 \mu\text{m}^2$) and the thyreocytes are higher ($P < 0.05$) in winter ($10.7 \pm 1.5 \mu\text{m}$) than in summer ($9.3 \pm 1.3 \mu\text{m}$) irrespective of sex and age. These data are indicative that thyroid activity in this species is higher in winter than in summer.

Key words: Camel, thyroid, histomorphometry, Tunisia.

Abstract # 190

Anatomopathologic study of the goitre in the dromedary (*Camelus dromedarius*) in Southern Tunisia

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The goitre is a well-studied disease in man. However, in veterinary medicine, work related to this pathology remains very limited particularly in the dromedary. The objective of this study is therefore to carry out an anatomopathologic study of the goitre in the dromedary using 25 cases (21 females and 4 males) observed in the south of Tunisia.

At the macroscopic level, this pathology is characterized by the increase in volume of thyroid glands with the presence of cysts of variable size between 3 mm and 2.9 cm diameter. After incision, there is a flow of a yellowish thick liquid. The weight of the thyroid right lobe is $38.99 \text{ g} \pm 2.44 \text{ g}$ while the weight of the left lobe is $33.76 \pm 2.71 \text{ g}$. Total weight of the thyroid gland is $72.60 \pm 4.99 \text{ g}$.

The histological study revealed the presence of thyroid follicles, round, ovoid, tubular or irregular with variable size. Some follicles are excessively slack whereas others remain small and hyperplastic. The follicles of big sizes are filled with a homogeneous copious colloid coloured in pink and sometimes calcified. The epithelium of the follicles of small sizes is cubic or cylindrical, and is flattened in the follicles which are distended by the colloid substance. Sometimes, an epithelial proliferation was noticed in the form of cords or of papillae. The estimation of the percentage of the interstitial tissue by "LEICA QWin" Colour shows that the thyroid gland is fibrosis.

The immunohistochemic study shows that the cells are marked by antibodies anti thyroglobuline and presence of a colloid substance between the thyroid follicles.

Key words: Goitre, thyroid, dromedary, Tunisia.

Abstract # 191

Gross anatomy and histology of the hypophysis of camel (*Camelus dromedarius*)

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Gross anatomy and classical histology were used to study the pituitary gland in the camel. Hypophysis specimens from ten formaldehyde fixed brains of animals after slaughtering. Hematoxylin & Eosin and Masson's Trichrome stains were used on 6 µm paraffin-embedded sections.

The camel hypophysis has a globular shape, flattened slightly and linked to the floor of the third ventricle by a short and tilted pituitary stem. The gland is located in a deep pituitary fossa of *Sella turcica*, showing two or three holes of *Canalis craniopharyngeus*.

The gland is composed of:

- The adenohypophysis, including the *pars distalis*, the *pars intermedia* and the *pars tuberalis*.
- The neurohypophysis (*Pars nervosa*) that consists of the median eminence, the infundibular stalk and the neural lobe. It presents a large protrusion of the third ventricle.

The adenohypophysis of the camel presents some peculiarities; especially the presence of a large epithelial leaflet which surrounding the whole gland and seems to continue with the *pars tuberalis*. The *pars intermedia* separate the *pars nervosa* from the adenohypophysis and are attached also to the epithelial leaflet.

Two main cellular types are present in the *pars distalis*: chromophil and chromophobe. The first ones are two type, acidophil or basophile.

The epithelial leaflet and the *pars intermedia* show many follicles of colloid contents, small acidophil and basophile cells and many chromophobe cells are also present. The *pars tuberalis* presents chromophobe cells with rounded shapes.

In the neural lobe, a specific division in many lobules of different sizes constitutes a peculiarity of the camel. These lobules are surrounded by a conjunctive tissue which is supporting by many fibers. The *pars nervosa* show a high capillary density, pituicytes, axons of hypothalamic nuclei neurons. Terminal endings of these axons show Herring's bodies containing probably neurohypophyseal hormones synthesized at the level of the hypothalamus.

Key words: *Camelus dromedarius*, hypothalamus, hypophysis, anatomy, histology, cytology.

Abstract # 192

**Histological studies of testicular structure with relative to puberty in Shami Camel
(*Camelus dromedarius*)**

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Twenty five growing Shami camels raised at Shami Camel Research Station in Dier Al-Hajar, Animal Wealth Research Administration (AWRA) were divided equally into 5 groups, G1, G2, G3, G4, G5, according to their age (1-5 years) and used to measure the development of diameter of seminiferous tubules (ST) and determine the precise time of onset the spermatogenesis as predictable indicators of reaching puberty.

Testicular Biopsies of both sides were alternatively taken with a needle (4mm in diameter) from all camel groups at regular monthly interval over a period of one year. 5 mm of testicular tissue were taken from middle portion, fixed in Bouin's solution, processed for paraffin embedding and sections of 3 to 5 μm thick cut and stained with haematoxylin and G. Orange. Cross sections of seminiferous tubules with nearly uniform diameters were measured in each individual camel using an Olympus Vanox microscope fitted with a microscope eyepiece at x 10 magnification. The development of different type of germinal cells were observed in well defined tubules of each testis in each camel.

Results indicated that there was no significant difference between the average diameters of seminiferous tubules and spermatogenesis activities in the right and left testes within the age group but diameter increased significantly ($P < 0.05$) with the advancement of age within the age group and showed highly significant variations ($P < 0.01$) in the different age groups (1 to 5 years). The general average diameters of seminiferous tubules were 35 ± 1 , 39.5 ± 1 , 45 ± 1 , 72 ± 1.3 and $97.5 \pm 1.3 \mu\text{m}$ in G1, G2, G3, G4 and G5, respectively with least diameter during the summer and gradually increased throughout the autumn and winter to reach the largest size in the spring regardless the age group.

The different types of germinal cells and components and appearance of the interstitial tissue showed a wide variation among age groups with least activities in G2 and G1 especially in the summer months. Analysis of variance showed that there were highly significant changes in the number of spermatozoa and being greatest in G5, G4 and G3 especially in Winter. The number of spermatids and moderate sperm content appeared in the lumen of seminiferous tubules in G2 when they reach 2.5 years old. A clear appearance of Sertoli cells and an increase in the layers of germinal cells were observed in G1 when they became 1.5 -2 years old.

It was concluded that Shami camels reach their puberty age, based on the diameter of seminiferous tubules and spermatogenic activity when they are 2.5 years old and the histological changes are affected by the age and season.

Keywords: Histology, testis, seminiferous tubules, Spermatogenesis, Shami camel.

Testicular cytology of alpaca: comparison between impressed and smeared slides

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Testicular biopsy can provide information on testicular function more accurately than any other method. Among various testicular biopsy techniques, testicular fine needle aspiration cytology (TFNAC) has proven to be a less painful, simple and minimally invasive procedure. It allows evaluation of cytological parameters of seminiferous epithelium/tubules. There were no negative effects on sperm quality after testicular fine needle aspiration. The possibility to standardize this method might provide a greater impulse to the clinical diagnostics of male infertility. Therefore, the aim of this study was to evaluate the percentage variability of different testicular cells depending on the slide types, obtained by smear of fine needle aspirated testicular materials or by impression of piece of testicular parenchyma. Six adult alpaca males were used and samples of all testicles were performed immediately after slaughter. A fine butterfly needle (21G) connected to a 20 ml syringe was inserted into a testicle and multiple plane aspirations were carried out to obtain the materials destined to the smear. The impression slides were taken into consideration as a simulating procedure of testicular biopsy and prepared with three different imprints on slides. Slides were air-dried, stained with May-Grunwald Giemsa and then examined under light microscope with x100, x400 and finally x1000 magnifications. A total of 98 slides were obtained limiting the impression type to a maximum of three slides for each testicle. At least 200 consecutive spermatogenic cells and sertoli cells between germ cells were counted on each slide. Spermatogenic cells were subdivided into spermatogonia, primary spermatocytes, secondary spermatocytes, ab spermatids, cd spermatids and spermatozoa. The spermatozoa percentage was expressed as Spermatic Index (SI, the number of spermatozoa/ the number of total spermatogenic cells) and the number of sertoli cells, counted apart, was expressed as Sertoli Cell Index (SCI, the number of Sertoli cell/ the number of total spermatogenic cells). There was not any significant difference between the cytological parameters obtained from the two types of slides. Testicular fine needle aspiration can be used as an effective technique to identify different spermatogenic cell classes in alpaca.

Key words: Testicular fine needle aspiration, cytology, alpaca.

Abstract # 194

Glycohistochemical characterization of cell types in the allantoic duct epithelium of the dromedary umbilical cord

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The umbilical cord is the lifeline between the foetus and placenta. In Camelidae umbilical cord had four blood vessels and an allantoic duct, which represents the primitive excretory duct. The glycoproteins are involved in many biological activities including cell proliferation and cell differentiation. The aim of the present study was to examine and characterize glycoproteins in the epithelium lining the allantoic duct by means of the conventional and lectin histochemistry. Fragments of the umbilical cord from one fetus having 13 cm CLR (age: 3 months) were fixed in 4% (w/v) neutral formalin and embedded in paraffin wax. Sections (5 µm thick) were stained with PAS, Alcian Blue (AB) pH 2.5 and with 13 lectins (SNA, MAL II, PNA, DBA, RCA₁₂₀, SBA, HPA, Con A, WGA, GSA I-B₄, GSA II, UEA I, LTA). Before staining with MAL II, SNA, PNA, DBA, and WGA some sections were incubated with KOH-sialidase to cleavage sialic acids residues. Histologically, the duct was lined by a transitional type epithelium which was constituted of 1) basal cells, 2) pear-shaped cells, extending in the entire epithelium height, 3) intermediate polyhedral-shaped (vacuolized) cells, placed between the basal and surface zones of epithelium, and 4) surface flattened cells. Conventional histochemistry showed that the cytoplasm of the pear-shaped cells contained both neutral and acidic glycoconjugates, whereas the other cells were unstained with PAS or AB. Lectin histochemistry revealed no binding sites in both basal cells and intermediate (vacuolized) cells, whereas pear-shaped cells reacted with all the used lectins, and the flattened cells did not react with MAL II and SNA. After KOH-sialidase treatment the lectin PNA revealed cryptic binding sites in the pear-shaped and in the flattened cells. The results suggest that the pear-shaped cells and the flattened cells contain both N- and O-linked glycans sialo- and/or asialoligosaccharides, the latter terminating with α/βgalactose, α/βN-acetylgalactosamine, D-glucosamine, and αL-fucose. Since the flattened cells did not express sialoglycoconjugates terminating with Neu5acα2,3Galβ1,4GlcNac, Neu5Acα2,6Gal/GalNAc, it is possible to infer that the pear-shaped and the flattened cells represent a different maturational phase of a same cell type, whereas the vacuolized un-reactive cells constitute another cell type. Additionally, since lectin binding cells can release a part of their cytoplasm in the lumen, which contains an unreactive fluid, it may be supposed that the intraluminal environment of the allantoic duct of dromedary umbilical cord contains active glycosidases.

Keys words: Camel, glycoproteins, umbilical cord.

Abstract # 195

Clinical evaluation of Medetomidine Hydrochloride as sedative and its reversal with Atipamizole in camels

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Studies were done on six camels suffering from different surgical ailments. Medetomidine hydrochloride (6.0 µg/kg) was administered intravenously and the camels were operated for minor surgical disorders under local anaesthesia. The animals showed the signs of sedation with analgesia. The surgical intervention was carried out without any struggling and discomfort on the part of animals as well as the surgical team members. Immediately after completion of the procedures, atipamezole (30.0 µg/kg) was administered intravenously. All the animals showed the signs of uneventful recovery and the camels were on their feet and ready for ambulation.

Key words: Medetomidine, atipamizole, camel.

Abstract # 196

Comparative evaluation of yohimbine and atipamezole for reversal of medetomidine in camels

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Forty atropinized adults camels used in this study were divided into 2 groups (A & B) having equal number of animals. Intramuscular administration of medetomidine @ 20 µg/kg body weight, induced sedation in 10.50 ± 0.50 minutes. Anaesthesia lasted for 49.20 ± 4.20 and complete recovery occurred in 135 ± 8.20 minutes in the animals of group A. A significant tachycardia followed by bradycardia, respiratory depression and hypothermia were seen after administration of atropine and medetomidine. Hemoglobin, packed cell volume, total erythrocyte count and total leucocyte count showed non significant changes and the plasma serum glucose significantly increased upto 2.0 hrs which could returned to near preadministration level by 24 hours. Total serum protein, urea nitrogen, creatinine, sodium and potassium remained unaltered. The animals of group B were further divided into two sub groups viz., B₁ and B₂. The animals of sub group B₁ and B₂ were subjected to intravenous administration of atipamezole @ 20 µg/kg and yohimbine @ 0.150 mg/kg body weight after 20 minutes of administration of medetomidine. Atipamezole effectively reversed the sedative and anaesthetic effect in all the animals of subgroup B₁ with mean arousal time 0.70 ± 0.20 minutes and mean walking time 1.14 ± 0.40 minutes. While in the animals of subgroup B₂ yohimbine reversed the effect of medetomidine with mean arousal and walking time 1.10 ± 0.05 and 2.15 ± 0.15 minutes, respectively except in two animals who have the complete

failure of the yohimbine in the reversal of medetomidine. Mean arousal time, standing time and walking time was longer in the yohimbine administered group as compared to atipamezole group.

$\alpha_2 - 2$ adrenergic agonist medetomidine can be used safely in camels and can be reversed by yohimbine or atipamezole however atipamezole is more effective as compared to yohimbine as the yohimbine could not reverse the effect of medetomidine in two cases.

Key words: Yohimbine, atipamezole, medetomidine, camels.

Posters

Communications affichées

Surgery & Anatomy

Abstract # 197

Topographic anatomy, blood supply and nerve supply of the muscles of the eye ball in camel (*Camelus dromedarius*)

Jain RK

The dorsal oblique muscle of the eye ball in camel had the longest tendon (3.02 cm), while the ventral oblique muscle had the shortest tendon (1.20 cm) amongst all the extrinsic muscles of the eye ball. The line of insertion of dorsal rectus muscle was the widest (2.28 cm) while the ventral rectus muscle was the narrowest (1.70 cm) amongst all the recti muscles of the eye ball. The line of insertion of the lateral rectus muscle was nearest to the corneo-scleral junction (0.40 cm) and its tendon was the longest (2.58 cm) amongst all the recti muscles. The blood supply to the eye ball was carried by the ophthalmic artery which arose from the internal maxillary artery. It gave off the frontal artery, lacrimal artery and a branch to the dorsal oblique muscle and then formed the ophthalmic rete. The ophthalmic rete gave off branches to the rectus and retractor muscles of the eye ball. Unlike ox, the ciliary artery arose directly from the internal maxillary artery and supplied blood to the tunics of the eye ball. The sensory nerve supply to the muscles of eye ball was carried by the ophthalmic nerve which arose from the convex surface of the trigeminal ganglion. The ophthalmic nerve divided into nasociliary and zygomaticotemporalis branches. The nasociliary nerve gave off branches to the muscle obliquus dorsalis and then terminated by dividing into the ethmoidal and frontal nerves. The motor nerve supply to the muscles of the eye ball was carried by oculomotor, trochlear and abducent nerves. The oculomotor nerve supplied the muscles rectus dorsalis, rectus ventralis, obliquus ventralis and levator palpebrae superioris. The trochlear nerve supplied the muscles rectus dorsalis and obliquus dorsalis. The abducent nerve supplied the muscles rectus dorsalis, rectus lateralis and retractor oculi.

Key words: Muscles, blood, sensory nerve supply of the eye ball, camel.

Abstract # 198

Abdominal ultrasonography in the dromedary (*Camelus dromedarius*)

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The aim of this study is to establish a reference for abdominal ultrasonography in the dromedary, in order to have a diagnostic tool for investigating abdominal disorders.

Abdomen of three camels underwent a sonographic examination in the standing and sternal positions. For each organ, the ultrasonographic protocol, its localisation and its ultrasonographic appearance were studied and illustrated.

The results of this investigation showed that all abdominal organs of the dromedary can be explored by ultrasonography.

Finally, a comparative study between anatomic and ultrasonographic localisation of all abdominal organs and practical usefulness of abdominal ultrasonography in camel's medicine are discussed.

Key words: Altrasonography, Abdomen, dromedary.

Abstract # 199

The gross anatomy of the cerebral ventricles of the dromedary camel (*Camelus dromedarius*)

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The present work studies the conformation and topography of the cerebral ventricular system of the dromedary camel (*Camelus dromedarius*). Twelve isolated heads of dromedaries, aged 3-11 years were used for this study using the moulding method, the X-ray ventriculography as well as serial frozen cuts obtained following the basi-horizontal plan of Horsley-Clarke (H₀). The cerebro-ventricular system of dromedary camel shows large similarities with that of equines and ruminants regarding its disposition and topography but also some specific peculiarities such as the presence of the collateral eminence of Meckel, the great divergence of temporal horns of lateral ventricles and the expansion of third ventricular recessus.

Key words: Cerebral ventricles, nervous system, dromedary, third ventricle, lateral ventricle.

Abstract # 200

Histochemical investigation on the carotid and aortic bodies and the related arteries of the dromedary camel

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The aim of this study is to investigate alkaline and acid phosphatases in the carotid and aortic bodies and the adjacent parts of the common, internal and external carotid arteries to the carotid bodies. The material was collected from 10 camels after slaughtering. The alkaline phosphatase was demonstrated by the modified Gomori and azo- dye coupling methods. The acid phosphatase was demonstrated by using the lead nitrate and Bancroft and Stevens methods. The cytological demonstration of phosphatases depends upon the formation of insoluble coloured precipitate at sites of substrate hydrolysis. Acid and alkaline phosphatases were demonstrated between and around the nerve fibers and the two types of cells (type 1 and type 2 cells) of the carotid and aortic bodies. The intensity of the reaction was not uniformly

distributed. Acid and alkaline phosphatases were also demonstrated in the tunica intima and tunica adventitia of the common, external and internal carotid arteries, while the tunica media was negative. The significance of these results was discussed in the text. The authors did not find any information pertaining to the histochemistry of the sensory organs of arteries and the parts of arteries related to the carotid bodies in the camel.

Key words: Carotid, aorta, alkaline and acid phosphatases, dromedary camel.

Abstract # 201

Electrocardiogram in young male camel (*Camelus dromedarius*)

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Electrocardiography in young camel has not been well documented. Our study aims to investigate electrocardiogram parameters in dromedary and to evaluate the effect of some cardiac reflex.

The study is carried out on five males dromedaries, aged of 3 years and with an average body weight of 260 kg. Animals are living under a semi extensive mode and come from El Alam OTD farm at Kairouan. Camels were acclimatized during 3 weeks at National Veterinary School of Sidi Thabet and the electrocardiograms were recorded in sternal recumbency without sedation. Two technical types of derivations were used and compared: Standard derivation and Dubois derivation.

The results are as below:

- The heart rate is 47 ± 6.9 beats/min.
- Standard derivation techniques show little information's in comparison with Dubois derivation.
- The basic cardiac parameters in Dubois derivation (DII lead) are as follow (duration unit is second and amplitude unit is mV):
 - P wave: Duration: 0.074 ± 0.005 Amplitude: 0.098 ± 0.025
 - qRs: Duration : 0.0974 ± 0.005 Amplitude: 0.743 ± 0.436
 - T wave: Duration: 0.116 ± 0.025 Amplitude: 0.322 ± 0.121
 - PR, RT and RR intervals duration are: 0.212 ± 0.024 , 0.444 ± 0.023 and 0.700 ± 0.155 , respectively
- Wave's morphology (in Dubois derivation) is characterized by:
 - P wave is biphasic in 86%, monophasic in 10% and bifid in 4%.
 - T wave is monophasic in 78% and biphasic in 22%.
 - The qRs is rS type in 100%.
- Preliminary results of cardiac tests show that oculocardiac reflex have more impact in cardiac response than otocardiac reflex and this fact is accompanied by a significant decrease of heart rate and an increase of RR interval.

Keywords: Dromedary, electrocardiogram, young camels, Dubois derivation, Standard derivation, cardiac reflex.

The osteology of the head of the camel (*Camelus dromedarius*): Revisited

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The osteology of the skull was investigated in 20 heads of the dromedary camel. Structures passing through the foramens and the muscles insertions were also studied. Description was compared to the literature especially to the results of Smuts and Bezuidenhout (1987). Specific anatomical peculiarities, such findings are listed bellow; not mentioned in the literature have been found.

- Existence of a fronto-naso-maxillary foramen which is closed in live animal by a fibrous lamina.
- Existence of a nasal process of the maxillary bone, growing and moving with age to take position between the nasal and the incisor bones.
- Disappearance of the facial crest, the facial and the lacrimal tubercles.
- Presence of a large and deep fossa in the rostro-medial side of the foramen stylomastoid in which lies, the temporal styloid process. The raised edges of this fossa reduce the amplification of strong movements of the laryngo-pharynx block.
- Presence of a maxillary tuberosity showing variations with age which depends of the eruption of the 3rd molar.
- The petrous part formed by the *vagina processus styloidei* and the tympanic bulla is joined to the basilar process of the occipital bone, separating the foramens jugular and carotid from the lacerate foramen. The foramen jugular gives passage to the glossopharyngeal (IX) and the vagus (X) nerves while the spinal accessory nerve is absent (XI).
- In the literature, the identification of the foramens, carotid and lacerum are confusing. The foramen lacerum is filled by a fibro-cartilage that houses the vidian sulcus (*S. n. canalis pterygoidei*). It is crossed by a branch coming from the maxillary artery and vidian nerve. While the foramen carotid is dug in the petro-occipital fissure (*fissura petrooccipitalis*) and provides access to the internal carotid artery, which ensures the irrigation of the brain by contributing to the founding of the caudal cerebral rete mirabile.
- The foramen orbitotundum is crossed by the oculomotor (III), trochlear (IV), abductor (VI), ophthalmic and maxillary nerves.
- The foramen ovale is crossed by the mandibular nerve.
- The infratrochlear notch is crossed by the infratrochlear nerve, the infratrochlear and the malar arteries.
- The facial (VII) and vestibulocochlear (VIII) nerves are passing through the foramen stylomastoid.
- Presence in the pterygoplatine fossa of two additional foramens: the lateral sphenopalatine foramen opened on the nasal cavity and filled in live animals with a fibrous lamina and the second one is the accessory maxillary foramen.
- Presence in the ventral side to the mandibular foramen of a vasculo-nervous groove, crossed by the mylohyoid nerve, artery and vein.
- Caudally to the last molar tooth, opens a foramen witch is prolonged by a groove containing a small branch of the inferior alveolar nerve.
- Presence of two articular surfaces on the mandiblar condyle.
- Absence of cartilage ends on thyrohyoidian horns.

Key words: *Camelus dromedarius*, anatomy, osteology, skull, head, mandible, hyoid, foramen, muscles, nerves, arteries, veins.

Abstract # 203

Isolated, injected and MRI aspects of the dromedary's kidney

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While the critical loss of water is around 15% in mammals, the dromedary can tolerate up to 30% without irreparable damage. This is allowed by an ability to drink as much water as it is available when it is possible, and a capability to save water in the kidney and to concentrate urine. The camel's kidney plays a major role in the process of conserving water through increasing the urine osmolarity. There are few accounts on the anatomy of this viscus; we intend to deepen the subject, not only on a macroscopical point of view, but also using imaging technics. We have used one left male dromedary kidney [12 x 8.5 x 6 cm, 500 g] from El Khroub (Algeria). Kidney was put one day at 4°C and was fixed in formaldehyde solution (5.5%) during five days.

Four techniques were used:

- 1) Magnetic Resonance Imaging: MRI (T1 sag. TR 350, TE 12 and T2 sag. TR 2500, TE 89), slides 4 mm, with head antenna, 1 Tesla, Harmony Siemens,
- 2) Angiography (injection I₂ in the renal artery, 16 mAs, 46 kV, 19 ms), with Convix 30, Universix 120, Fuji FCR 5000,
- 3) Red latex injection of the renal artery,
- 4) Frontal section of the kidney.

As known, the dromedary kidney shows a very large medullar surface. The cortical zone is unified and gives a smooth external aspect. The cortico-medullar ratio is very low, according to a great surface of water reabsorption at the level of the medullary. The renal pyramids end by papilla(s) which join in a renal crest. Depending on the section level, we can observe the whole crest or not. The kidney of the dromedary is very different from the one of the pig and the cow, but, in regards to the shape, it seems to the horse, which presents a large medullary area and a similar renal crest. However, contrary to the horse, the angiography shows that all the renal arteries enter in the kidney by its hilum.

In conclusion, the macroscopic observations and imaging techniques are in concordance with the strong capacity of water re-absorption, and a faculty to eliminate very concentrated urine. In fact, the very important medullary area, where the Henle's loops are localised, explain the great adaptation to the life in arid and semi arid biotopes.

Key-words: Kidney, anatomy, MRI, angiography, dromedary.

Oral Communications

Communications orales

Genetics

Abstract # 204

Phenotypic characterization and description of Sudanese camels (*Camelus dromedarius*)

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Phenotypic measurements and descriptions data were obtained on 274 camels (different breeds). The purpose of this study is to characterize and re-grading some of Sudanese camel breeds according to their morphological traits. The results of this study showed that averages barrel girth, heart girth, height at shoulder and body weight were 2.45 ± 0.02 m; 2.02 ± 0.01 m; 1.90 ± 0.01 m and 463.25 ± 4.90 kg respectively. The results also revealed that phenotypic measurements were significantly influenced by breed of camel and age groups. The Shanbali camel recorded the highest values of barrel girth (26.4 ± 0.04 m), heart girth (2.08 ± 0.02 m) and body weight (516.69 ± 12.48 kg), followed by the Kenani camel; however, Rashaidi, Annafi and Bushari camel breeds recorded the lowest values. Regarding to the age groups the camels in second group (7-9 years) have significantly the highest values of phenotypic measurements, followed by the third group (10-12 years), while the animals in the first group (4-6 years) recorded significantly the lowest values. Moreover the results showed that the sex of camel was significantly affected the heart girth, height at shoulder and body weight; and the male have significantly higher values than female. The study concluded that the Shanbali and Kenani camel breeds are the largest Sudanese camel followed by Maalia and Maganeen camels.

Key words: Sudanese camels, phenotypic characterization.

Abstract # 205

Camel genetic resources in Tunisia

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The objective of this study was to describe phenotypically dromedary populations raised in Southern arid and semi arid regions of Tunisia. A survey was conducted in 2005-2006 and included 75 camel breeder's with more than 5900 heads of dromedaries in three Southern regions (Kebili, Medenine and Tataouine). The survey dealt with different aspects (coat color and hair structure, size of animal, ethnic classification of animals, management systems, type of bulls and their origin). Results allowed to identify and to describe the main coat colors encountered. With the percentages: 47%, 29%, 11%, 6%, 5% and 2% for the coat colors red, yellow, chegra, black, white and Hajla, respectively. For the breeders, the color of the coat

represents a key criterion used to differentiate among individuals. The important variation observed in the color of the coat and the hair structure within genotypes showed that the dromedary population is a mosaic from several genetic sources. This variability offers possibilities to establish sub-populations. The dominance of the red coat (47%) seems to constitute a criterion of dromedary adaptation to harsh environmental conditions. The uncontrolled crossbreeding is a common practise in the studied areas. Results of the survey showed that 85% of the bulls stem from their herds of birth leading to inbreeding risks. Tunisian camels were classified into five ecotypes according to their ethnic names and their geographical localization. A molecular study is necessary in order to find out genetic distances and better characterize these populations.

Key words: Camel resources, description, classification, Tunisia.

Abstract # 206

Genetic parameters of some productive characteristics on Shami camels in Syria

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This study was carried out at Der-Alhajar state farm belonging to Syrian Ministry of Agriculture. Records of body weight and milk production within 2002-2007 were used to study some non genetic factors (year of production, parity, milking time, sex of the born calf) affecting body weight at different ages and milk yield, also to estimate some genetic parameters in Shami Camels.

Total records, 1968 of milk and 218 of weight traits were analyzed using the fixed and animal models for the non genetic factors and the genetic parameters, respectively.

Parity was significantly effected ($P < 0.01$) on different milk traits. Moreover, year of production was significant ($P < 0.01$) on all milk traits except lactose (%). Time of milking and the interaction between parity and milking time had non significant influence on all studied milk traits. The interaction between years of production and milking time had non significant on all studied milk traits except test day milk. The study also shwed that, there is non significant influence of calf sex, year of production and the interaction between them, on all body weight traits, except production year and the sex of the calf on birth weight and weight of 1.5 year old, respectively.

Heritability estimates of test day milk, protein%, fat%, birth weight, six-month weight, and yearling weight were 0.79, 0.04, 0.05, 0.28, 0.61 and 0.00, respectively. While genetic correlation between different body weights were null, and between different milk traits ranged 0.07-0.19. Because of high estimate of heritability of test day milk ($h^2 = 0.79$) and six-month of calf weight ($h^2 = 0.61$), then, we can conclude that, these traits could be a good criterions for genetic improvement in Shami camels.

Key words: Shami camel, milk, weight, genetic, Syria.

Abstract # 207

Microsatellite analysis of Indian dromedary breeds

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Notwithstanding the pressure of mechanization, the ship of the desert is still thriving in sizable number in the north-western division of this country. Nevertheless, the important breeds of Indian dromedary require attention of conservation scientists and policy makers as the populations of different breeds of the species are declining at a very fast rate. Microsatellite markers are now considered as the markers of choice for molecular genotyping of different breeds of livestock species. In order to carry out the molecular characterization of the Indian dromedary breeds, 43 microsatellite primers were procured and successful amplification at 38 microsatellite loci was achieved. Allelic polymorphism was observed at 20 loci in the Indian dromedary breeds viz. Bikaneri, Jaisalmeri and Kachchhi. The observed & expected heterozygosity, polymorphic information content and the genetic distance among the breeds was calculated. The phylogenetic analysis was also carried out. The analysis revealed existence of close phylogenetic relationship among the Indian dromedary breeds.

Key words: Dromedary breeds, genetic characterization, Microsatellite, India.

Abstract # 208

Genetic characterization of Moroccan camel populations by using microsatellite markers

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The aim of this study was to perform an initial genetic characterization of Moroccan camel populations by using microsatellite markers. This study was carried out on a total of 140 camels belonging to five populations (Guerzni, Marmouri, Khouari, White, and Mountain). DNA from the five populations was analyzed by seven microsatellites (YWLL59, VOLP3, CVRL6, CVRL5, CVRL1, CVRL7, and YWLL44).

A total of 79 alleles were observed: 52 in Guerzni type, 47 in Khouari type, 53 in Marmouri type, 40 in Mountain type and 43 in White type. The average number of alleles was 7.4 in Guerzni type, 6.7 in Khouari type, 7.6 in Marmouri type, 5.7 in Mountain type and 6.1 in

White type. A new specific allele (210 bp) was observed at the locus CVRL6 in Mountain type.

Based on average heterozygosity values, variability was relatively lower and the same in White and Mountain types: 0.6406 and 0.6366 respectively, while it was higher in Guerzni, Khouari and Marmouri types: 0.7619, 0.7162 and 0.6751 respectively. By using Genetix, Population and Tree view softwares to estimate genetic distances, Fst, AFC and phylogenetic relation. A high similarity was found between White and Mountain populations and between Guerzni, Marmouri and Khouari populations.

Probabilities of exclusion obtained with the 7 markers were higher than 99.99% for the five populations and probabilities of identification of individual camels varied between $1/8.10^6$ and $1/55.10^6$.

The percentage of the affectation of each animal to his type was estimated by GENECLASS showing a good percentage of assignment (85 to 89 %) for the White type. This study shows the efficacy of microsatellite markers in identifying individuals, as well as detecting false filiations.

Key words: Genetic characterization, microsatellites, Moroccan camels.

Abstract # 209

Genetic and environmental factors affecting Camel heifer reproduction

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This investigation was carried out to assess the various factors affecting camel heifer reproduction expressed as: age at first service (AFS), age at successful service (ASS), age at first calving (AFC), services per conception (NS), conception rate (CR), service period (SP), gestation length (GL), and calving interval (CI). The data arranged were analyzed using a model included as fixed effects month and year of first service, season, color, and service sire, and sire as random effect. The overall means were: 1056 ± 20.4 , 1127 ± 23.4 , 1521 ± 24.9 , 2.5 ± 0.2 , 61.2 ± 4.2 , 65 ± 17.6 , 686 ± 28.5 and 392 ± 2.6 for AFS, ASS, AFC, NS, CR, SP, CI and GL respectively. The analysis of variance results indicated significant effects ($P < 0.05$) of month and year of service on AFS, ASS, AFC. Sire and service sire effects were significant on ASS, AFC, NS, CR, GL, and CI. Heritability estimated using 11 paternal half sibs groups were: 0.27 ± 0.13 , 0.73 ± 0.15 , 0.64 ± 0.15 , 0.43 ± 0.12 , 0.59 ± 0.14 , and 0.79 ± 0.15 for AFS, ASS, AFC, SP, CR, GL. The additive genetic variation associated with heifer reproductive traits was fairly high indicating possible improvement through selection. Then year and month of service sire and service sire ought to be considered in any programs to evaluate and improve reproductive efficiency of camel heifers.

Key words: Camel heifer, improvement, genetics.

Abstract # 210

Genetic diversity of Tunisian dromedary (*Camelus dromedarius*) as revealed by microsatellites

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Dromedary (*Camelus dromedarius*) is of significant socio-economic importance in many arid and semi-arid parts of the world, and its milk and meat constitute an important component of human diets in these regions. In Tunisia, dromedary camels are mostly found in the southern arid regions. While a considerable amount of data is available as regard genetic characterization of other livestock species using molecular markers, few studies have concerned camelid species. The genetic diversity and the relationships among the Tunisian dromedary camel populations are poorly documented and no data is currently available. In the present study, we evaluated genetic variability of Tunisian dromedary camel population in the south of the country by using a set of 4 microsatellites loci. Three dromedary sub-populations [*Ourdhaoui Médenine*, *Ourdhaoui Tataouine* and *Merzougui*] defined on the basis of morphologic and geographic criteria were included in the study. Genomic DNA was extracted from blood samples (N = 62) using standard protocols, and polymorphism was analysed by polymerase chain reaction and polyacrylamide gel electrophoresis with ethidium bromide detection. Data analysis was performed using Genepop v4, Genetix v4.05, Fstat v2.9, and Phylip softwares. A total of 26 alleles were observed in the three sub-populations with a mean number of alleles (MNA) of 6.5. Expected heterozygosity (H_{exp}) ranged from 0.751 to 0.814 whereas the observed heterozygosity was absolute ($H_{obs} = 1$) for all the three groups. The mean estimates of F statistics were $F_{IT} = -0,20$, $F_{ST} = 0,06$ and $F_{IS} = -0,27$. The matrix of genetic distances constructed with Nei & Li's coefficient showed a moderate structure between the different sub-populations groups forming the camel population. Little differentiation was observed between *Ourdhaoui Médenine* and *Merzougui* sub-populations, compared to *Ourdhaoui Tataouine* sub-population which seems to be more established. The results showed the limits of camel classification on the basis of only morphologic and regional distribution criteria.

Key words: Genetic diversity, camel, southern Tunisia, microsatellites.

Abstract # 211

The use of microsatellite markers for detection of genetic diversity in Tunisian dromedary (*Camelus dromedarius*) populations

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This study investigates the genetic diversity and relationships among Tunisian camel populations in three different geographical locations (Kebili, Medenine and Tataouine) from Southern arid and semi-arid regions. Eight selected microsatellite markers were used for a sample of 90 dromedary genotypes from grazing herds. A total of 34 alleles were detected in the three populations. The number of alleles per locus varied from two to seven with an average of 4.25 ± 1.9 alleles per locus. For each population the average of allele per locus is 3.33 ± 1.03 , 3.71 ± 1.49 and 3.87 ± 1.69 for Kebili, Medenine and Tataouine, respectively. The mean of the observed heterozygosity (H_o) were 0.43 ± 0.038 , 0.50 ± 0.041 , 0.57 ± 0.028 and 0.52 ± 0.028 for Kebili, Medenine and Tataouine and Total populations, respectively. These values were inferior than expected heterozygosity (H_e) values 0.50 ± 0.044 , 0.57 ± 0.031 , 0.62 ± 0.019 and 0.61 ± 0.019 , respectively. The average inbreeding coefficient was 15.3% in Kebili, 11.4% in Medenine and 8.3% in Tataouine. The mean estimates of F-statistics were $F_{IT}=0.15 \pm 0.020$, $F_{IS}=0.071 \pm 0.021$ and $F_{ST}=0.083 \pm 0.033$. These values were different ($P<0.05$) from zero and suggest a moderate differentiation. An inbreeding rate of 15% was found. Estimated genetic distances revealed by the loci varied from 0 to 0.9 between dromedary individuals. The estimated genetic distances pair-wise showed 0.104 among Medenine-Tataouine, 0.280 between Kebili- Medenine and 0.29 between Kebili-Tataouine. The distance matrix was able to distinguish between two separate genetic entities: Nefzawa (Kebili) including Merzougui, G'oudi and M'hari ecotypes and the Aaradh group (Medenine and Tataouine) which includes Maghribi and Khaouar ecotypes. Results of this study did not confirm the present classification established by dromedary herders. Which divides the population into five different ecotypes, apparently based on the sociogeographical criteria. These preliminary results showed that microsatellites are promising tools for breed characterisation. They indicated that investigated populations have high genetic variability and would be suitable as genetic stocks for conservation and sustainable utilisation programmes.

Key words: Dromedary, genetic diversity, differentiation, microsatellite loci, Tunisia.

Posters

Communications affichées

Genetics

Abstract # 212

Body measurements in Maghrebi camel types (*Camelus dromedarius*) in the Southern Tunisia

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The genetic diversity amongst the dromedary (*Camelus dromedarius*) populations is poorly documented. The objective of this study was to identify, the different types of Maghrebi camels in the Southern region of Tunisia by recording their phenotypic traits (body measurements). Five recognized dromedary types have been identified in this region (Ourdhaoui Medenine for the Tawazins tribe; Ourdhaoui Tataouine for the Oudarna tribe, Guiloufi for the tribe of Beni Guilouf in Kébili, Gueoudi for the Ouled Gharib tribe in Kébili and the Merzougui for the Marazigues tribe in Kébili). The identification of these types was achieved by recording nine body measurements, taken in a standing position on a level platform with the use of measuring tape, in 304 adult females (age ≥ 6 years): the body length (BL), the neck length (NL), the thoracic girth (TG), the abdominal circumference (AC), the height at the hump (HH), the height at the withers (HW), the width between shoulders (WS), the length of anterior limb (ALL) and the tail length (TL). The results revealed that phenotypic measurements were significantly influenced by type of camel. The body length (cm) of Gueoudi (147 ± 6) and of Guiloufi (145 ± 7) type was higher ($P < 0.05$) than in Ourdhaoui Medenine (138 ± 9) and Ourdhaoui Tataouine (136 ± 13) type. The Merzougui type occupied an intermediate position between the two groups. The measurement of thoracic circumference (cm) was more important ($P < 0.05$) in Ourdhaoui Medenine (201 ± 13), Gueoudi (200 ± 11), Guiloufi (200 ± 9), and Merzougui (199 ± 9) than those in Ourdhaoui Tataouine (198 ± 12) type. The Gueoudi, Merzougui and Guiloufi type exceeded ($P < 0.05$) the two Ourdhaoui types (Medenine and Tataouine) in the abdominal circumference. The measurement of the height at the hump (cm) was more important ($P < 0.05$) in Gueoudi (194 ± 4), Guiloufi (193 ± 7), Ourdhaoui Medenine (192 ± 8) and Merzougui (190 ± 9) type than Ourdhaoui Tataouine type (185 ± 12). The Gueoudi type exceeded ($P < 0.05$) all the others types in the height at the withers (182 ± 7 cm). The Merzougui, Guiloufi and Ourdhaoui Tataouine types had a medium values (from 170 ± 13 to 176 ± 9 cm). The Gueoudi, Guiloufi, Ourdhaoui Tataouine and Merzougui types exceeded ($P < 0.05$) the Ourdhaoui Medenine in the anterior limb length. The width at the shoulders was larger ($P < 0.05$) in Gueoudi the Ourdhaoui and Ourdhaoui Medenine type than Guiloufi and Merzougui type. Tataouine type takes a medium measurement for the width at the shoulders trait. The Ourdhaoui type exceeded ($P < 0.05$) Guiloufi, Merzougui and Gueoudi types in the tail length. However, the neck length did not differ ($P > 0.05$) between the five studied Maghrebi camel types.

Key words: Body measurements, Maghrebi camel types, southern Tunisia.

Abstract # 213

Who came first in Suleiman mountainous region? Bactrian or dromedary

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Suleiman Mountainous region comprises six northeastern districts of Balochistan, Pakistan. The region had very rich history. Avesta the holy book of Zoroaster written in 2570 and 25230 BP determines the Suleiman mountainous region and the Paktia province of Afghanistan collectively as Orawah. The region had been called as Arya Warsha (mean the place for grazing). The word is still in use as Pashto (Warsh) word for the grazing land. In Mohenjo-Daro, and Harappa archeological sites, the statues of indicus cattle were found but not that of camel. In Suleiman region (Loralai) the statues of horses were excavated from the ruins dating back to the third millennium B.C. In Killi Gul Muhammad (Quetta) the statues of Deer and Indicus cattle had been found. In Vida (old book of Aryan), the name of sheep, goat and cattle is common but the name of camel is not discussed. The first definite reference to the dromedary in the Indian subcontinent appears to be in connection with the Muslim conquest" (Muhammed bin Qasim, 717 A.D., Sindh). But this statement is true for the Indus delta, not for the mountainous region of the Suleiman region. Because the Suleiman Mountains are a major geological feature bordering ranges between the Iranian Plateau and the Indian subcontinent. The time of the introduction of the dromedary in the Suleiman mountainous region is particularly difficult to determine on account of the pre-existence of the Bactrian camel. In the Avestha the holy book references to the camel are common but it is not clear to which specie reference is being made. It is assumed that dromedary entered in the region concurrent with the Muslim preachers. The assumption is born out by craving on the walls at Persepolis, constructed sometimes during the fifth or sixth century BC, assumed that the craving Bactrian camel on the walls at Persepolis, leading by man is believed to be the picture of the local people and camel of that time. The author personally visited the Buddha museum in Sawat (Falling in the north end of Suleiman mountainous series), where the statue of Bactrian camel was placed. Sawat is bordering Suleiman region in the north are the arid highlands of the Hindu Kush. Another proof of the pre-existence of the Bactrian in the region is the ability of the present camel breeds of the area having the ability to cope with the very low temperature. The Kohi camel found on the peaks of Suleiman Mountains with a height more than 3000 meter ASL and the mercury remain below 0° in winter.

Key words: Bactrian, dromedary, Avestha, Vida, Suleiman Mountains, Balochistan, Pakistan.

Abstract # 214

Raigi camel: a newly discovered breed from Balochistan, Pakistan

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This paper describes the Raigi camel, a very distinctive breed from northern Balochistan, Pakistan. The breed is characterized by considerable milk production potential (7-10 l/day) and consumes salt bushes and brackish water. The milk is believed to have high total solids and used mainly for Kurth making locally. The animal has mean±SE body dimension as wither height (164.23±0.45 cm), rump length (139.27±0.26), sternal pad distance from the ground (89.70±0.71 cm), canon bone circumference (19.87±0.14 cm), breast width (42.98±0.15 cm) and estimated live weight (373.98±3.51 kg). The camel wool has long staple length with fine fiber, mostly used locally for rugs fabrication. Although the Raigi camel has long been recognized as a distinct population by local camel breeders, scientists were previously not aware of the existence of this breed. Information about the distribution area, estimated population size, and physical characteristics of the Raigi camel is provided and the prevailing management and production system is described. It is concluded that the Raigi camel represents a valuable genetic resource and that steps are necessary to ensure its survival as a separate gene-pool.

Key words: Raigi, camel, breed, Kurth, body dimension, Balochistan, Pakistan

Abstract # 215

Molecular identification of some Sudanese and African camel types using RAPD-PCR (DAF/AP-PCR)

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Five blood samples were collected from each 18 Sudanese camel types and subtypes, one Somalian type (Arhou) and one Chad type (spotted camel) from all over the country; western, south, north Kordufan, and eastern part of the Sudan (Red Sea State, Kassala State, Showak, Gedareff State, Albutana Region.), and from the River Nile State (Damer, Atbara, and Barber). DNA was extracted and its presence and concentrations were detected by gel electrophoresis and spectrophotometer respectively. 10 random primers were used in this study of 6 those gives a polymorphic bands. RAPD (Random Amplification of Polymorphic

DNA) technique uses oligonucleotides to prime arbitrary amplification from genomic DNA with PCR (Polymerase Chain Reaction) were the technique of choice.

Genetic similarity (similarity index) calculated between the twenty samples according to Nei's and Li's coefficient, and it's ranged between 0.299 and 0.927 between Rebaigat (Kabashi) and Chad (spotted type) and between Abu Omair (Shanabla) and Aiadap (Lahawe) respectively.

Also the result show the close genetic similarity between Chad (spotted) type and Abukhamseen (Kinani) type 0.633, between Annafi and Awlad Gallis type 0.833, between Bishari (Aririt - Bashkwap) and Amirap type 0.842, between Abu Omair (Shanabla), Nawahia (Dar Hamid), Aiadap and Hawaweer ranged between 0.853 - 0.927, and between Kabashi (Rebaigat), gemei, Kawahla (Muradi) and Maidoup type ranged between 0.578 – 0.882. The genetic similarity between Chad type (Spotted) and Somalian type (Arhou) and all Sudan types ranged between 0.298 – 0.660, while between Somalian (Arhou) type and Chad (Spotted) and all Sudan types ranged between 0.472 – 0.825.

Our goal in this study was to genotype all camel types in Sudan to determine the genetic similarity and distances between them, and to compare them with Somalian (Arhou) type and Chad (Spotted) type.

Key words: Sudanese and African camel types, Molecular identification, RAPD-PCR (DAF/AP-PCR)

Abstract # 216

Sequencing the M-allele for microsatellite markers used for paternity testing of *Camelus dromedaries*

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Previous scientific publications that describe the analysis of microsatellites currently used in the parentage verification of dromedary camels (*Camelus dromedaries*) indicate a dearth of information about useful and informative markers. Research that has been done on developing microsatellite markers for the family Camelidae focus primarily on the Bactrian camel, Llama, Alpaca and Guanaco, and to date, there has only been a single publication that has reported markers developed in dromedary. To date, some 98 microsatellites have been identified from different species of the Camelidae family, with only a few of which used for the parentage verification in dromedaries. The overall aim of our work is to develop new microsatellite markers for dromedaries, to localize them on the genome and to sequence and

thus identify the middle (M) allele of the markers for size verification. Sequencing the M-alleles of microsatellite markers used in parentage verification tests is important to verify the actual size. These can then be used as a size reference for the other alleles of the marker. Our work will also define accurate sequence of each marker in dromedary to enable other lab to set up the test, as most of the existing markers have been adapted from other camelidae species and these sequences may differ. Based on the results from an existing genotyping database, homozygous animals were selected for this part of study. Out of 34 amplified markers in dromedaries, we have sequenced the M-allele of 7 markers. Markers were successfully amplified, sub-cloned into pGEM-T vector, sequenced and verified at least in two independent camels. The 7 markers are LCA18 (230bp), LCA66 (241bp), LCA56 (149bp), LCA82 (113bp), YWLL38 (187bp), YWLL44 (105bp), CVRL01 (228bp), CVRL02 (207bp), CVRL05 (171bp) CMS32 (225bp) and CMS16 (213bp).

Key words: dromedary camel; microsatellite markers; parentage verification; sequencing; M allele.

Abstract # 217

Effects of preslaughter stress on meat quality and phosphocalcic metabolism in Camels (Camelus dromedarius)

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It's broadly known that feeding and conditions under which the animals are produced, transported and slaughtered may influence the oxidative stability of the meat and several physiological functions. The purpose of this study was to determine the effects of preslaughter stress on meat quality and physiological responses in dromedary camels and their correlation with phosphocalcic metabolism. Animals used in this experimentation were clinically healthy. They were subjected to a long transportation stressor (TS) or remained unstressed before slaughter (NS). Blood samples were collected from the jugular vein. Muscle glycogen and pH were measured on samples from longissimus muscle collected at 15 min and 24 h postmortem. The TS camels had higher plasma Cortisol, Thyroxine and glucose ($P < 0.05$) concentrations

than NS camels. In contrast, plasma concentrations of sodium, potassium, calcium, inorganic phosphorus, Parathormone and 25-Hydroxyvitamin D in TS and NS camels showed no significant difference. These results indicate that long-term preslaughter transport can cause noticeable changes in stress responses and muscle metabolism, without any variation of phosphocalcic metabolism hormones in camels.

Key words: Dromedary camels- Thyroxine- Cortisol- 25(OH)D- Meat Quality- Preslaughter stress.