

Reproduction

34. The Appropriate Time Required for New-Born Calf Camel to Get Optimal Amount Of Colostrum Immunoglobulin (IgG) with Relation to the Levels of Cortisol and Thyroxin

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Introduction

Camel placenta is of epitheliochorial type, and the new born are considered agammaglobulinemic. The amount of colostrum immunoglobulins that can be absorbed will depend on the passive transfer through intestines in the early days. Failure of passive immunity transfer (FPT) due to gut closure, might expose calves to infection leading to high mortality. The relationship between cortisol and thyroxin and passive immunity in camelidae has not been reported. The objective of this study was to determine the appropriate time required for the new-born calf camel to get optimal amount of immunoglobulin (IgG) with relation to the levels of cortisol and thyroxin.

Material and Methods

The study used 11 pregnant female camels with varied age and gestation. After delivery 7 calves were used for this investigation. Blood sera and colostrum whey samples were collected. Immunoglobulin (IgG) was determined using Single Radial immune Diffusion(SARL). Protein was analyzed by Biuret method. Thyroxin and cortisol were estimated using ELISA methods. Data was treated as complete randomizing design mean separated by Duncan .Turn – over rate calculated using semi – log curve.

Results and Discussion

Table 1 summarizes the average concentration of Total protein (TP), immunoglobulin (IgG), cortisol and thyroxin.

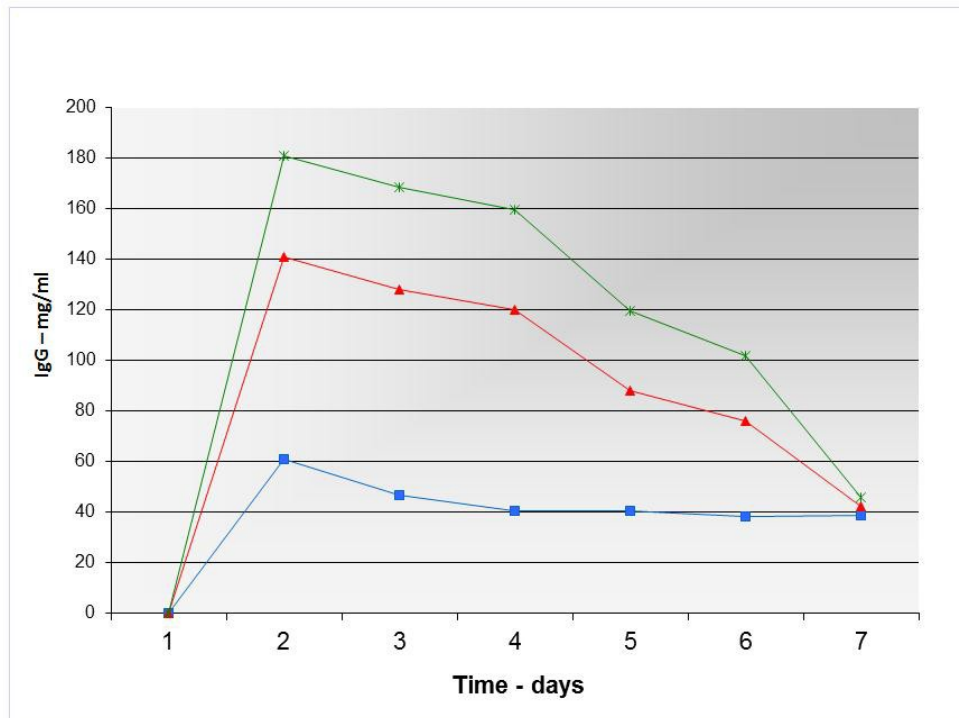
Table 1 : Average of total protein (TP) , immunoglobulin (IgG) , cortisol and thyroxin during :) 0 , 24 , 48 , 72 , 96 , 120 , 144 hrs , 2nd , 3rd , 4th wks post-partum

Time (hrs .. wks)	Total protein (gm / 100 ml)	IgG (mg / ml)	Cortisol (ng / ml)	Thyroxin (ng / ml)
4	6.02 ± 1.12 a	0.0 ± 0.0	19.0 ± 7.0 a	218.3±19.4a
24	7.56 ± 1.06ab	140.75±62.91a	14.1± 2.6 a	222.0±37.2a
48	7.01 ± 1.67ab	127.76±63.11ab	22.8 ± 9.9 a	197.0±49.3a
72	6.58 ±1.29ab	119.73±61.78ab	23.80± 16.0 a	171.5±45.7a
85	6.76 ± 0.60a	87.88±60.74abc	19.60± 8.5 a	201.8±32.0a
120	7.12 ± 1.36ab	76.02±48.59bc	17.60 ± 10.5a	199.2±38.7a
144 hrs	6.69 ±0.79ab	41.97±5.61cd	19.0± 10.40a	181.5±29.3a
2 nd	8.52 ± 2.59ab	42.10±5.88cd	16.60± 10.4a	186.6±29.2a
3 rd	6.96 ± 1.29ab	39.86±4.42cd	16.0 ±5.3 a	191.1±22.5a
4 th wks	7.61 ±1.79ab	38.50±5.84cd	12.8 ± 5.0 a	200.0±33.2a

Total protein increased significantly(p<0.05) at 24 hrs post suckling which agree with the findings of Garmendia *et al*, (1987) but was higher than other study (Kamber *et al*, 2001). Values remained unchanged thereafter. Levels of IgG increased sharply (140.75 mg / ml) within 1st 24 hrs, declined gradually to lower levels at 144 hrs (41.97 mg / ml), similar result was reported by Sedlinska *et al*, (2006). The average Turn – over rate (K) of plasma IgG (fig 1) estimated to be 0.24, the T1/2 was 3.22 days (80 hrs), indicating the optimum time for the new born calf to get the amount of IgG. This time may depend on the amount of IgG absorption, age at first suckling and breed (Wernery, 2001). Calves with IgG values greater than the average, the K = 0.27 and T1/2 = 2.56 days (30 hrs), while those with lower values, the K = 0.03 and T1/2 = 7.7 days (185 hrs). In this study Cortisol levels showed no significant correlation with IgG utilization. In lambs Hough *et al*, (1990) reported high

levels of cortisol during early hours post-partum led to delay in gut closure and elevation in IgG absorption. Thyroxine plasma levels did not show significant changes (range ; 171.5 – 222 ng /ml) during the whole period. These values were similar to previous report (Magdub and Johnson,1986).

Figure 1: Concentration of IgG during post-suckling



In summary, it appears that one hump new- born calf can get enough IgG within 1st 24 hrs post-suckling. However, this may vary with the amount of IgG absorbed. No correlation was detected between Cortisol and thyroxin levels with rate of IgG utilization.

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35. A Preliminary Study On The Effect Of Follicle Numbers Recruited Into A Follicular Wave On Superovulatory Response in Dromedary Camels (*Camelus dromedarius*)

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Introduction

Multiple ovulation and embryo transfer (MOET) in dromedary camel has been considered as one of the efficient methods for increasing the number of offspring from genetically superior animals in a relatively short breeding period (Skidmore, 2005). Superovulation was induced by using either FSH (20 IU ovine FSH or 400 mg porcine FSH) or equine chorionic gonadotropin (eCG; 2000–6000 IU) alone or a combination of eCG and pFSH, however, ovarian response and embryo yield remain highly variable and unpredictable (Tibary, 2010). Ovarian response to superovulation depends on the number of gonadotropin sensitive follicles present prior to superovulation treatment in farm animals (Draincourt, 2001). Hence the present study was carried out to examine the effect of follicle numbers (high versus low) recruited into a follicular wave on superovulatory response in dromedary camels.

Materials and Methods

This study was conducted on adult dromedary camels (n=13) aged between 8 to 22 years during the peak breeding season (January to March). Ovulation was induced in these animals by the use of a single intravenous injection of 1500 IU hCG (Chorulon, Intervet, EU) when there was a mature dominant follicle in the ovaries. Superovulation treatment with pFSH (Folltropin-V; Bioniche; Canada) was initiated 4 days after the first hCG injection. All animals received 400 mg pFSH twice daily intramuscularly in declining doses (80, 60, 40, 20 mg) for 4 days. Ovarian scanning was carried out daily by using an ultrasonographic equipment (LOGIQ P5, GE Health Care, Wauwatosa, WI, U.S.A) equipped with 5 to 10 MHZ linear transducer (I739; GE Health Care) by the same operator, beginning at the time of the first hCG injection and continuing until mating. At each ultrasound session, the total number and size of the follicles in the ovaries of each animal was determined. Animals were divided into three groups based on number of follicles (≥ 2 mm in diameter) recruited into a wave following ovulation prior to pFSH treatment: low (8 to 15 follicles, n=7), intermediate (16 to 25 follicles, n= 1) and high (> 25 follicles, n= 5). Animals in the intermediate group were not included in this study. Animals were mated twice, 24 h apart, when the majority of growing follicles reached to a diameter of about 10 to 20 mm (Mature follicles) and treated with hCG after the first mating and monitored every 8 h for 48 h by ultrasonography. The uteri of the animals were flushed non-surgically 8 days after mating. Embryos were assessed morphologically and graded 1-4 (IETS grading system). All statistical analysis was carried out using SPSS 15.0 software (SPSS Inc, Chicago, IL, USA). Student's t test was used to find significance between the groups.

Results and Discussion

The superovulatory response in low and high group animals are presented in Table 1. High group animals developed twofold more mature follicles than low group animals. Similarly a positive correlation was found in bovines between the follicle numbers and ovarian response to superstimulation (Singh *et al.*, 2001; Ireland *et al.*, 2007). In the present study, the transferable embryo yield in high group was fivefold lower than low group animals. Asynchronous follicular growth and follicles of different sizes were recorded at the time of mating in high group animals. The poor embryo yield in high group animals might be due to high number anovulatory follicles. Anovulatory follicles in superovulated dromedary camels affect the fertilization rate and embryo transport (McKinnon *et al.*, 1994). In the present study, the transferable embryo yield in the low group animals was equal to that reported by others in dromedary camels (McKinnon *et al.*, 1994; Skidmore and Billah, 2005). In conclusion, the results of the present study showed that the development of matured follicle numbers following superovulation treatment depends on the number of small follicles

present in the ovaries prior to superovulation treatment. The transferable embryo yield was very poor in high group than in the low group animals.

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Table 1. Superovulatory response (mean \pm SEM) in dromedary camels treated with eight decreasing superovulatory doses of pFSH.

Variables	Low group	High group	P value
Follicles recruited	13.4 \pm 0.4 ^a	37.6 \pm 3.4 ^b	<0.001
Mature follicles	11.3 \pm 0.5 ^a	30.4 \pm 3.3 ^b	<0.001
Follicles ovulated	8.6 \pm 0.9 ^a	21.6 \pm 2.6 ^b	<0.001
Anovulatory follicles	3.6 \pm 0.8 ^a	12.6 \pm 1.7 ^b	<0.001
Transferable embryos	4.4 \pm 0.5 ^a	0.8 \pm 0.8 ^b	<0.002

Values in the same row with different superscripts differ.

36. Motion Characteristics of Inra 96 Diluted Dromedary Camel (*Camelus dromedarius*) Semen Stored at 4°C

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Introduction

Artificial Insemination (AI) is an important technique that ensures rapid genetic progress in any species. A large number of extenders (green buffer, lactose, Tris) have been used for fresh and liquid storage of dromedary camel (*Camelus dromedarius*) semen (Skidmore, 2005). Most extenders for short term preservation contain either egg yolk or milk of animal origin which may differ between batches. INRA96 a chemically defined extender containing native phosphocaseinate instead of milk was used for storage of fresh stallion semen (Batellier *et al.*, 2001), fertility rate of 68% and 40% were reported after AI at 0 and 72 hours respectively. However, the report of its use in dromedary camel semen is limited, hence the present study was undertaken to evaluate its suitability as an extender for camel semen and assess sperm motion characteristics using CASA at 0 hour (37°C) and during storage (4°C) at 24 and 48 hours.

Materials and Methods

In the present study, six ejaculates were collected during the breeding season from dromedary male camels (n=2) belonging to the Royal Camel Corps. Semen collection was carried out by artificial Vagina. Fresh semen was immediately diluted (1:1) in INRA96 and kept in a water bath (37°C) for liquefaction, final dilution was carried out based on sperm concentration (Spermacue, Minitube, Germany). Motion characteristics were evaluated by placing a 5 µl drop of diluted semen on a 2X-CEL dual sided sperm analysis chamber (20µm depth) and examined using 20x objective of CASA (CEROS, Version12, Hamilton Thorne Biosciences, USA). Analysis setup Camel with preset parameters was used. Five frames were acquired and 400 sperms counted. Motion characteristics of spermatozoa estimated were total motility (T.Mot%), progressive motility (P.Mot%), path velocity (VAP, µm/s), progressive velocity (VSL, µm/s) and track speed (VCL, µm/s), lateral head amplitude (ALH, µm), beat cross frequency (BCF, Hz), straightness (STR%) and linearity (LIN%). Initial motility (0 hour, 37°C) was estimated, diluted semen transferred to cold handling cabinet (4°C, IMV, France) and motility of chilled semen estimated by CASA during storage at 24 and 48 hours. Statistical analysis was carried out using non-parametric Kurskal Walis test to find the significance in percentage data and ANOVA for all other variables.

Results and Discussion

The average volume of semen and sperm concentration during the present study were 4.5 ml and 379 x10⁶/ml respectively. It was observed that complete liquefaction of semen occurred within 30 minutes after extending camel semen with INRA 96 and motion characteristics of sperm easily evaluated by CASA. The mean values observed in the present study of sperm motion characteristics by CASA are presented in Table 1. The total motility of camel semen extended in INRA96 during present study at 0 hour was similar to the findings of Wani *et al.*, (2008), who reported motility of 71-84 percent using different extenders at 0 hour. In addition, total motility at 0, 24 and 48 hours in our study was higher than the findings of Zeidan *et al.* (2008) who reported motility of 60.7, 51.3 and 41.8 percent during storage for 0, 1 and 2 days respectively. Present study showed no difference between 0 and 24 hours of storage at 4°C for few motion characteristics (T.Mot, P.Mot, VAP, VCL and BCF), however difference was observed in other motion characteristics (VSL, ALH, STR and LIN). Over time reduction in most motion characteristics was observed at 48 hours of storage at 4°C. The mean values observed in the study were higher than those reported by Al-Qarawi *et al.*, (2002) using a computer cell motion analyzer for variables, T.Mot, VAP and VCL (57.3, 124.9 and 129.8), but lower for variables, VSL, ALH, STR and LIN (121.5, 6.9, 97 and 92), however, value of P.Mot (50.6)

reported was similar in both studies. During the present study camel semen extended in INRA96 was used for AI (24h, 4°C) of four female camels and resulted in birth of one calf. Similarly, AI (24h, 4°C) of two superovulated donor camels resulted in harvest of five grade ‘_A’ expanded Blastocyst. Results indicate INRA 96 as an ideal extender for dromedary camel semen stored at 4°C and fit for artificial insemination (AI) upto 48 hours.

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Table 1: Motion characteristics of dromedary camel semen estimated by CASA (Mean±SE)

Variables CASA	At 0 hour	At 24 hour	At 48 hour	P value
Total Motility (T.Mot) %	80.6±2.5 ^a	72.6±2.6 ^{ab}	44.4±2.9 ^c	0.002
Progressive Motility (P.Mot) %	50.6±2.1 ^a	44.6±3.0 ^{ab}	26.4±3.6 ^c	0.004
Path Velocity (VAP)µm/s	134.9±3.2 ^a	126.4±3.8 ^{ab}	110±3.2 ^c	0.001
Progressive Velocity (VSL)µm/s	104.9±2.7	103±3.5	95.7±1.8	0.126
Track Speed (VCL) µm/s	175.2±10.4 ^a	168.4±5.7 ^{ab}	128.4±5.3 ^c	0.012
Lateral Amplitude Head (ALH) µm	4.7±0.08 ^a	4.0±0.11 ^b	3.1±0.08 ^c	<0.001
Beat Cross Frequency (BCF) Hz	0.7±0.02 ^b	0.8±0.02 ^{ab}	0.5±0.04 ^c	<0.001
Straightness (STR) %	80.8±1.1	81±1.1	83±1.0	0.237
Linearity (LIN) %	66.1±1.5	64.8±1.6	69.6±1.7	0.158

Values with different superscripts in same row differ.

Anatomy and Surgery

37. Histological and Histochemical Study of Skin in Camel (*Camelus dromedarius*)

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Introduction

The skin consists of two layers the epidermis that works as a protective layer for the dermis and the dermis, as well as the skin appendages and glands (Parakkal and Montagna (1974), Dellman and Brown, (1976) Revis and Seagle, (2006) explain the responsibility of the small subcutaneous nerve trunks under the skin on the establishment of nerve plexus, which in turn sends branches to the reticular layer of the epidermis, for the processing layers of the skin and its accessories in general.

Montagna, (1962) show that the distribution of glycogen varies in the dermis layer, as it noted that the dermal papilla are rich in glycogen granules, while the quantities begin to recede in collagen fiber bundles in the retinal layer.

Lee *et al.*, (2007) pointed out that the neutral fat granules distributed through the hair follicles are distinct with different sizes granules lipid. In the upper part of the hair bulb, and the external root sheath of the hair follicle neutral pigment lipid granules have been observed (Montagna 1962).

Materials and Methods

The present study was carried out on fifty healthy camel skin, the samples were collected from Al-Zubair abattoir in Basrah, each contains skin of back, neck and muzzle. The samples were immersed in 10% formalin solution before being transported to the laboratory for the purpose of testing of the present study. The sample cuts into small pieces (1 cm) and sequentially numbered and post fixed for 24 hours in 10% formalin. Fixed tissue was washed in current water, dehydrated in a graded series of alcohol, cleared in xylene and embedded in paraffin wax. Serial sections of five micrometers thick were made. Mounted on slides and stained with haematoxylin and eosin (Luna 1968). The following stains were suggested for histochemical studies;

- **Periodic acid schiff**: For glycogen investigation
- **Osmium tetroxide**: For lipids demonstrations.

Results

The result of study was determined for histological and histochemical characterization (Glycogen and Lipids) in the samples examined.

The epidermis layer appeared different in thickness among the examination samples, depending at the site of sample, however, it consists of four secondary layers; stratum corneum, stratum granulosum, stratum spinosum and stratum basal layers, while the dermis composed of two nuclear non separated layers contain of superficial papillary and reticular layers.

The histochemical study showed the presence of glycogen and lipid. The glycogen granules were noticed at the cells of basal layer of the epidermis, as well as in the dermis layer. In addition, the glycogen compound was found at blood vessels, smooth muscle associated with the folliculars and sweat gland ducts. The lipids drops were detected in the dermis and epidermis layer, the lipid droplets found in graduated concentration toward the tissue lining cells.

Discussion

Camels skin is composed of stratified squamous epithelium that composed of the stratum corneum, the granular layer, spinous layer and basal layer. This is identical to what is reported by Tomlinson *et al.*, 2004. The hair follicles are arranged individually and in regular manner, this is what was observed in most mammals (Bacha and Wood, 1990).

Dermis layer is characterized by the presence of neutral polysaccharide and gave a positive reaction with PAS. This finding is similar to Montagna, (1962)

The skin layer gives a strong response to neutral lipid technique, especially in the stratum corneum. This corresponds with the findings of Elias *et al.*, (1988).

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38. Rectal and Reproductive Tract-Associated Lymphoid Tissue in Camels (*Camelus dromedarius*)

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Introduction

Mucosal membranes mediate an interface between the body and environment, which present a variety of innate and adaptive immune defense mechanisms against microorganisms (Holmgren, 1991; Bowersock *et al.*, 1999; Gerds *et al.*, 2001). These surfaces are covered by a layer of epithelial cells, separating the internal organs from an environment rich with potential pathogens. Lymphoid tissues comprise of mucosal-associated lymphoid tissues (MALT) are distributed in various locations such as respiratory, intestinal or urogenital tracts (Shewen *et al.*, 2009). MALT are the initial inductive sites for mucosal immunity, antigens are sampled from mucosal surfaces and cognate naïve B- and T-lymphocytes stimulated. MALT structures are the origin of lymphocyte trafficking to mucosal effector sites. MALT contains lymphatics which transport immune cells and antigens to regional lymph nodes that can therefore be called part of the inductive sites of mucosa and augment the immune responses (Liebler-Tenorio and Pabst, 2006). The vast majority of infectious diseases in all species are initiated by colonization of or entry across, mucosal surfaces of the respiratory, intestinal or urogenital tracts. There has been a great deal of interest in immune response at these sites and in development of vaccines that target these portals of entry (Hodgins *et al.*, 2005). The reality is that most current vaccines for such infections are delivered parenterally and act thorough induction of systemic rather than mucosal immunity. Recently, there are reports of outbreaks of diseases in camel species, which mostly involve respiratory associated illness and cause abortions and in most cases leads to sudden death (Dawo, 2010). This preliminary investigation attempts to assess the presence or otherwise of mucosal associated lymphoid tissue in the rectum and the reproductive tract as these sites has the potentials of vaccines delivery in this animal species.

Materials and Methods

Seventy-five (75) Adult Camels (*Camelus dromedarius*) presented for slaughter at randomly selected camel slaughter houses in Nigeria were used for this study. Ante-mortem examination was conducted to exclude animals with reproductive, gastrointestinal and respiratory problems.

During post-mortem examination, attention was focused on the rectum and reproductive tracts. Representative tissue samples from the rectum, vulva, vagina, cervix, uterus and uterine horn were collected and placed in 10% neutral buffered formalin for at least 12 h. The samples were then processed routinely for histopathology using the paraffin embedded technique, sectioned at 5µm, stained with hematoxylin and eosin [HE].

The processed slides were viewed under light microscopy (Nikon Eclipse 80i) attached to Nikon NIS element imaging software version 2.33. Attempts were made to identify the rectal-associated mucosal lymphoid tissue (RAMALT) and reproductive tract-associated lymphoid tissue in at least 5 microscopic fields before the sizes and/or count of the RAMALT and reproductive tract-associated lymphoid tissue were determined by measuring the diameters. The numbers of lymphocytes were determined by counting the cells using the NIS element imaging software version 2.33.

Results

Diffuse lymphoid tissues and intraepithelial lymphocytes were observed in all segments of the sections examined (Table 1), however, severe infiltration of diffuse lymphoid tissue and intraepithelial lymphocytes were seen in uterus and uterine horn, but solitary lymphoid nodules were only seen in the rectum.

Table 1: Mean diffuse lymphoid tissue and/or intraepithelial lymphocyte count in Camel (*Camelus dromedarius*)

Organ	Lymphocyte count (per unit area)
Vulva	120.2±2.30
Vagina	28.5±1.78
Cervix	38.4±1.13
Uterus	312.8±2.80
Uterine tube	288.2±1.05
*Rectum	789.5±2.10

* Only Rectum showed lymphoid nodule with mean size of 385.2±4.7µm

Discussion

The present studies on mucosal-associated lymphoid tissue in the rectum and along the reproductive tract provides a baseline data on mucosal tissue response in both rectum and reproductive tract of camels. The study was triggered by the mysterious mortalities of camels in many region of the world (Dawo, 2010). As studies on mucosal tissue response provide baseline information on mucosal immunity studies. However, an increasing pattern in the reproductive tract after vulva from the vagina observed in this study may be associated with level of exposure to external pathogens. The increasing in intraepithelial lymphocyte in the uterus and uterine horn may indicate the level of protection to the mucosal integrity and to possible invading pathogens. Certainly, where the goal is prevention of infection, the presence of mediators on the mucosal surface is needed. Memory cells generated at mucosal sites and in draining lymph nodes, home preferentially to other mucosal locations providing a primed response at all potential portals of exposure (Youngman *et al.*, 2005). There are also non-immunological reasons for seeking vaccines that are delivered without injection, including ease of delivery and the absence of injection site reactions. Vaccination of food producing animals would be facilitated by mass delivery of vaccine in feed or bolus, water or by aerosol, meaning less labour cost for producers and reduced stress on the animals. Additionally, carcass condemnation due to needle breakage or injection site reactions would be avoided (Roeber *et al.*, 2002). Increasing consumer pressure for organically produced food and a natural approach to disease management is more compatible with disease prevention using non invasive methods of vaccine delivery. This study provide preliminary information, in which further studies on CD4 and CD8 characterization and other cardinal for confirm of protection along the mucosal surface will be based in the future.

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39. Anatomical Characteristics of Kidney in One Humped Camel (*Camelus dromedarius*) in Sudan

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Introduction

Sudan ranks the first among the Arab countries and the second in Africa with respect to animal population. According to recent estimates of livestock, there are about 4 million head of camel (Ministry of Animal Resources, 2005). The kidney of the camel is playing a vital role in water retention through the production of highly concentrated urine (Schmidt-Nielsen, 1964). The anatomical details of the kidney of domestic animals (Sisson, 1975) One Horned Rhinoceros (Talukdar *et al.*, 2003) and morphometric observations on kidney of camel (*Camelus dromedarius*) (Abdalla *et al.*, 1978) were reported. The morphometry and detailed sequential differences involved in the measurement of the kidney in camel breeds is very meager. Hence, the present study was conducted to elucidate the morphometric studies of kidneys in Sudanese camel breeds. The available information on the camel kidney is mainly concerned with general morphology and topography (Chauveau, 1891; Lesbre, 1906; Leese, 1927; Droandi, 1936; Tayeb, 1948; Joseph, 1969; Abdalla, 1973; Abdelraheem, 1992).

The data concerning the comparative study between the right and the left kidney of camel is lacking. The objective of this study is to determine of morphology of kidney in one humped camel and to compare it in two sides.

Materials and Methods

This study was conducted at Tamboul Camel Research Centre (TCRC) in Butana area where camels are usually purchased from different regions of Sudan for the slaughter at local market of Tamboul for human consumption. Samples were collected from slaughtered camels at Tamboul Slaughter House (TSH) during the period from April - May 2011. The kidneys were removed immediately after slaughter from apparently healthy animals. The samples were collected after slaughtered, the weight of the kidneys were taken by digital balance, separately for right and left (**gm**) kidneys and the greatest length, girth and width (**cm**) was measured by using tape. The data between right and left kidney were statistically analyzed by using (SPSS, 13) and compared using student's t-test.

Results and Discussion

The difference in camel non carcass components may be due to physiological, behavior, type of feed and age of the animal (Yagil *et al.*, 1994). Both kidneys of the camel (male and female) are bean-shaped, the capsule is thick, whitish in colour and not elastic. The various biometrical parameters to right and left kidneys of different sex have been depicted in table (1 and 2). The measurements of all parameters varied between right and left kidneys. The weight of left kidney in male and female was higher ($P < 0.05$) than that in the right one. Al-Ani (2004, chap. 6) reported that the larger kidney, which was twice that in cattle and four times that of sheep, was possibly due to adaptation of camel to arid desert life.

The length values reported of the left kidney was greater than the right one. Likewise, was observed for the width. The left kidney exhibited higher values than its right counterpart in the all anatomical characteristics in sexes of camel. The girth of both kidneys varied significantly in left and right and this variation was highly significant in left kidneys. However, significant variation in the parameters of kidney was evident between left and right kidneys. In the present study the mean of weight, length, girth and width of left kidney was greater than right one. (Constantinescu, 2004) reported that the greatest dimension of kidney may be due to size of the animal, direction and position.

Table 1: The Mean±S.E of biometrical parameters of 120 right kidneys in one humped camel in Sudan

Age groups	Sex	Weight(g)	Length(cm)	Girth(cm)	Width(cm)
(5-8) years	Male	888.5±34.9	16.6±0.22	44.8±0.4	12.2±0.2
(9-12) years		1121.0±34.9	19.1±0.22	47.0±0.4	12.3±0.2
(5-8) years	Female	813.7±34.9	16.6±0.22	43.8±0.4	11.9±0.2
(9-12) years		1192.4±34.9	18.3±0.22	45.9±0.4	12.4±0.2

Table 2: The Mean±S.E of biometrical parameters of 120 left kidney in one humped camel in Sudan

Age groups	Sex	Weight (g)	Length(cm)	Girth(cm)	Width(cm)
(5-8) years	Male	1108.4±34.9	17.5±0.22	46.6±0.4	12.9±0.2
(9-12) years		1227.0±34.9	20.5±0.22	48.8±0.4	13.0±0.2
(5-8) years	Female	887.5±34.9	17.8±0.22	45.6±0.4	12.7±0.2
(9-12) years		1255.6±34.9	19.0±0.22	47.3±0.4	13.0±0.2

Table 3: Coefficients of correlation between weight and morphometrics of kidneys in one humped camel

	Kidney	KW	KL	KG	KW
Kidney Weight (KW)	0.17				
Kidney Length (KL)	0.33	0.59			
Kidney Girth (KG)	0.28	0.47	0.57		
Kidney Width (KW)	0.33	0.32	0.48	0.61	

(N = 120). All values were highly significant different at (P<0.05).

Conclusion

We concluded that, in one humped camel; kidney is different than bovine. In the present study the mean of weight, length, girth and width of left kidney was greater than right and difference was significant (p<0.05). However, dimension of each organ in left and side cannot be variable. For example, size of many organ such as: left and right ovary. Left and right dorsal lacrimal gland and etc., in some animals are same. Results of the present study, in same other structures in left and right sides and without the previous studies. The morphometrics characteristics of kidneys in one humped camel in Sudan secured in this study. All the left kidneys parameters were greater than the right one. All the parameters were highly correlated with each others.

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Pastoral Systems

40. The Role of the Camel in the Preservation of the Flora Covered Rangeland

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Introduction

Seed dispersal by animals (the zoochory), particularly the endozoochory is one of the crucial elements for the ecological balance of ecosystems. In Sahara, the camel is the main farm animal using resources desert flora (Ghauthier Pilters, 1977 and Chehma *et al.*, 2010) and can thus contribute to the transfer of seeds per endozoochory. The role of disseminator camel has long been noted (Grenot, 1968 ; Barkoudah and Van Der Sar and Corraera, 2006) but no real study has focused specifically on this interesting aspect of its ecology. The aim of the present study was to highlight the quantitative importance of seeds transferred the camel on the basis of the analysis spatiotemporal its faeces.

Methodology

Samples of droppings fresh faeces, scattered on the ground, several individuals (different sexes and ages) were collected into two areas involving the six types of journey camels; Ghardaia (wadi bed, Depression and Hamada) and Touggourt (Reg, Salty soil and Erg) for the four seasons of the year 2009/2010.

The seeds and faeces were selected, coded and counted in several types. They were been classified according to their morphology, size and color before they were stored in sealed bottles.

Results and Discussion

The total number of seeds identified in the faeces of the camel was representing seeds of a 2967 spatiotemporal. Differences in morphological (shape, size and color) seeds were observed and grouped into 35 different types representing 35 species.

The number of seeds depending on the areas identified. The results showed that the largest recorded in the Ghardaia region with 1802, Touggourt with 1125 seeds. Chehma *et al.* (2008) show a low record of the river seeds, while the lowest of phytomass, reg and salty soils, seeds and the highest values of phytomass and reg and salty soils, the lowest.

This study showed that the area of Ghardaia is 94.3% and 60% Touggourt of seed types identified. The inequality, two harvest areas is closely related to the types of rangeland that make up each.

During summer, 1609 seeds were collected and this figure is of five times more than the other seasons, followed by winter and spring with 516 and 422 seeds and then fall with 420 seeds. This might be due to variability of the production time of phytomass grazed rangeland.

The number of identified 35 types is unevenly distributed according to the season. The season summer is the most represented with 28 types, followed by the fall with 21 types, then winter with 15 and 12 types in spring. This uneven distribution is due to the phenological stages of Sahara plants.

Our results showed the special role of the dromedary as a vector seed dispersal in terms of quantity and quality. In addition, faeces offer conditions for the preservation and seed germination. From this we can assume that camel is helping to preserve its environment and its role in seed dispersal may be ecologically important in the community extremely fragile.

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41. A Photo-Essay on Dromedary Camels in Sudan

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Abstract

The one humped camel (*Camelus dromedarius*) is a multipurpose domestic livestock. It is well adapted to the harsh conditions of the arid and semi-arid zones and therefore thrives where other livestock species do not. The dromedary camel is versatile and its ability to survive and perform in the harsh, arid and semi-arid areas of the world has earned it a good reputation amongst pastorals of tropical Africa and Asia (Waziri *et al.*, 1999). The dromedaries are found in the northern parts of Sudan on latitudes 12°N and 18°N. Sudan has about 3.6 million camels (Report, 2003). The most recent estimate puts the Sudan camel population at 4000,000 pastoralists are people who depend for their living primarily on livestock. The Nomads and pastoral groups in Darfur, Kordufan, Buttana, Kasala and Gadaref states own most of the camels in Sudan. The dromedary camel can provide a wide array of functions and products. It is probably best described by Bulliet (1975) who wrote that, —the camel can be milked, ridden, loaded with baggage, eaten, harnessed to a plough or wagon, traded for goods or wives, exhibited in zoo or turned into sandals and camel hair coats|. The camel feeds on plants or parts of plants not eaten by more conventional livestock. In addition to being complementary to other stock as a feed resources, camels complement them in production. Camel keeping is a common activity in Sudan camel breeding areas. During a field visits to camel regions between July, 2006 and September, 2010 different aspects of camel production were captured using photographs. The significance of these pictures for camel research and development in Sudan will be highlighted.

The Photo-essay

Photographs can serve as a tool to draw the attention of scientists and researchers to issues relevant to camel research and development for sustainable livelihood in developing countries like Sudan. Moreover, photographs are noted as useful tool because they convey complex information and in the case of a photo-essay, the photographs are not disjuncted from research context (McClatchey *et al.*, 2005). Informed consent was obtained from camel owners who participated in the field survey. Photographs were taken from Darfur and Kordufan in Western Sudan, Damer in Northeastern Sudan and Buttana region in Eastern Sudan. All photographs were taken using a Nikon COOLPIX L18 digital camera with a 5.7-17.1 mm lens. The photographs presented here were selected to provide visual insight into some aspects of camel production in Sudan. Other than image resizing, the photographs have not been substantially modified.

Method of keeping camels in Sudan



Nomadic system

Semi-Nomadic

Sedentary system

Racing camel



Ridig camel

Pack camel

School less with camel looking for future



Fire wood (Pastoralism and livelihood)

Camel Festival



Foetal wastage in slaughter camel



Extrusion of soft palate and frothing of mouth in dromedary bulls

A pregnant camel

Camel slaughter

Wasted foetus from slaughtered pregnant camel

Significance and recommendations for camel research and development

- *Absence of a distinct breed classification of the dromedaries found in Sudan. Identification, therefore, is mainly by body colour and morphology.
- *Four major ecotypes reported in livestock markets in Western Sudan are the sand-brown, grey-white, dark- brown pied coloured dromedaries (Majid, 2000).
- * Mohamed Zain (2007) reported that 34.06% of female camels slaughtered for meat at Tambool abattoir in 2006 were pregnant. Government intervention is needed in marketing of pregnant camels for slaughter.
- * Linkages between pastoralist livelihoods and development: education, health, and women's development are priorities.
- * Veterinary antemortem pregnancy diagnosis should be enforced and butchers should be compensated in a situation where camel is found to be pregnant and slaughter is denied.
- * Best practice, joint research, and collaborative learning. Interventions must be based on wider regional best practice among pastoralists. Capacities of local research institutions and universities must be built and mobilized. Local universities need to be assisted in the integration of issues of

pastoralism, livelihoods, and conflict in their curricula and in broadening their research agendas in collaboration with national and international institutions.

* Research into veracity of traditional remedies for ailments in camels and documentation of indigenous knowledge is necessary.

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42. Camel Welfare: A New Challenge

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Animal welfare is a complex and multifaceted issue which includes ethical, scientific, economic and cultural dimensions. Farm animals including camels, are sentient beings that are capable of suffering. In fact, there's general agreement that good welfare means satisfying an animal's needs which can be classified into physiological needs, safety needs and psychological needs. This article will consider, some welfare considerations in relation with breeding conditions, transport, slaughtering, working camel and scientific research.

Breeding conditions

Management practises that may cause pain may not be carried out if painless practical methods of husbandry are available and restraint should be the minimum necessary to perform management procedures efficiently. The tethering of camel must allow it to stay in a comfortable position such as by using a sufficient rope enabling it to sit down. In addition, any injury, illness or distress should be treated promptly.

For dromedary pain management, three S concepts (Suppress, Substitute, Soothe), elaborated by INRA in 2009, can be applied in camel. Therefore, many solutions can be brought aiming at suppressing some practise breeding at the origin of pain, substituting these practices when they are improvable but essential and Soothing the pain when it's not avoidable.

Water and food must be provided in sufficient quantity and quality in spite of phenomenal tolerance of camel to the thirst and its high valorization of the poorest food.

Transport

The transport of the camel should not be accomplished on long distance and must allow the animal to stand at least every 4 hours to stimulate blood flow in their legs and avoid injury. Thus, camels must be transported in single deck trailers (wide of 2.4 m) with sufficient clearance for them to stand comfortably.

Slaughtering

The slaughtering of camel must be performed and guarantees a minimum of respect. The transport of camels for slaughter must be ensured in a way that causes minimum discomfort and pain. These practises must be respected because handling and transport have significant effects on carcass quality. Poor handling can lead to bruising and bone or joint trauma, which are painful and can lead to the carcass being downgraded or having to be trimmed. Moreover, the holding of camel prior to slaughter should be for a minimum time and animals held for longer than twelve hours must be fed.

According to Islamic religion (Halal slaughter), camel must be slaughtered as quickly as possible with the knife under the base of the neck.

Working camels

The camel welfare can be preserved by reducing the working time with alternating several animals. Moreover, camel must be well fed, not maltreated or overloaded in agriculture activities. In circuses and zoos, camels must be kept under humane conditions.

Scientific research

Camel used for experimentation should profit from the carrying out of the 3Rs rule of Russel and Burch (Replace, Reduce, Refine) applied on classic laboratory animals. Replacement refers to the use of methods utilising cells, tissues or organs of animals as well as those that do not require the use of animals to achieve the scientific aims. Reduction, aims to the decrease of the number of camels used for scientific purposes with comparable levels of information. Refinement refers to the use of methods that prevent, alleviate or minimise pain, suffering and distress for the animals. Camels should benefit from an adequate analgesia and anaesthesia by using some specific products which ensure

muscle relaxation, sedation and analgesia. Human endpoints must be determined in some protocols like dehydration, food restriction and model disease.

In conclusion, the major question is how to manage a balance between an appropriate welfare and the preservation of the dromedary capacity to live under desert conditions. The interaction between OIE and Non Governmental Organisms like ISOCARD can achieve the common goal of promoting camel welfare which leads to increasing the productivity of this species around the world.

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43. Dromedary Chamels in Mauritania

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Introduction

Climatic and socio-economic conditions make Mauritania as a country of excellence for the breeding of dromedaries. Dromedaries are estimated around 1.4 million heads for a population about 2.5 million persons. With the urbanization, we note an increased number of dromedaries in periphery of the great urban centres and along the principal road axes (Martinez, 1989), as well as the birth of co-operatives, associations of stockbreeders and socio-professional organizations on the breeding of dromedaries.

With an aim to show the big importance the dromedaries in the Mauritanian economy that the present study is registered.

Material and Methods

This study was carried out in the field by investigations near the stockbreeders of dromedaries, the co-operatives, associations and socio-professional organizations on the breeding of dromedaries in the cattle markets at the slaughterhouse of Nouakchott, at the producers or to retailers of fresh milk for the different dairies. In add my personal experience.

Results and Discussion

Schematically, the study showed 4 dromedary channels in Mauritania: family, trade on feet, meat and milk.

Family which we meet in the great urban centres for family requirements out of milk at personalities not wanting to cut themselves from their own rural way of life. The number is 2 to 5 dairy females. These animals are nourished by concentrate feed with distribution of salt. When they are dried up, they join their female congeners in the pasture inside the country and are then replaced by others in lactation and so on.

Trade on feet characterized by the sale of dromedaries inside the country or outside in the border countries, the Canary Islands or elsewhere. Thus, the transactions made abroad constitute a source of currencies for the stockbreeders.



Year after year, Mauritania would export the equivalent out of meat of more than 15,000 tons towards the Maghreb countries.

In Mauritania, the overall yearly consumption *per head* is 19.7 kg, including 10.9 kg of meat of small ruminants, 5.5 kg of meat of dromedaries and 3.3 kg of meat of cattle (Dia, 1988). With the dryness,

one attends truly the reconversion of the practices as regards red meat consumption. The slaughter of dromedaries is an increasingly significant place in order to supply the cities for red meat.



In 2010, the national production of red meat of controlled slaughterhouses would be 76 000 tons including 22.5% from dromedaries, 24% from bovines and 53.5% from small ruminants. In addition, the liver and the hump of the dromedary are always sold separately of the meat.

The fresh milk is sold on the spot by the producers or to retailers.



Just after the milking this milk is of good bacteriological quality (Tourette *et al.*, 2003). In Nouakchott and its periphery which are not a cattle-breeding area, there are many herds of dromedaries only the production of milk for sale and the number of dromedaries is estimated between 2000 and 2500 heads (Garba et Dia, 1999 ; Dia, 2000). The producers of camel milk are organized into cooperatives, they deliver milk collected for the different dairies of which the most important are Tiviski, Top Lait, El Watania and Assava. Each dairy has its own distribution chain and participates in the incomes of the stockbreeders and the health of the animals Abeiderrahmane, 1994, Ould Mohamed, (2003). In addition, Mauritania have a dairy which produced a manufactured soft cheese from the only camel milk.



Manufacture formerly considered in the past impossible because of the difficulties to carry out the coagulation of camel milk (Ould Eleya et Ramet, 1994).

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44. Kohi Camel: A Viable Working Animal in Mountainous Ecosystem of Balochistan

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Abstract

In Suleiman mountainous region of Northeast Balochistan, the pastoral people continuously move with their livestock in search of foliage and water. The locale is composed of mountainous ecosystem and typically Kohi camel is used as working animal for goods transportation of their daily needs. Camel is always considered as desert beast but Kohi camel is unique of its kind and well adapted to the mountainous bionetwork of the region. In spite of important draft animal, Kohi camel is rarely reported in literature. This study was exceptional of its kind designed to know the working ability of Kohi camel. Fifty (50) Kohi camel pastoralists were interviewed on a prescribed proforma for the factors like, age & sex, type of work, feed supplementation, distance covered, time and intensity of work and riding ability of camel. It was known that only male camels at the age of 4 years and onward are use for work. The pastoral people use it for diverse purposes like water & belongings transportation, agricultural operation and riding etc. An amount of 4 kg of grains (oat, wheat, maize or gram) was provided after the work was performed. A camel covered a distance of 16 km in pastoral movement but for riding camel the distance was even longer and averaged about 25 km. Camel plays a pivotal role as a work animal in the livelihood pastoral people of the region. Camel need focus of the research and development arena of the country for its development and support to make it a viable entity in the livelihood of the pastoral economies of the country.

Materials and Methods

Draft ability was accessed by interviewing herders 50 camel takers (25 wood cutters and 25 pastoral camel herds) on a prescribed proforma for the parameters like, type of work, age and sex of working animals, supplementation to working camel, earning of camel taker, distance covered, time and intensity of work and riding camel. The statistical software program, SPSS (1999) was used for the analysis of the data..

45. Advocacy for Camel Research and Development in Kenya

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Camels are used for food security and as source of livelihoods. Challenges of climate change lead to more attention to camel keeping which was unrecognized until 80s. The United Nations Educational, Scientific and Cultural Organisation had identified the huge untapped potential of camels in 70s. The Government of Kenya was influenced by above findings to focus on the camel together with stakeholders in the camel value chain to enhance the economic returns from this resource. The camel potential and its great role in the changing climate in contribution towards attainment of the Kenya Vision 2030 is also the main aim of the Kenya Camel Association. Three major camel research and development in the arid and semi arid lands of Kenya were implemented in 70s to early 90s with varying successes and failures. The Kenya Camel Association was founded to advocate on camel research and development to better the wellbeing of camel owners. The association works with partners in creation of appropriate policies, addressing the threats of climate change and uses the annual Kenya Camel Forums as a platform for information sharing and interaction. The forum is the trademark in advocacy for camel research and development in Kenya which will be discussed in this paper. The Government of Kenya and partners have goodwill for camel development thus the future of camel extension in Kenya is promising.

46. Effect of Management System on Camels' (*Camelus dromedarius*) Blood Composition

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The effect of managementsystem on glucose, non-estrified fatty acids (NEFA) and urea concentration in one humped Sudanese camels were studied. Eighteen (18) lactating camels were divided into two equal groups, the first group was raised under semi-intensive system and the second was reared under traditional system. A total of 324 blood samples were collected during 18 successive months. Blood samples were analyzed for blood composition.

The results indicated that the management system effect significantly ($P<0.01$) on the concentration of blood glucose of camels, the lowest level of glucose (g/l) recorded was 0.59 ± 0.001 and 0.45 ± 0.002 in semi-intensive and traditional system, respectively. The average mean of glucose concentrate (g/l) during the experimental period in semi-intensive and traditional management was 0.81 ± 0.007 and 0.53 ± 0.005 , respectively. The glucose concentrate showed opposite trend in traditional system so its level decreased significantly ($P<0.05$) during the first seven months of experiment and recorded the lowest level during this period on 6th month (0.52 ± 0.003 g/l). The results indicated that the months of the autumn season showed increasing in glucose level.

The highest value of non-estrified fatty acids content in semi-intensive system was recorded in the first month of experiment (0.39 ± 0.001) mmol/l and start to decreased significantly ($P<0.05$) even reach the lowest value (0.25 ± 0.001) in 7th month of experiment. The non-estrified fatty acids content in traditional management increased significantly ($P<0.05$) during the experiment and recorded period the highest value (0.52 ± 0.003 mmol/l) on the 7th month of experiment. The average of the blood urea content was (0.19 ± 0.1 g/l) and (0.34 ± 0.002 g/l) in semi-intensive and traditional system, respectively. The lowest value of urea content under semi-intensive management was 0.13 ± 0.006 g/l, on the other hand the highest value recorded in semi-intensive system was 0.32 ± 0.002 g/l. The level of urea content declined during all months of supplementing. The urea content under traditional system was increased, and the highest value (0.39 ± 0.003 g/l) was recorded in 7th month of experiment while the lowest value was recorded in the 10th month during the experiment period (0.27 ± 0.008 g/l).

47. Characterization of Indigenous Tunisian Camel (*Camelus dromedarius*) Populations: Implications for their Conservation

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Genetic structure and diversity of the camel population, management practices, and orientation of farmers towards the future of camels in the region were investigated to address the issue of development programs of camel breeding and conservation in the region and nationwide. Based on the results of this characterization, some components such as the organization of the sector of camel production, protection of camels, and valorization of camel products were identified. Revealed characteristics showed a great potential for the improvement of camel production in the region. These results can guide the over all pattern of conservation and development of camel in the country. They furthermore may be an outline of a comprehensive vision for conservation and sustainable development of the species, which actually has a potential favorable for farming in arid areas.

48. A Joint Project on Contemporary and Future Camel Production – For a Global Review

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Old world camels (Dromedary and Bactrian) are precious animal genetic resources of drylands and harsh ecosystems. The dromedary camel is highly adapted to the difficult and hostile environment in its habitat, and produces in a very low or even zero input livestock production system. The camel products especially the milk are unique and of high quality. The production traits are highly variable, especially milk production which ranges from 4 to 40 kg/day. The importance of the camel is more significant than ever. The camel has potential for development as a farm animal in the future.

Pastoral people and other camel keeping communities carry the entire burden of preserving the camel for the future. They face severe difficulties due to climate change, feed and water scarcity, restriction to grazing lands, faulty livestock policies and other man made consequences. The number of camels is declining and camel breeds are at risk for extinction, especially in Asia. Scientific work on camel is often not connected to and relevant for the camel keepers.

However, every cloud has a silver lining. The global camel scientist community ISOCARD represents an important possibility for joint projects. Other networks like owners of biocultural protocols and national camel associations connect camel keepers. Camel friends need to work together and share ideas and support each other. The message about the diversity and capacity of the camel can then reach the policy makers.

A global review of camel productions and possibilities is urgent and requires pooling of available data on camel in a systematic and uniform manner. We present a pilot study with data and conclusions from contemporary and future camel production in three different countries.

49. Unexpected Rift Valley Fever Outbreak in Northern Mauritania Affects Camels, Small Ruminants and Humans

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End of September-beginning of October 2010 unprecedented rainfall created large ponds of water in the oases of the Saharan region of Adrar, Northern Mauritania. Such rains had not been observed for decades, and the locals refer to 1954 (locally known as the —year of the fever!) to describe similar events.

The climatic changes translated in unusual growth of vegetation, attracting shepherds and pastoralists from remote areas, including South and Southeastern regions of the country. It also favored the multiplication in high densities of several species of mosquitoes, mainly from the genus *Culex* and *Anopheles* (*Cx. Quinquefasciatus*, *An. Pharoensis*, *An. protoriensis*, *Cx. Poicilipes*, *An. gambiae*, *Ae. vexans*, *Cx. antenatus*, *An. rufipes*, *Ma. uniformis*, *An. Ziemani*.) including competent vectors for major arboviruses.

Few weeks after these rains, severe outbreaks of malaria and Rift Valley fever (RVF) were reported in several oases (—Graret Levrassl) of the Adrar region. Interestingly the first probable reportable case in livestock was a sick dromedary camel during the last week of October 2010 in the Aoujeft area, with symptoms evocating pasteurellosis. The herdsman slaughtered the animal before it died, but delayed the cutting up because of the remote location. Subsequently the meat was shared within the family, in which several people died with intestinal and hemorrhagic symptoms during the next few days. Testing for several pathogens was requested by the health authorities, including Crimean-Congo Hemorrhagic Fever and RVF, and results showed positive for the latter. While it is improbable that these people got infected through the consumption of meat – the virus is rapidly destroyed after maturation-, it is now obvious that the virus intensively circulated in this area at the given time.

Two weeks after this index case additional camel cases, abortion storms in small ruminants and human fatalities (hemorrhagic fever, icterus, nervous symptoms) were massively reported. At the end of December 2010, a total of 63 human cases, including 13 deaths, were officially reported, but the real number is probably much higher due to the remoteness of the affected area. First serological results indicate an IgM/IgG prevalence reaching 33% in camels and 44% in small ruminants, respectively. IgM was as high as 43% in Adrar, and even reached 54% in the Eastern Inchiri area 2 weeks after the index case in camel was observed. Interestingly, a significant number of camel samples showed positive RT-PCR results, while IgM ELISA and serum neutralization test were still negative, indicating an onset of infection.

50. Theories of the Dromedary Camel Entry Into Africa Based on the Archeological Evidence, A New Concept

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The proposed time of camel domestication is before 2000 B.C. (Ripinsky, 1985). The only domestication center for the dromedary could be mentioned is South Arabia at about the 4th millennium B.C. The suggested route of camel entry into Africa is either by the south route crossing the Red Sea, or the north route, crossing Sinai about 2200-2100 B.C., or by both routes.

Many archeological findings were discovered in Palestine, Negev Desert, Jordan, Syria, Iraq and Sinai, as well as Libya, Algeria and Morocco confirming the north route of camel entry via Sinai then it spread in North Africa. In Sudan, Somalia and Ethiopia as well as Yemen, Oman, Gulf area (Kuwait, Bahrain, Qatar, Abo-Zabi) and Saudi Arabia, many archeological findings and cave engravings and figures were discovered. This indicates the south route of camel entry into Africa and its rock drawing presence in the Arabia.

The presence of remnants of large-sized camels (*C. thomasi*) in Algeria (Zeuner, 1963), Negev desert (Grisson, 1983) and recently in Syria near the village of El Kowm (2006) may prove the north entry of wild camels into Africa at first where they have been subsequently tamed or died out. The domesticated camels entered Egypt after this period which may lead to support of the north route of camel entry via Sinai.

In conclusion; both the north and south routes of camel entry to Egypt were suggested. In addition, this paper suggests that the north route is the most probable route from which camels travelled to the east and southward up to the African horn. Therefore camels may have not needed to cross the Red Sea (in its wild form) from Yemen to Ethiopia.

Archeological findings of the dromedary in different countries:



Jordan

Syria

Iraq

Lybia



Egypt

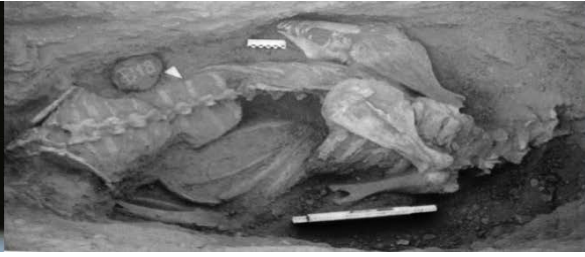
Algeria

Somali

Sudan statue



Yemen



Yemen



Oman



Negev Desert

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51. Camel Management and Utilization Pattern in Changing Socio-Economic Scenario of Arid Region Of India

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Introduction

Presently, draught camels face challenges like increased use of tractors which have gained importance in some areas, but much of sandy terrain farming and poverty of the population preclude this type of power application in the interior villages of the Thar desert. Moreover, increased cost of fuel, non-availability of spare parts in time in the interior village conditions, difficult maintenance and upkeep of tractor engines pose problems for farmers compelling them not to replace camel power with tractors. With the situation that the fossil fuel sources are depleting quickly, the role of draught animals for agriculture and allied operations continues to remain important. It is urged within the present day context to know the utilization patterns of camel and the challenges they face.

Materials and Methods

The quantitative and qualitative data were collected through interview, interaction and discussion with farmers, key informants, housewives and secondary sources. The selection of respondent was carried out from two districts (Hanumangarh and Bikaner) by using stratified random sampling technique based on camel population. From Bikaner district, 8 tehsils were selected and from each tehsil 3 villages were taken. In Hanumangarh district, 5 villages were selected. From each village 6 to 8 farmers were participated and total of 203 farmers were interviewed from 29 villages. The data were analyzed as per Snedecor and Cochran (1989). Chi-square test was applied on various aspects of feeding management systems and rearing practices of camel.

Results and Discussion Socio-

economic scenario

The analysis of data on socio-economic status of farmers indicated that mixed farming (55.48%) was practiced by the majority of respondents although 44.52% of respondents were opting animal husbandry as major occupation. Economic analysis on camel carting system indicated that overall total fixed cost of whole camel carting system was Rs. 5056/- which included interest on total investment, depreciation of cart, (junk value also considered @ 10%), depreciation of camel (salvage value was considered @ 12%), insurance on animal and cart (@ 5%) which included basic value, liabilities, 1% of average actual value of cart and an additional 5% service tax. The different components of variable cost on yearly basis included wages of operator, the expenses towards maintenance (feeding and health cover) of camel, repairing and maintenance cost of cart viz: subcomponents like repairing of tyre puncture, replacement of tyre and repairing/replacement of different body parts etc. The total expenditure and earning from camel carting system was Rs. 44126/- and Rs. 76545/-, respectively. The actual profit was Rs 32419/-. The pay back period (P.B.P) was 8.64 months. Finally benefit cost ratio (B.C.R) was 1.73 which indicated that camel carting in these region is advantageous for farmers. The Spearman's correlation test indicated that objective of camel rearing significantly ($P < 0.01$) differ between camel keepers and camel merchants. Camel selling and purchasing prices varied according to age, sex, body conformation and health condition. The average age of cart camel was 7.28 ± 4.19 year (Bhakat and Pathak, 2009).

Camel's merits and demerits in comparison to tractor system

Many advantages of camel system in comparison to tractor system were reported by respondents in various agriculture operations included camel requiring comparatively less maintenance cost (97.82%), protection of land fertility and its sustenance for longer time (95.65%). The farmers (93.48%) felt that camels were suitable to all type of works on all types of lands and camel ploughing enhanced the soil fertility. The respondents (82.61%) reported that comparatively less cost was involved in camel ploughing and whenever needed, camels were available and work can be done easily (70.65%). It was also reported (98.91%) that in less moisture arid soil, single attempt

seeding by camel was successful, so repeated seeding was not needed which ultimately reduced the cost of cultivation specially in case of cash crops like ground nut (*Arachis hypogaea*) cultivation in hot arid villages. The respondents opined that camels never harm the soil texture even during continuous use and camel manure was pivotal during cultivation activities (85.87%). The demerits of camel in comparison to tractor were also reported (73.91%) as it requires more time to complete the work, work difficulty, problems in meeting out feed cost, shrinkage of grazing / browsing land (96.74% respondents) and it was felt as a burden during the idle period. To resolve this it was suggested that camel work days need to be increased. For better work efficiency the camel of better body condition needed and work difficulty can be reduced by use of appropriate camel specific implements.

Advantages and demerits of tractor in comparison to camel system

Although tractors were used in many cases, majority of respondents (91.30%) reported that the tractors can finish the work quickly and there is less labour involvement (83.69%). On the contrary, many demerits of tractor in comparison to camel were perceived by farmers viz: high input cost requirement (73.91%). Most of respondents felt that tractor can harm to soil texture in continuous use (95.65%) because it hardens the land and it was not suitable for any type of land and work (96.74%). The low skill of operator (64.13%), its non availability during needed hours (53.26%), costlier fuel expenditure (68.47%) were reported as major demerits. Most of the respondents felt that in less moisture arid soil, single attempt seeding may not be successful, so repeated seeding by tractor increases the cost of cultivation (98.91%). Apart from this spare parts were not available in interior villages (46.74%) and quality of ploughing depends on the operator's skill. In India, various farming operations are carried out by manual, animal and mechanical power sources and animal power contributes about one third. Eighty-four million draught animals are used for crop production and transportation purposes (Cartman, 1994). The present degree of mechanized farming in hot arid region is selective. This situation prevents to use any labour saving equipment like tractors etc.

Though mechanization came into arid agriculture few years back, tractors are used by farmers of large categories but use by other categories of respondents is still very limited in hot arid regions. The results of this study amply demonstrated that average size of operational holdings on tractor-operated farms was substantially higher than those who use camel. Acquisition of tractor helps in timely accomplishment of farm operations. Despite of application of tractors in arid agriculture farming, camel power contributes substantially in hot arid villages. The value produced by draught animals in India would be over Rs 1000 billion whereas; mechanical sources of agricultural power depend on fossil fuel that has only limited life. According to current estimates, India's petroleum and natural gas resources may last 25-30 years and coal 130-140 years (Sastry and Thomas, 2005). So it calls for a viable solution to use the camel for dry land agriculture.

Rearing practices for draught camel

Investigation on camel keeping pattern and the observations on feeding management practices indicated that the practices varied as per number of animals at household. The analysis of observation indicated that the farmers who are maintaining 1 camel, (88.64%) of them fed at household level farmers having 2 – 4 camels, majority of them fed their camel at household level along with 6 to 9 hrs grazing/browsing at backyard area whereas farmers having more than 4 camels, majority of them fed their camel in extensive management practices. The Chi-square test indicated that the camel keeping pattern significantly ($P < 0.01$) influenced feeding management practices of these study areas.

Conclusion

The results indicated that with greater advantage and lesser cost of the camels were useful to perform the arid agricultural operations than when it was done by using the tractors. Major constraints with camel were more time consumption shrinkage of grazing land and feeding management. Use of camel in farming may be advantageous and beneficial for small and medium farmers who are in majority numbers in India. When farmers can meet out proper feeding management practices by their own source of feed then camels are better than tractor, especially for small and medium farmers for dry land agriculture. Hence suitable measures needed to be taken to conserve the indigenous camel with proper feeding management in the changing socio-economic scenario.

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52. An Epidemiological Study of Internal Parasites and Trypanosomiasis in Camels in Gedarif and Kassala States of Eastern Sudan

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Introduction

The camel population in the Sudan is estimated at about 3.039 million head, of which 831 thousands are in the States of Eastern Sudan (Sakr and Magid, 2002). Camels are the basis of a subsistence economy to a large sectors of pastoralists and are kept majorly for their milk, hair and transport capacity. At present the camels contributes 30% of the total foreign currency earnings generated by the animal wealth exports. Camel trypanosomiasis and other parasitic infections i.e Haemonchosis are considered to be the main disease constrains that affect the health and production among all producing animals including camel (Arzoon *et al*, 1984 ; Agab and Abbas, 1998).

The present epidemiological study was undertaken to know the prevalence of camel trypanosomosis and internal parasites in camels in Gedarif and Kassala States of Eastern Sudan.

Material and Methods

This study was conducted in two major camel producing areas of Eastern Sudan viz: Gedarif, and Kassala states. The basins of many seasonal streams and their tributaries are good grazing areas for camels. The main camel owning tribes in Kassala are the Hadandawa and the Rashaida tribes and all of them own both Bishary and Arabi types of camels. The camel owning tribes of Gedarif State are the Shukriya, Lahawiyeen, Kenana and Ruffaa tribes.

Blood samples from 580 randomly selected camels were collected by jugular venipuncture and microhaematocrit centrifugation technique (MHCT) was conducted in all the samples. A total of 328 faecal samples were collected at random directly from the rectum of camels from different herds of the both the states and further they were examined by the floatation and sedimentation and faecal culture techniques. (Burger and Stoye, 1983).

Results

The results of internal parasites and trypanosomosis infection rates in eastern states are shown in Figure (1) and Table (1).

Discussion

The present epidemiological study was conducted in camels belonging to different migratory groups in Kassala and Gedarif States. Historically, camel trypanosomosis is known to be the most dreadful disease by the camel owners and in untreated camels mortalities used to exceed 90% (Knowles, 1927). In this study, the Trypanosome infection rate in both dry and rainy season were low which may be due to insensitivity of diagnostic method used to detect low parasitaemias which characterize the disease situation in the field. Rihab Yagi (2007) reported the wide spread of drug resistant *T.evansi* stocks to both quinapyramines and melarsoprols in Kassala and Gedarif and that treatment with trypanocidals gives clinical cure but the parasitaemias remain at very low levels. This result was supported by the work of Croof (2008) who found similar *T. evansi* prevalence rates among camels of Gedarif State using conventional methods, but when he examined the same animals with PCR the infection rate was higher (90%).

In this study the high trypanosomosis prevalence was observed in the rainy season, a period which usually coincides with peaks of biting flies abundance, particularly Tabanids and high trypanosomosis prevalence as well. Therefore, the low disease prevalence might be a result of the good nutritional status of animals at the time of the survey, due to the good pasture conditions.

The expansion in the mechanized rain fed agricultural projects, together with the establishment of Rahad and khasmalgirba irrigated agricultural projects, affected the movement of the camel owners in Eastern Sudan, the camels changed from tree browsers to grass grazing. Parasitic diseases like Schistosomosis, Coccidiosis started to be a real problem in camels (Majid *et al*, 2000).

Infections with internal parasites were found to be high during the rainy season. The effect of internal parasites and the economic losses they cause in camel production in Gedarif State (Butana) was previously studied by Agab and Abbas (1998), Arzoon *et al* (1984) and Abdel Ghaffar *et al* (1984). Fadl *et al* (1992) also studied the prevalence of gastrointestinal nematodes in Butana area and their results were in line with the results obtained from this study. Higher PCV values were obtained from camels examined during the rainy season in Kasala State when compared to that in the dry season. This might be due to the good pastures available in the rainy season and also to the relatively low parasitic burden of internal parasites during this season. Higher PCVs values were observed in Gedarif State during the dry season where most of the camel owners keep their camels in post harvest products. During this period both internal parasites and trypanosomosis prevalence were low and this might be the reason for this improvement in the general condition of the herd. Holmes *et al* (2000) related the disease prevalence of animal trypanosomosis mainly to the level of nutrition of the infected animals.

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Fig (1): Comparison of Parasitic Burden of Camels in Kassala and Gedarif States During the Dry & the Rainy Seasons

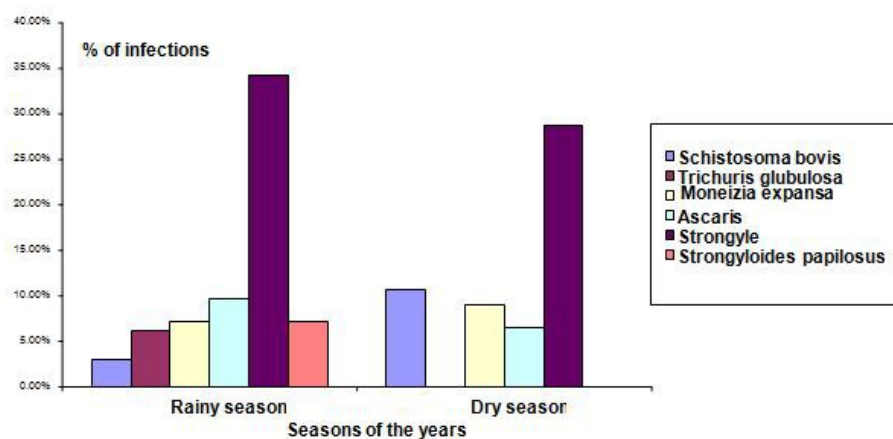


Table 1: *T.evansi* Prevalence Among Camels in the Eastern States During the Rainy and Dry Seasons:

Rainy season	No. exam	No. +ve	Prev (%)	Dry Season	No. exam	+ve	- ve
Fashaga (Showak)	144	3	2.1	Kasala	89	0.0	0.0
Hamoshk oraib	256	1	0.6	Gadarif	99	1	1%
Total	400	6	1.5	Total	188	1	0.5%

53. camel Production and Management in Selected Areas of the Somali Region, Ethiopia

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Introduction

Livestock contribute 15 to 17 percent of GDP and 45 percent of agricultural GDP, and 37 to 87 percent of the household incomes in Ethiopia (Sintayehu *et al*, 2010). The population of camels in Ethiopia is close to 3 million heads and of these nearly 60% are found in Somali region. Camel is the source of livelihoods and income for millions of pastoralists and agro-pastoralists in Ethiopia. The camel market chain (Yacob and Catley, 2011) has impacted the livelihoods of tens of thousands of pastoralists, agro-pastoralists, farmers and traders living in diverse agro-ecological zones. With the growing impact of climate change, pastoralists who never owned camels are now diversifying their herd by introducing camels. However, little work has been done so far at research, teaching, and development to support camel production in pastoral production systems. There is a welcome trend at present, in terms of government commitment to support camel production as evidenced by the establishment of regional camel research center in Somali region, and the Institute of pastoral and agro-pastoral studies in Haramaya University. This study is a contribution to the national efforts to build the knowledge base in understanding the production of camels under the traditional management.

Materials and Methods

The study was conducted in two districts of Somali region-Babilie and Kebribeyah. The objective was to generate baseline information on the camel herd size, herd structure and camel herd production and management parameters, under the traditional management. The method of data collection employed was a single-visit-formal-survey. The data were analyzed using Statistical Package for Social Sciences (SPSS).

Result and Discussion

The mean family size in the study area was found to be 5 and 4 for Babilie and Kebribeyah districts, respectively. All respondents from the study area were agro-pastoralists, and migration is common to all. There are distinct locations in respective district where herds move in search for forage, water, and mineral lick. The ownership right to camels was variable with one district depicting male ownership, whereas, in the other, both males and females shared ownership right. The major sources of household income were sale of camel milk, charcoal and firewood. The mean camel herd size was 14 and 20 for the two districts. The male to female ratio of camels was found to be (1.25, 0.88) for the age group less than two years old, (1.27, 1.23) between two and four years old, (1.23, 0.43) greater than four years old camels respectively. A similar result was obtained by Ishag and Ahmed (2011) that the percentage of matured camels found to be 45.8% for females and 3.1% for the males respectively. From our data we can draw a conclusion that Babilie district respondents depend on camel as a source of traction power, but in Kebribeyah camel was kept as a source of milk. Respondents own diverse species of livestock and camels predominate.

Most respondents in Babilie district (88%) herd their camels separately (milking camels; and dry she-camels with the rest of the herd) irrespective of season, whereas in Kebribeyah district (48.3%) herding depends on season, *i.e.* during wet season, they herd all camels in one, but separately during dry season. Camel feed solely depends on grazing/browsing, and there is limited provision of supplemental feed. According to respondents, the source of water for camels is mainly well-water, and the distance of watering points from grazing area for well-water users, was greater than five kilometers.

There was no special management for breeding bull in both districts. Respondents in Babilie (80%) and Kebribeyah (90%) districts used one breeding bull for the entire herd. Those who have no

breeding bull use their relatives' bull free of charge. The mean age at first mating for male and female camels was 6 and 5 years respectively. According to respondents, a breeding camel bull can cover on average of 12 female camels per day. The average life span of camels, according to key informants, was reported to be between 25-30 years, and the average number of camel calves during its productive life was reported to be 10. Mean weaning age of camel calves were found to be between 8 to 9 months. The mean weight of camels for Babilie district was 435.23 and 377.96 kg; whereas in Kebribeyah district it was found to be 407.34 and 401.70 kg for male and female camels, respectively. Estimated mean daily milk yield was reported as 5.69 and 3.82 liters in the wet and dry seasons respectively. Milking frequency ranges between two and three times a day. During the study period camel calf death rate ranged from 7-20 for Babilie; and 23- 57 for Kebribeyah district. The reported production levels are being constrained by variable factors. These as reported by the herders include fertility problems, diseases, lack of social services, deforestation and loss of browse species, and lack of water. Others like lack of mineral water, marketing problems, conflicts and drought were also noted as requiring attention.

Conclusions

The camel will continue to play a significant role not only in supporting livelihoods of pastoral and agro-pastoral systems, but also as a source of income to pastoral households and the national economy. The Camel can contribute into the projected livestock export income in the Growth and Transformation Plan (GTP) of the Federal Democratic Republic of Ethiopia, but a lot of work is needed to overcome the major constraints of production, particularly emerging camel diseases that if left unattended can pose a threat to the lives and livelihoods of pastoralists and agro-pastoralists in Ethiopia. Given the emerging trend of increased frequency and severity of drought and the changes in the natural resources base in some pastoral areas of Ethiopia (increased bush encroachment and prevalence of woody species), camels are being introduced into the herd. This requires building the capacity of new camel herders through mentorship by skilled pastoral herders. In view of the growing camel market as well as the camel milk marketing, efforts need to be exerted on bringing efficiency into the market, as well as adding value to camel milk products and ensuring quality milk handling during transit to terminal markets. This study contributes to the possible interventions along these can only be realized when baseline data is available on the current state of camel production and management.

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54. Camel Research Status and Future Research Strategy in the Somali Regional State of Ethiopia

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Background

The Somali National Regional State (SRS) is the second largest Federal state of Ethiopia, covers the eastern and south-eastern arid and semi-arid area of the lowlands, which lies between 4⁰-11⁰ N'L' and 40⁰-48⁰ E'L'. It borders Oromiya, Afar, Djibouti, Kenya and Somalia. The region's landmass encompasses a total area of about 300, 000 km² is administratively divided into 9 zones and 67 districts. The region has two generalized major climatic zones; hot arid and hot semi-arid. In the Somali Regional State, agriculture is the most important economic sector. Livestock production is the dominant sub-sector, and most of the inhabitants obtain their subsistence and other requirements directly or indirectly from this sector. Nomadism and transhumanism are the main livestock production systems while agro-pastoralism is also practiced in the nearby highland districts and river valleys.

Material and Methods

Past camel research results published by Somali Pastoral and Agro-Pastoral Research Institute and Haromay University were reviewed. In addition, the camel research strategic plan of the region was also reviewed.

Result and Discussion

Past research achievements

The newly established Camel Research Center carried out different camel research activities. A summary of these are organized and presented hereunder. Camel (*Camelus dromedarius*) is highly adapted domestic animal to arid and semi-arid environment. According to the Investment Office of the Somali National Regional State, the population of camel is estimated to be 2.032 millions. Information's on behavior and plant preference and quality of forage selected by dromedary camels were also generated in Babile area of the Somali State (Kebebew, 1998; Moges, 2001). On average browsing/grazing was found to be the dominant daytime activity occupying between 59-69% in both seasons followed by waking, resting, and ruminating and other activities.

Some herd and individual growth rate of camel's data had been generated in Babile district (Zelege and Bekele, 2001). The findings indicated that the average annual herd growth and commercial offtake rate of camels monitored for two years were 10.66% and 4.65%, respectively. Regarding the individual growth of camels, female immature camels (1-4years old) showed significantly ($P<0.01$) higher daily weight gain (59.40 ± 0.61 g/d) than male camels of the same age (33.24 ± 0.50 g/d). Concerning camel reproduction information have been generated on puberty age, sign of heat, pregnancy and gestation in Afder zone (Ahmed Sh Mohamed, 2001) in Ogaden area (Abebe, 1991) in Shinille area (Bekele and Getu, 1998, Tezera and Beley, 2000, Melaku and Feseha, 2001) in Babile (Zelege and Bekele, 2001). The annual calving percentage, number of services preconception, open days and abortion rates for the camels herd in Babile (Error) were 42.7%, 1.4 ± 0.1 , 162.8 ± 7.9 days and 12.1%, respectively. Age at puberty, Age at first calving, calving interval, calving rate, calf mortality for Shinille camel herds were reported to be 4 years, 5 years, 2 years, 50% and 50%, respectively. Similar findings were reported from Afder and Ogaden area of the Somali State. The milk production performance, the effect of party, season of calving, calf death, and lactation characteristics of camels has been studied by a number of investigators in the Somali Region (Abebe 1991, Kebebew and Baars, 1998, Baars 2000, Tezera and Hans, 2000, Zelege and Bekele 2001, Melaku and Fesaha, 2001, Ahmed Sh Mohamed 2001, Bekele *et al.*, 2002). The milk yields of camels was 8-10, 7.5, 2.9-5.5, 4.14-6.77, 4-5 kg/day in Ogaden, Error, Afder, Babile and in Shinille and Jijiga, respectively. Preliminary information on the meat production, processing and utilization of

camel meat in Shinille and Jijiga zone were reported (Tezera and Belay, 2000). The mean live weight for adult male and female camels was 486 ± 81.3 kg and 427 ± 62.2 kg and 384 ± 80.8 kg and 326 ± 62.9 kg for Jijiga and Shinille, respectively. Information on the epidemiology, pathology, clinical signs and treatment response of the new camel respiratory disease were responded in Shinille (Bekele, 1999).

Research Gaps and Strategy

The research activities were prioritized as follows: the gaps in breeding, production, reproduction, husbandry and management, health, nutrition and socioeconomic and processing will be addressed and the strategy approach likely to contribute to improved research co-ordination and to enhance research that will be conducted through short-term, medium and long term plan in the future will be addressed.

Conclusion

There had been attempts to study camel marketing in the region but more studies on camel and camel product market value chain is required. Different experiment should be conducted to study the effect of supplementation with protein or energy sources on milk yield in lactating dromedary. Moreover further camel research should be conducted based on the research thematic area of the region.

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Meat and Products

55. valuation of Camel Crossbred (*Dromedarius* and *Bactrianus*) Carcass Traits

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Introduction

Food production in arid and semi arid regions is critical. The camel is an animal that has adapted to live in harsh region and is a good meat producing animal. Iran has wide spread desert regions, with limited rangeland and low annual rainfall. It is necessary to pay attention to the food supplies for the growing human population in these regions. Recently, the world consumption of camel meat has increased. The population of one humped and two humped camels in Iran is 150,100 heads respectively. This study was conducted to characterize the quality of male and female crossbred camel (*Dromedarius* and *Bactrianus*) carcasses (Figure 1). Limited studies have been conducted on the breeding and crossbreeding of camels. Asadzadeh (2008) compared the fattening performance of native dromedary and crosses of dromedary and bacterian camels and showed that there was no significant differences between the two groups for average daily gain, average feed conversion ratio and average slaughter weight ($P>0.05$).

Material and Methods

Eleven male and female crossbred camels of 20 months of age were evaluated in complete randomized design experiment. Camels were slaughtered and carcasses kept in the cold storage room at 4°C for 24 hour. Percentages of meat, bone, fat and meat to bone ratio (M/B) in six regions of body: leg, shoulder, breast, loin, flank and neck were measured. Analysis of variance was performed using a general linear model (GLM) of SAS package (1995). Differences between means were tested using Duncan's new multiple range test.

Result and Discussion

There was no significant difference in the carcass traits between male and female crossbred camel (Table 1). The average percentage of meat, bone, fat and the meat to bone ratio (M/B) in crossbred camel carcasses were 57.6 ± 1.77 , 23.3 ± 1.30 , 13.2 ± 1.19 and 2.7 ± 0.16 respectively. Yousif (1989) indicated that meat, bone and fat percentage were 56, 19 and 13.7 respectively. Leg and flank had the highest (69.0 ± 1.77) and lowest (38.5 ± 1.77) percentage of meat respectively. The highest bone percentage was 34.7 ± 1.30 in breast. The highest (46.1 ± 1.19) and lowest (0.8 ± 1.19) percentage of fat were in flank and neck respectively. The ratio of meat to bone was 3.1 ± 0.16 and 2.8 ± 0.16 in leg and shoulder respectively.



Figure 1- crossbred camel (*Dromedarius* and *Bactrianus*)

Table 1: Carcass characteristics of crossbred camels

Factors		Meat %	Bone %	Fat %	M/B
Sex	Male	57.5±1.02	23.6±0.75	12.7±0.69	2.7±0.09
	Female	57.7±1.02	23.1±0.75	13.8±0.69	2.7±0.69
Cuts	Neck	67.4±1.77 ^a	21.8±1.30 ^b	0.8±1.19 ^c	3.2±0.16 ^a
	Shoulder	64.9±1.77 ^a	23.1±1.30 ^b	9.3±1.19 ^{bc}	2.8±0.16 ^a
	Loin	51.9±1.77 ^b	26.3±1.30 ^b	12.7±1.19 ^b	2.0±0.16 ^b
	Flank	38.5±1.77 ^c	12.0±1.30 ^c	46.1±1.19 ^a	3.2±0.16 ^a
	Breast	54.0±1.77 ^b	34.7±1.30 ^a	7.2±1.19 ^{cd}	1.7±0.16 ^b
	Leg	69.0±1.77 ^a	22.1±1.30 ^b	3.3±1.19 ^{de}	3.1±0.16 ^a
	Carcass average	57.6±1.77	23.3±1.30	13.2±1.19	2.7±0.16

* a,b,c,d,e Within columns, mean without a common superscript differ at p<0.05

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56. Evaluation of Carcass and Hide Production from Camels

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Introduction

Different technical reports have shown that camel is an animal that can easily adapt to the harsh conditions of dry and semi dry regions. Not only it can have good production, but it also plays a major role in improving peoples conditions (Katemi, 1990). The economical value of hide, leather products and their by-products appear to be highly valued in addition to meat production (FAO 2010).

Unfortunately, very few studies have been carried on other camel products. The objective of this study was to evaluate the effect of sex on the hide, carcass and body weight of camel.

Material and Methods

In this study, 14 Iranian male and female Dromedary camels were slaughtered at the age of 21 months. The fresh hides were weighed. The salted hides were placed in the shade (15°C and 50 % humidity for 30 days) for drying. The extra salt was removed through shaking and the dry salted hides were weighed. During and after tanning processing the crust weight, grain leather weight and leather size were measured. Data were analyzed statistical using General Linear Model (GLM) (SAS, 2002).

Results and Discussion

The overall results of this experiment are shown in Table 1. A wide range of live and carcass weights has been reported for camels in literature, but these traits depend on age, sex, environmental conditions and general health of the animal (El Amin, 1979). The average live weight of camels was 279 kg at 13 months and 339 kg at 21 months.

Even though yearling weight was affected by sex ($P < 0.05$; Figure 1), previous studies indicated no marked sex differences on live weight at early ages. At older ages males were significantly heavier than females (Kadmin *et al*, 2008).

The data obtained in a study indicated that the males were heavier than females. The growth rate of males was higher than the females.

The ranges of warm and cold carcass weight were 168.4 – 291.0 and 165.1 – 286.7 kg, respectively and were influenced by sex ($P < 0.05$; Figure, 1). The average carcass weight of 187 to 220 kg has been reported for Iranian camels (Khodai, 2001).

Table 1: Summary of unadjusted means and range on measured characteristics of camels

Characteristics	Mean \pm SE	Cv	Min	Max
Live weight (13 month old)	279.0 \pm 11.1	14.9	201.50	347.0
Slaughter weight (21 month old)	339.1 \pm 9.8	10.8	286.0	400.0
Warm Carcass (kg)	211.5 \pm 8.33	14.7	168.4	291.0
Cold Carcass (kg)	206.1 \pm 8.2	14.9	165.1	286.7
Wet hide weight (kg)	30.7 \pm 0.9	11.9	23.7	37.5
Dry hide weight (kg)	20.2 \pm 1.2	22.7	12.7	27.0
Crust Weight (kg)	13.6 \pm 0.3	9.4	11.9	15.7
Leather weight (kg)	3.65 \pm 0.09	10.9	2.9	4.2
Leather size (sqft)	25.2 \pm 0.8	11.7	20.4	30.3

The skin weight and skin surface area of males and females also increased with age but the rate of increasing was smaller than that for body weight (Al-Jassim and Al-Saigh, 1999). Although there were differences in the weight of fresh and dry hides, with respect to sex, but there were significant differences ($P < 0.05$) in weight. This was not observed in the leather weight of the two sexes (Figure, 2).

There were a positive correlation ($r= 0.4$ to 0.6) between yearling weight and slaughter and wet weight of hide. The correlation between slaughter weight with wet and dry weight of hide, and with leather weight were positive ($r= 0.4$ to 0.8). The wet weight of hide and dry hide, leather weight were highly relative ($P<0.001$). There was small negative correlation between the leather size and slaughter weight, carcass and skin weight.

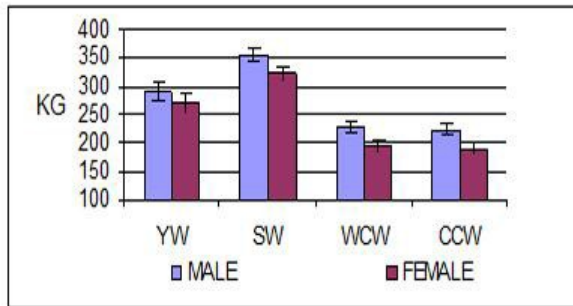


Figure 1. Effect of sex on yearling weight (YW, kg); slaughter weight (SW, kg); warm and cold carcass weight (WCW and CCW, kg) of Dromedary camel

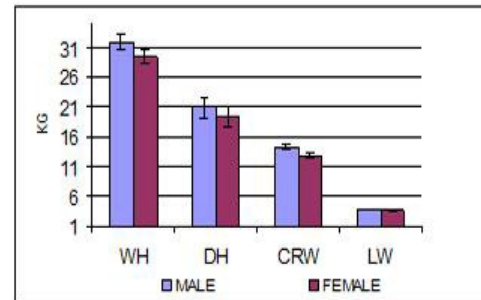


Figure 2. Effect of sex on wet, dry, crust and leather weight (WH, DH, CRW and LW, kg) of Dromedary camel.

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57. Comparison of Carcass Yields in Two Algerian Camel Populations: The Targui and The Sahraoui

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Introduction

Algeria has not yet come to evaluate the camel as a source of protein, despite the shortage of red meat, in particular in the Saharan regions. However, the consumption of camel meat is negligible at the national level (4.2% of total red meat consumed). It remains important in the Sahara since the camels contribute 33.02% of all red meat slaughter. Despite many constraints, the Algerian camel remained closely linked to camel owners in spite of the hard life in rural Sahara. Camels uses for other aspects (transport, hair, etc.) have fallen sharply with the modernism in the Saharan regions. The objective of this study was to determine the yield of the carcass in two populations of camels among the largest camels in Algeria: the Sahraoui and the Targui.

Materials and Method

The live weight of camel was calculated using the formula (Boué, 1949) used for camels in Algeria:

$$P = 53 \times CT \times CA \times HG$$

P = body weight

CT = chest circumference (m)

AC = abdominal circumference (m)

HG = height at the withers (m)

Carcass weight was determined in both abattoirs (Ouargla and Tamanrasset) representing five age groups (3-4 years, 5-6 years, 7-9 years, 10-12 years and more than 12 years) consisting of ten male camels for each group.

To determine the weight of the carcass, we have the addition of the weights of separate parts forming the frame (9 for cutting Tamanrasset and 7 to that of Ouargla).

Results and Discussion

The result showed that carcass weight was depending on camel's age of 52.14% for the age group 3-4 years to 54.18% in the third age category 7 to 9 years. The range of carcass will be varied from (Table 1).

Table 1: Performance of the carcass according to age among the Targui

Category	Age (years)	The carcass yield (%)
01	3 to 4	75.18
02	5 to 6	75.29
03	7 to 9	72.51
04	10 to 12	71.42
05	>12	66.66

As for the Sahraoui dromedary, the results had rates ranging from 75.18% in the first age group (3-4 years) to 75.29% age group of 5 to 6 years. The average yield of the carcass for the five age categories in Targui was 53.32% while 72.21% for the Sahraoui.

Table 2: Performance of the carcass according to age among the Sahraoui

Category	Age (years)	The carcass yield (%)
01	3 to 4	52.14
02	5 to 6	53.33
03	7 to 9	54.18
04	10 to 12	53.69

The differences between the yields of carcass in both breeds studied were significant with an ideal age for slaughter in 7-9 years the Targui and an earlier age in the Sahraoui (5-6 years). In accordance with the present studies, 53.5% was the average yield of the carcass for animals older than 5 years and 51.4% for Sudan (Wilson, 1978). El-Gasim and El Hag (1992) found that in Saudi Arabia camel, the carcass yield was 52.1% for Majaheem and 56.1% for Hamra. High feeding camel produce 61.:31 carcass yield in Tunisian camel aged 3 (Kamoun, 1993).

Among the Targui dromedary, there was no much variability in the carcass from one category to another where the difference between the maximum yield and minimum yield is about 2.04% in contrast to Sahraoui dromedary, which recorded a difference of 8.63%.

Conclusion

This study concluded that the optimum age for slaughtering camels were 7-9 for the Targui and 5-6 years for the Sahraoui.

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58. pH Measurement of Six Muscles of Bactrian Camels (*Camelus bactrianus*) From Kazakhstan

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Introduction

The camel is one of the most fundamental pillars of the national economy and the food security of arid and semi-arid regions. Camels can provide human with high quality meat.

In Kazakhstan, three types of camels are available (Bactrian, Dromedary and their hybrids), the Bactrian is predominant (80% of the 148,000 heads) and used for meat and wool productions. The demand for camel meat appears to be increasing due to health reasons, as they produce carcasses with less fat as well as having less cholesterol and relatively high polyunsaturated fatty acids than other meat livestock (Kadim *et al.*, 2008).

The ultimate pH of muscle is regarded as one of the important parameters affecting meat quality and largely dependent on glycogen content. Meat quality parameters of Bactrian camel received little attention and marketing system for camel meat requires more information on muscle pH values of various muscles due to its effect on quality parameters. Identification quality characteristics of individual camel muscles will increase the demand for their products. The objective of this study was to determine ultimate pH of *infraspinatus*, *triceps brachii*, *longissimus thoracis*, *biceps femoris*, *semitendinosus*, and *semimembranosus* muscles.

Materials and Method

The *infraspinatus*, *triceps brachii*, *longissimus thoracis*, *Biceps femoris*, *semitendinosus* and *semimembranosus* muscles were removed from the left and right sides of three year-old Bactrian camel carcasses within 20 min postmortem. Samples were kept in the chiller (1-3°C) for 48 hrs. The pH of the six muscles was monitored using a portable pH meter (Hanna waterproof pH meter, Model Hi 9025, Italy) fitted with a polypropylene spear-type gel electrode (Hanna Hi 1230) and a temperature adjusting probe. pH measurements were recorded at 40 min, and 2, 4, 8, 24 and 48 hrs post-mortem. The general liner model, ANOVA procedure within SAS (1993) was used to compare the six muscles on pH values.

Results and Discussion

Average pH time curves for six muscles are presented in Figure 1. Small variation in pH values between six muscles might be due to variation in muscle fiber types, which contributed in differences in patterns of muscle metabolism (Swatland, 1982), and consequently differences in ultimate pH value. Changes in glycolysis within time postmortem were monitored by measuring the rate of pH fall after slaughter, and post-mortem time taken by muscles to reach a pH of 6.0. After a relatively fast fall within the first two hours, the mean pH values underwent a slow decline until an ultimate pH at 48 hours post-mortem. These findings are in accordance with those of Kadim *et al.*, (2009) a fast decline in pH within the first 3-4 hours in meat from camels. The time needed for muscle pH values to reach 6.0, is a reflection of rigor onset. In the present study, the time to pH 6.0 ranged from 2.00 to 2.30 hours (Figure 1). Reduction of the time required for muscles to reach pH 6.0 is of very practical importance. The ultimate pH values across the selected muscles were ranged from 5.5 to 5.8. The muscle *semimembranosus* had lowest pH value at 12 hrs postmortem, while *Infraspinatus* had the highest value. The difference between the two muscles appeared more obvious. Respectably, the ultimate pH of *semimembranosus* was 6.07 after slaughter, in contrary, the muscle *semimembranosus* pH was 6.83 this indicated that under the same conditions locations of muscles effect on the pH value of muscles. Other muscle's pH decline was similar.

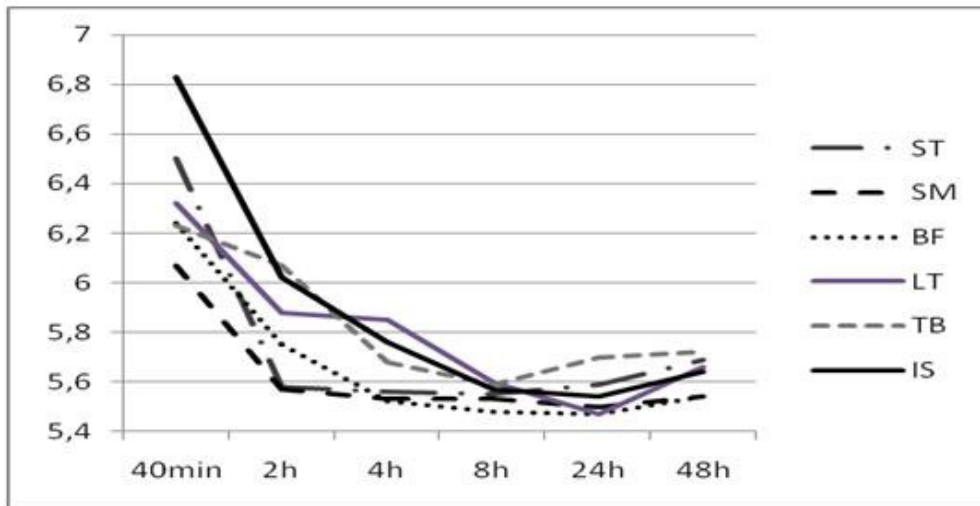


Figure 1. Mean changes in pH within infraspinatus (IS), triceps brachii TB), longissimus thoraces (LT), biceps femoris (BF), semitendinosus (ST), and semimembranosus (SM) muscles in carcass from Bactrian camel.

In conclusion, muscle locations had a small effect on decline pH. The decline in pH of the Bactrian camel muscles had similar pattern to those of the dromedary camel.

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59. Effect of Feed Intake on Composition of the Arabian Camel (*Camelus dromedarius*) Muscles

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Introduction

The one humped camel is found in the semi-arid and arid regions of the world. Camels are able to survive under harsh environments, due to their unique morphological and physiological features. Camels can produce high quality food at comparatively low costs under extremely harsh environments (Yousif and Babiker, 1989). They also play an important role as meat producers in developing countries due to the versatile role, rather than as a symbol of social prestige which has declined (Dawood and Alkanhal, 1995). Camels are considered as a good meat source which yields heavy carcasses (Kadim *et al.*, 2008a). Management systems play a significant role in camel growth and production. These include environmental conditions, composition and size of the herd and the way camels are raised either alone or mixed with sheep, goats and cattle (Bakhiet, 1999). Camel management should consider production patterns on feed availability and production target, such as increased milk production, prolonged lactation, herd growth, reproduction and meat production (Hashi *et al.*, 1995). The demand for camel meat appears to be increasing especially in arid regions (Kadim *et al.*, 2006). The chemical composition and meat quality of camel are influenced by age and anatomical locations within an animal (Kadim *et al.*, 2006, 2009). The aim of this study was to evaluate the meat production and performance under intensive management.

Materials and Methods

Visible fat was removed from the muscle samples and then placed in plastic containers and dried in an Edward's freeze dryer (Modulyo) for five days under 100-mbar pressures at -50°C. They were ground to a homogenous mass in a grinder for chemical analysis. Dry matter, crude protein, fat content and ash content were determined according (AOAC, 2000).

The data were analyzed using analysis of variance procedure (SAS, 1993). Significances between means were assessed using the least significant-difference procedure.

Results and Discussion

Camel muscle composition varied according to age, type of muscles, and nutrition. In the present study the mean moisture values was within the range of values reported by Al-Owaimer (2000), Kadim *et al.* (2006; 2008b) and Suliman *et al.* (2011). However, these values were lower than values (78.3%, 79.6%) reported by Naser *et al.* (1965) and El-Kadi and Fahmi (1985), respectively. The *Triceps brachii* contained (77.7%) moisture similar to that reported by Kamoun (1995 a,b) for the same muscle but higher than values reported by Babiker and Yousif (1990). We found that the higher value of *semitendinosus* muscle moisture was 75.4% which was lower than value reported by Kamoun (1995 a,b) and same as value reported by Babiker and Yousif (1990). *Longissimus thoracis* muscle contain moisture of (73.8%) with in the same range values reported by Babiker and Yousif (1990) and Kamoun (1995 a,b) but higher than values reported by Kadim *et al.* (2006; 2008b). These variation may be because of age differences, pre-slaughter handling, types of feed and management.

In the present study there was a variation in fat content between muscles, and average values were similar to that reported by other studies (6.0 to 7.9%) which lower than values recorded by Kadim *et al.* (2006; 2010) (10.5%) and Kamoun (1995 a,b) . Suliman *et al.* (2001) reported a mean fat value for different breed ranged from 3.5 to 4.8%. Kadim *et al.* (2006 and 2008b) reported a mean fat value of 6.4% and 4.4% for *longissimus thoracis*, respectively; which is lower than 7% reported by Dawood and Alkanhal (1995). El-Faer *et al.* (1991) and Elgasim and Alkanhal (1992) recorded slightly higher values, whereas Cristofaneli *et al.* (2004) reported lower values (0.5-1.43%). The lower values of fat content was reported in *triceps brachii*, *semimembranosus* and *biceps femoris*, 1.93%, 2.49%, 2.51%, respectively. These results were in line with finding by Kamoun (1995 a,b) for *triceps brachii*. For the *semitendinosus* muscle these authors reported lower values (2%) than our finding (6.89%-3.10%). These results and fat content variation indicates that camel deposit more fat when get

older. The present results indicated that type of feed has a significant effect on fattening animals and raising camel under intensive management may deposit more fat than animals moving for long distances.

In the present study the values of ash ranged between 0.75 to 1.18%, which was lower than values 4.4% reported by Kamoun (1995 a,b) and the same as values reported by Naser *et al.*, (1965). Ash content in camel meat ranged between 1.1 to 1.5% (Al-Owaimer, 2000; Kadim *et al.*, 2006, 2010; Suliman *et al.*, 2011). In the present study the ash values was within the range reported for other animals. There was no significant difference in ash content between muscles. These findings are in line with those reported by Dawood (1995) for different cuts (chuck, ribeye and leg).

In the present study the value of protein for *longissimus thoracis* muscle ranged between 18.78 to 19.09% was similar to values reported by Kadim *et al.* (2008a), but slightly lower than values reported by Babiker and Yousif (1990), Kadim *et al.* (2006, 2010) and Elgasim and Alkanhal (1992). Protein content in camel meat ranged between 19.4 to 24.5% (Al-Owaimer, 2000; Kadim *et al.*, 2006; 2008b; 1986; Suliman *et al.*, 2011). Protein content for the *semitendinosus* muscle in the present study was in the same range of values reported by Babiker and Yousif (1990), but for *triceps brachii* muscle was higher. There were significant variations in protein content between the six muscles are in line with findings by Herrman and Fischer (2004). The latter authors found that the shoulder and top-side muscles had higher protein content than *longissimus thoracis* muscles. The differences might be due to functions of individual muscle. The locomotive muscles need more than postures (support) muscles nutrients.

In conclusion, meat moisture, protein, and fat% were significantly ($P < 0.01$) different among muscles. There were significant differences among muscles in unsaturated, mono-unsaturated, poly-unsaturated fatty acids and ratio of saturated to total fatty acid. Feeding levels and type of muscles had significant effect on iodine number. This study indicated that intensive management had a small effect on meat composition of muscles. Variation among muscles may be due to different functional properties according to their locations.

Table 1: Effect of nutrition on proximate composition (wet basis) of six muscles from Omani camel.

%	Level of feed intake ²																		Significance ⁴		
	(1.5%)						(2%)						(2.5%)								
	Muscle ¹																				
	IS	TB	LT	ST	SM	BF	IS	TB	LT	ST	SM	BF	IS	TB	LT	ST	SM	BF	SEM ³	Treat	Muscle
Moisture	63.0 ^a	74.3 ^b	62.7 ^a	73.0 ^b	69.2 ^{ab}	67.2 ^{ab}	73.3 ^b	73.1 ^b	69.6 ^{ab}	72.5 ^b	72.5 ^b	69.1 ^{ab}	73.2 ^b	77.7 ^c	73.8 ^b	75.4 ^{bc}	63.0 ^a	74.3 ^b	2.25	***	**
Protein	20.8 ^b	23.5 ^c	18.8 ^a	22.8 ^{bc}	23.3 ^c	18.7 ^a	20.6 ^b	19.0 ^{ab}	19.1 ^{ab}	20.3 ^b	23.3 ^c	19.1 ^{ab}	18.2 ^a	17.1 ^a	19.0 ^a	18.5 ^a	22.1 ^{bc}	20.8 ^b	1.03	**	**
Fat	7.0 ^{bc}	3.2 ^{ab}	6.0 ^b	5.8 ^b	3.8 ^{ab}	4.5 ^b	8.2 ^c	3.5 ^{ab}	7.9 ^{bc}	6.9 ^b	4.2 ^b	3.5 ^{ab}	5.3 ^b	1.9 ^a	6.2 ^b	3.1 ^{ab}	2.5 ^a	2.5 ^a	1.04	*	***
Ash	1.2	1.2	1.1	0.94	1.2	1.1	0.85	1.2	0.99	0.92	0.75	1.2	0.96	1.0	0.85	0.91	0.93	1.0	0.10	NS	NS

¹Muscle: IS; *infraspinatus*, TB; *triceps brachii*, LT; *longissimus thoracis*, ST; *semitendinosus*, SM; *semimembranosus*, BF; *biceps femoris*. ²SEM: standard error for the mean. ³Level of feed intake: 1.5, 2, 2.5% of body requirements ⁴ Significant NS; not significant, * $P < 0.05$; ** $P < 0.01$, *** $P < 0.001$. No significant interactions between the treatments and muscles were found therefore, not included in the table

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60. The Relevance of Camel Meat for Society

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Camel meat is a valuable source for human nutrition. Camels can produce meat under environmental conditions where other species fail to produce anything. The low intra-muscular fat content of camel meat makes it a valuable part of low cholesterol diets. On the other hand there are many prejudices against the consumption of camel meat from people who are not used to camels. And there is a religious taboo against the consumption of camel meat for Hindus, Zoroastrians, Jews, Copts and Ethiopian Christians. The presentation shows the pros and contras of camel meat consumption.

61. Effect of Storage Time on Physical and Chemical Properties of Burgers Made With Different Amounts of Camel Meat

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This study was conducted to investigate the effect of using different levels of camel meat and storage time on properties of burgers. Twenty-five kilograms of meat (12.5 kg camel and 12.5 kg beef) were used. Five levels of camel meat were used 0% (pure beef, control), 25%, 50%, 75%, 100% and two storage periods 1 and 7 days at -17°C . Chemical composition, cooking loss, water holding capacity, objective color, ultimate pH, oxidative rancidity and sensory evaluation were determined.

Statistical analysis revealed no significant difference between burgers of various the levels of camel meat and storage periods except for protein, fat, ash, pH, WHC and color (L). Moisture% decreased significantly ($P<0.05$) protein, fat and ash percentage decreased significantly ($P<0.05$), while pH, WHC increased significantly ($P<0.05$) with increasing storage period. Cooking loss and shrinkage decreased significantly ($P<0.01$), while the oxidative rancidity (TBA –values) increased ($P<0.01$) with increasing storage time.

Redness decreased significantly ($P<0.05$) and yellowness increased with increasing storage time. There was significant ($P<0.05$) interaction effect between the level of camel meat and the storage time on lightness. Tenderness and color decreased slightly ($P>0.05$) but flavor and juiciness increased slightly with increasing the storage time.

62. Laser Induced Breakdown Spectroscopy to Dose Zinc in Camel Skin in the South of Morocco

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Introduction

Promoting camel dromedary as livestock animal is a strategic issue for the economic development of Southern provinces of Morocco. However, this promotion is limited by zootechnical and socio-economic constraints as well health conditions, particularly, skin diseases that represent major concern for both veterinary authorities and camel farmers.

Recent studies on the characteristics of mineral metabolism in camels showed that it differs from other species by a remarkable adaptability to sub-mineral nutrition (Faye *et al.*, 2000). However, due to prolonged exposure to under-nutrition and years of recurring drought in southern Morocco, the camel could suffer from deficiencies in essential minerals, some of which may be the cause of skin sensitivity to diseases. Thus, the present work is part of a study on the relationship between skin diseases and mineral deficiencies in camels in Morocco.

Context and purpose

Relationship between mineral deficiencies and skin diseases has been widely documented in many species. Some trace elements are involved in the defense and the integrity of the skin including zinc and copper (Ramiche, 2001). Zinc has a catalytic role in the migration, proliferation and maturation of epidermal cells. It has also an important role in the functioning of the immune system (Mc Dowell, 2003).

Several studies conducted for determination of zinc in camel plasma have concluded that this animal has lower zinc levels compared to other species, mainly sheep and cattle (Bengoumi *et al.* 1995; Ghosal and Shekawat, 1992). Ghosal and Shekawat (1992) have explained this low levels by camel adaptation to extreme thermal conditions and nutritional stresses; stress causes increase in zinc dependent enzymes requirement so then causing an increase in intestinal absorption and liver uptake of zinc. A study was conducted in Indian camels to determine normal zinc levels in seminal plasma, blood serum and hair of camel showed estimated levels of zinc are higher in camel hair (279.6 ± 3.6 $\mu\text{g}/100\text{ml}$) compared to seminal plasma level (126.6 ± 3.9 $\text{g} / 100\text{ml}$) and blood serum level (101 ± 4.1) (Singh *et al.*, 1994). For this purpose, the present study aims to determine zinc levels in both camel diseased skin and healthy skin in order to evaluate relationship between occurrence of skin diseases and skin zinc levels.

Experimentation

Laser Induced Breakdown Spectroscopy (LIBS) is a quick and simple method to analyze trace elemental concentration used by Sun *et al.* (2000) to trace zinc in human skin. There are several analytical techniques for elemental analysis in skin including particle probes, X-ray micro-analysis, X-ray fluorescence. These instruments are both very complicated and expensive, or require extensive sample preparation. However, LIBS is simpler, relatively inexpensive and requires little or no sample preparation.

LIBS is a technique is based on a significant power density by focusing the radiation coming from a pulsator laser which operates at fixed wavelength to generate plasma light from the sample. The plasma composition is representative of the elemental composition and the system consists among other things, a computer equipped with software for data collection and analysis.

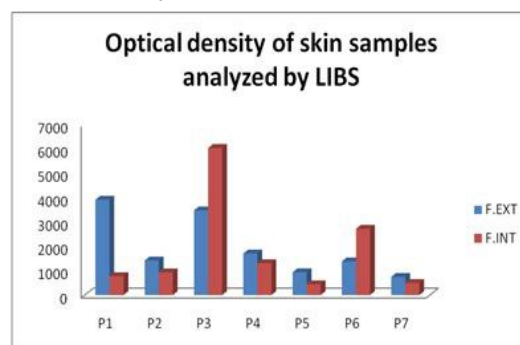
To prepare the analysis system, we conducted the pre-alignment of the laser beam for vertical focusing of this beam on the sample. Then, we started to optimize the parameters by location of exact positions of the lines of Zinc observable with a piece of metallic zinc. Lines observed and identified are those that corresponding to 2138 A° , 3282 A° , 3302.5 A° and 3345.9 A° unresolved and 3345.02 A° , 3345.57 A° and 3345.9 A° are unresolved too. Then we used a sample of camel skin to see if the same lines indicated above are observable. Thus, the lines that are around 3300 have not been identified, probably because of the presence of other lines that are very intense in this area but the line 2138 A° was well identified, this result corresponded to the line of determination of zinc used

by Sun *et al.*, 2000. Samples were used to determine the intensity of the laser beam, the size of the slit of monochromator, the number of shots, the number of spectra and cumulative length of the line. Sun *et al.* study in 2000 for determination of zinc by LIBS has been carried out in an area corresponding to the average area of the blades studied. The goal of the current study is to dose zinc in skin samples that have substantial thickness. So then, LIBS will be applied to both deep and superficial surface of skin samples and results obtained will allow us to see if there is a significant difference between the two surfaces. Otherwise, the average zinc content of the two surfaces will be given to the content of each sample. If the difference is significant, it is planned to conduct a study to check zinc content variation according to different layers of the skin. Skin samples were collected from different parts of the body in camels at slaughterhouses in three towns in southern Morocco and preserved in formalin in Eppendorf tubes. Before LIBS analyses, sample was dried in air which makes handling easier, dimensions (length, width and thickness) of each were taken before and after analysis to calculate the area.

According to Sun *et al.*, 2000, calibration was performed on the basis of a preparation of PMMA, which provides a matrix similar to the skin. This product was not available in the laboratory that's why we stuck to qualitative analysis of seven samples to study if there is any difference between zinc content in outer and inner layers of the skin.

Results and Recommendations

Analysis of variance with two factor repetition of zinc content with Excel Microsoft shows that difference is significant between the skin samples analyzed. Furthermore, the difference was not significant between the inner and the outer surface of the skin. These results should be interpreted with caution given the small number of samples analyzed. To this end, further analysis will be put in place to confirm the homogeneity of the zinc content between the different layers of the skin, including the inner and the outer face. In addition, the acquisition of the PMMA will help to determine the amount of zinc in the skin by LIBS.



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Milk and Nutrition

63. Pregnant Female Camels Response to Energy Levels in the 9th and 10th Months of Pregnancy

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Introduction

Optimum nutrition is essential for proper reproductive performance of camels; also it has a profound impact on proper fetal growth, as well as milk production. The energy requirements for pregnant female animals are well described for most domestic animal. However, there are few references concerning energy requirements for pregnant female camels. The present study was carried out to investigate the response of pregnant female camels in the 9th and 10th months of pregnancy to varying dietary energy levels.

Materials and Methods

Twenty-eight female camels (*Camelus dromedarius*) in the 9th month of pregnancy (491.83 ± 11.87 body weight, with parities 1-3) were used to study the effect of four levels of dietary metabolizable energy 80, 100, 120 and 140 Kcal/kg^{0.75} for G1, G2, G3 and G4 respectively keeping similar CP about 10% on the performance of pregnant female camels. Experimental animals kept for 60 days. The animals were randomly distributed into similar groups (7 pregnant female camels in each group). At the start of the 10th month of pregnancy, four animals from each group were used in a digestibility trial. Data were statistically analyzed using the method of least squares analysis of variance using software SPSS for windows (SPSS, 1999).

Results and Discussion

Dry matter intake (DMI) g/kg^{0.75}, kg/h was significantly increased by increasing energy level of energy (Table 1). Hammadi *et al.*, (1998) indicated that the daily dry matter intake were 7.3 kg /h/d for pregnant female camels. But the values obtained in this study were less than the values reported by (Wardeh, 2004). Data of metabolizable energy intake for pregnant female camels was significant (P<0.05) differed between the four groups based on MEI kcal /kg^{0.75}. The present result of MEI value were less than those reported by (Wardeh 2004) that pregnant female camels weighed 500-550 kg need 13.19-14.16 Mcal /h

Table 1: Effect of changing the ration energy level on dry matter intake (DMI), Metabolizable energy intake (MEI), Nutritive Value and Nitrogen Retention of pregnant female camels (Mean ± SE)

Items	Experimental rations			
	G1	G2	G3	G4
DMI, kg/h/day	3.76±0.272 ^a	5.82±0.36 ^b	6.36±0.193 ^b	6.49±0.23 ^b
DMI, g/kg ^{0.75}	44.96±0.54 ^a	53.18±0.823 ^b	59.24±0.826 ^c	60.80±1.07 ^c
MEI kcal/kg ^{0.75}	87.95±1.056 ^a	111.046±1.719 ^b	124.53±1.735 ^c	138.019±2.429 ^d
Nutritive Value ME Mcal	1.956±0.132	2.088±0.1232	2.102±0.063	2.272±0.046
Nitrogen Retention (NR) g/kg ^{0.75}	233.29±33.091	362.23±64.02	326.45±26.57	386.36±55.18
Nitrogen Retention NR/NI%	33.64±5.13	42.056±6.43	33.58±2.75	38.12±2.024

G1 = 1.89 Mcal, ME satisfy (100kcal/kg^{0.75})

G2 = 2.08 Mcal, ME satisfy (120kcal/kg^{0.75}).

G3 = 2.33 Mcal, ME satisfy (140kcal/kg^{0.75})

G4 = 2.37 Mcal, ME satisfy (160kcal/kg^{0.75})

The nutritive values of the experimental rations as ME were not significantly affected by increasing energy level. Mosaad *et al.*, (2003) showed that high energy diet improved the condition of female camels which was reflected on the utilization of the nutrients and increasing the nutritive value.

Nitrogen retention as mg/kg^{0.75} and nitrogen retention as % of intake (NB/NI %) was not significantly affected as a result of increasing dietary energy level. Although, there were improvement in the values with increasing energy level of experimental ration. El-Banna, (1995) found that increasing dietary energy level increased nitrogen intake and total nitrogen excretion in sheep, goats and camels.

The difference in total and daily body weight changes were not significant ($P>0.05$) during the whole experiment. The present results were similar to those reported by Shawket Safinaze and Ahmed, (2001), who indicated that body weight changes of dry female camels were significantly ($P<0.01$) improved by increasing the energy level of supplementation. In conclusion, results of this study indicate that the ration G1 providing energy level 80 kcal ME/kg^{0.75} is sufficient to cover the energy requirements needs for the pregnant dromedary female camels in 9th and 10th Months of Pregnancy.

Table 2: Effect of the ration energy level on total body weight change and average daily body weight change of pregnant female camels (Mean \pm SE)

Parameters	Experimental groups			
	G1	G2	G3	G4
Initial B. Wt. (kg)	504.16 \pm 30.58	508.35 \pm 33.79	484.78 \pm 16.99	471.78 \pm 10.71
Final B. Wt. (kg)	528.25 \pm 32.123	536.71 \pm 30.11	535.14 \pm 20.037	538.78 \pm 20.97
Total Gain (kg)	24.08 \pm 13.066	28.35 \pm 6.61	50.35 \pm 23.206	67 \pm 20.069
ADG g/d	402 \pm 217.3	472.5 \pm 110.37	838.4 \pm 386.95	1116.7 \pm 334.49

^{a,b} Means in the same row with different superscripts differ significantly ($P<0.05$)

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64. Floristic Diversity of the Camel Diet in Northern Algerian Sahara

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Introduction

Despite the harsh desert conditions, Saharan rangelands are characterized by very valuable plant diversity (Ozenda, 1981 et Chehma *et al.*, 2005). Moreover, the camel is the only species able to exploit these vast Saharan areas (Gauthier Pilters, 1977; Chehma *et al.*, 2008). The microscopic analysis of plant debris contained in feces or esophageal bowls is a method of studying the diet of grazing animals (Mandret 1989). For this purpose, and to study the plant diversity of the camel diet in its natural environment, the content of plant fragments in feces were analyzed as indicators of types of plant species grazed.

Methodology

The samples of faeces were collected in two regions (Touggourt and Ghardaia), representing the different camels rangelands, over the four seasons of the year (2009/2010). Ground feces are macerated in water for 2 days and then filtered through fine sieve (0.2 mm) to separate the liquid residue. Then washed with bleach to destroy the contents of epidermal cell rinsed with tap water. The epidermis thus obtained were mounted between slide and cover slip in a drop of glycerin and observed with an optical microscope equipped with a camera. The epidermis are identified on the basis of the shape of epidermal cells, stomata, veins and the appearance of the edge of limb (Mandret, 1989)

Results and Discussion

The harvesting of epidermis found in the faeces of camel allowed identifying 102 types representative of 2567 fragments and identifying 65 types of species during the 4 seasons. The number of 65 species grazed by camels at the six harvest sites appears very important if compared with the total number of species listed in six different types of rangeland operated by the dromedary. As such, Chehma (2006) has inventoried 75 spontaneous plant species in the same rangeland studied. The time study showed that, despite the seasonal variability of plant diversity of Saharan rangeland, our results do not reflect a significant seasonal variation with 28%, 27%, 23% and 22% respectively for spring, summer, fall and winter. Chehma *et al.* (2005) recorded seasonal variations in plant diversity in the range 86% in spring, 34% in winter, 14% in fall and 11% in the summer.

This disproportionality between the seasonal variability of grazed species compared to available species, shows that the dromedary had a relative stability of its floristic composition diet, during the year. This confirms the work of Chehma and Faye (2009), who have shown that the dromedary stabilizes its annual nutrient inputs, despite the very significant seasonal variation.

This could be attributed to the dromedary feeding behavior, that is deemed selective for species and plant parts grazed (Yagil, 1985), and even if the forage is abundant, this animal is grazing by walking and generally consuming little of each plant, (Meres, 1959; Gauthier Pilters, 1965).

In terms of spatial distribution, the region of Touggourt represents the highest number, with 72 species for 64 species in Ghardaia. This distribution varies with different types of rangelands. In fact soil factors are involved in the development of vegetation, as they characterize the substrates on which various pastures are growing (Boudet, 1978).

Conclusion

This study indicated that plant diversity of the camel diet is very important, considering the number of fragments of plant species taken from its faeces. Camel were able to graze more than 86% of potentially available plant species in its rangeland. Moreover, because of its characteristic feeding behavior, the dromedary was able to relatively maintain stable annual feed of this diversity, despite

the variability of flora richness is very significant with the seasons. This enables it to exploit food resources less available and thereby make better use of its very poor saharan pastures.

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65. Serum Mineral Content of Omani Racing Arabian Camels (*Camelus dromedarius*)

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Introduction

The dromedary camel (*Camelus dromedarius*) is of great importance to nomadic and rural communities mainly in the dry tropics of Africa, Middle East and Indian sub-continent. It provides high quality animal protein in the form of milk and meat and as a mean of transportation and work. Recently the camel has gained popularity and importance as a racing animal in the Arabian

Biochemical values are useful for evaluating health status in animals including camels. However, published information on these aspects in camel reflects a wide range of values which was attributed to differences in breed, age, sex and sampling and analytical methods

There are some published reports on biochemical values in camels. These include serum mineral values of Sudanese, Saudi Arabian, Kuwaiti, Emirati, Iranian, Pakistani, Nigerian, Kenyan and even European camels. There are also some reports on the serum mineral values in the Bactrian camel

Materials and Methods

Blood samples were collected from thirty female, 2-year Omani native camels. The age of animals was determined by asking owners and dentition.

Serum samples were analyzed in the Camel Breeding Unit of the Diwan Royal Affairs, Sultanate of Oman for glucose; total protein (TP); albumin; blood urea nitrogen (BUN); creatinine; uric acid; total globulins (TG); cholesterol; total bilirubin; alkaline phosphatase (ALP); aspartate aminotransferase (AST); alanine aminotransferase (ALT); Gamma-Glutamyl Transpeptidase (GGT); lactate dehydrogenase (LD); Creatine kinase (CK); sodium (Na); potassium (K); calcium (Ca); phosphorus (P); iron (Fe); copper (Cu); chlorine (Cl) by spectrophotometric analysis using a CX7/CX7 serum chemistry analyzer (Synchron, Beckman).

Results and Discussion

Range, mean and standard deviation values are listed in Table 1. The standard deviation indicates the degree of variation in these parameters. Wide variations in metabolic parameters exist in published literature and were mainly attributed to variability in nutritional regimes, mineral supplementation, season and presence of disease (Faye *et al.*, 1995). These authors distributed camels to four groups as follows: 1) class with low protein, high minerals and high GGT; class with low Cu and ceruloplasmin; class with high mineral values and protein indicators; and class with intermediate values.

Table 1: Means, standard deviations maximum and minimum values of serum biochemistry parameters in Omani racing female camels

Parameter	Number of samples	Mean	Std Dev	Minimum	Maximum
Glucose ((mg/dL))	29	92.79	19.227	56.00	158.00
Albumin (g/dL)	28	2.80	0.167	2.50	3.100
TG (mg/dL)	29	32.21	9.933	11.00	66.00
Total protein (g/dL)	29	6.17	0.344	5.50	6.80
Uric acid (mg/dL)	29	0.28	0.041	0.20	0.30
Creatinine (mg/dL)	27	1.64	0.238	1.30	2.20
BUN (mg/dL)	27	15.48	4.492	8.00	26.00
Cholesterol (mg/dL)	29	40.52	13.225	4.00	77.00

Total bilirubin (mg/dL)	29	0.34	0.124	0.10	0.60
Enzymes					
ALP (IU/L)	29	113.93	29.745	50.00	187.00
AST (IU/L)	29	88.79	70.029	57.00	374.00
ALT (IU/L)	29	13.28	5.970	9.00	37.00
GGT (IU/L)	29	21.34	10.181	13.00	64.00
LD (IU/L)	28	419.89	160.380	303.00	971.00
CK (IU/L)	29	46.28	16.18	29.00	107.00
Minerals					
Fe (µg/dl)	29	107.79	25.538	56.00	158.00
Cu (µg/dl)	29	72.52	8.078	54.00	89.00
Ca (mg/dl)	29	9.63	0.428	8.700	10.30
Po ₄ (mg/dl)	29	9.56	0.759	5.00	8.50
K (mmol/l)	29	4.23	0.420	6.50	5.00
Cl (mmol/l)	29	113.08	4.516	105.40	127.20
Na (mmol/l)	29	144.45	5.800	132.30	160.50
Na/K	29	28.1	2.86	21.2	33.9
Co ₂ (mmol/l)	29	18.34	1.647	13.90	22.30

There was a significant correlation between BUN and creatinine as well as between TP and albumin. Therefore, either of these parameters may be used to estimate the other. Relation between TP and protein is obvious as TP equals albumin plus total globulins. There were high correlation between AST, ALT, GGT and LD. These are liver function enzymes and could be used to estimate one another to reduce analyses value.

The macro elements Na, Ca, and K had significant correlations. This was similar to reports in Omani racing camels. Although there are not many reports on this aspect, Kuria *et al.* (2006) reported a significant positive correlation between Na and Ca but a negative correlation between Na and P. On the contrary there were no significant correlations within trace elements but there was a significant correlation between Cl and Ca, K and Na.

From a practical point of view, correlations between certain elements would reduce the cost of analyses for these elements as values of some of them may be estimated from other elements using regression equations.

Findings of the current study provide baseline values that may be used by clinicians for racing camels in Oman and camels raised under similar conditions. Values recorded for all serum metabolic profiles, enzymes and minerals were within the ranges reported for racing camels in the Gulf region and indicated normal health of these animals. There were some significant correlations between some serum parameters that may be used to estimate their values which will reduce cost by reducing the number of elements to be analyzed.

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66. Water Intake in Omani Camels Kept on Various Levels of Feed Intake

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Introduction

Camels are well known to withstand extreme environmental conditions of high temperatures and lack of drinking water (Wilson, 1989). Camels are capable of keeping their appetite under severe draught conditions. However, reduced water intake or increasing water salinity in the camel reduces feed intake (Ayoub, 2006; Hashi *et al.*, 1995). Water requirements of the camel in relation to body size and normal functions do not greatly differ from that of other farm animals (Wilson, 1989). This study's aim was to measure water intake in general and specifically to study the effect of feed intake on water intake.

Materials and Methods

Ten Omani male camels were housed in partially shaded pens and fed a concentrate and Rhodesgrass hay (RGH) diet. The concentrate and RGH contained 92.5 and 91.5% dry matter (DM); 14.4 and 9.4 crude protein; 1.8 and 1.1 ether extract; 12.1 and 9.6 ash; 19.3 and 30.6 crude fiber, 24.1 and 35.8 ADF; 51.3 and 68.3 NDF as percentage in the DM, respectively. Camels were randomly allocated into three groups: two, four and four camels received a feed intake equivalent to 1.5, 2.0 and 2.5% of body weight, respectively with 60:40 concentrate:RGH ratio for 5 month. Water meters were fitted to automatic water troughs. Readings were made on these meters every day in the morning and water intake was measured. Water intake was adjusted for evaporation using pan system.

Results and Discussion

The average daily water intake in Omani camels ranged between 17 to 30.4 l/d with a mean 24.1 ± 4.7 l (Table 1). This corresponded to 7.5-14.3% of body weight (mean $10.5 \pm 1.8\%$ BWT). Reports in the literature on camel water intake vary greatly as it is affected by ambient temperature (season), type of feed and body weight. For instance, Basmaeil *et al.*, (2012) reported a daily water intake of 11.65 to 12.96 l/d in Saudi camels of mixed breeds ranged in weight between 270-292 kg. This corresponds to 4.4-5.6% BWT. The season had a significant effect on water intake by camels. Hermas (1990) reported a daily water intake of 23, 55, 40 and 16 liters/d in spring, summer, autumn and winter in Libyan camels. These figures are more relevant to those of the current study (mean 24 l/d).

Table 1: Water intake in Omani camels

Measurement	Mean	SD	Median	Maximum	Minimum
Total water intake over 14 weeks	8084.8	1561.0	8319.6	10184.56	5697.6
Daily water intake (l/d)	24.1	4.7	24.8	30.4	17.0
Daily water intake/body weight (%)	10.7	1.79	10.3	14.3	7.5

Water intake by the different experimental groups over the study period is given in Figure 1. There was a trend of increasing water intake with increasing feed intake. However, the lines representing medium and high feed intakes overlap which indicates no differences between the two groups. Regressing average daily water intake with camel body weight indicated a significant relationship ($R^2=0.73$) and generated a polynomial equation to predict water intake from camel body weight (Figure 2).

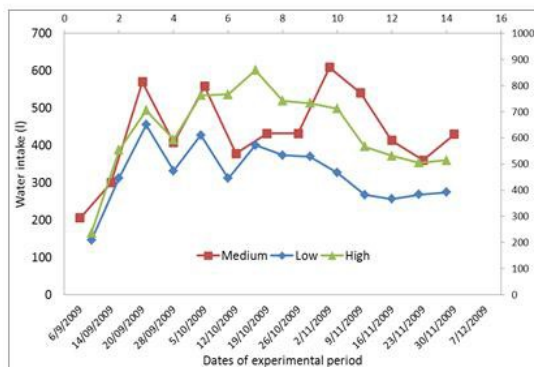


Figure 1: Water intake in Omani camels fed low, medium and high feed intake

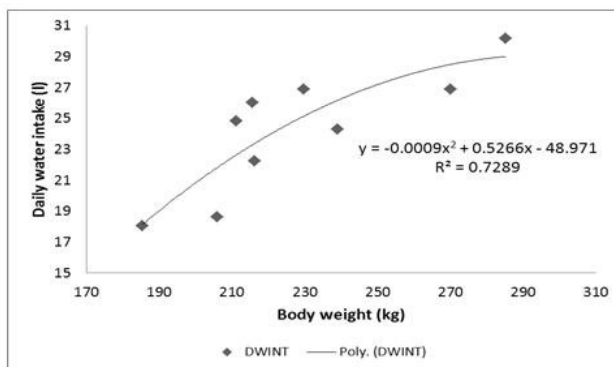


Figure 2: Average daily water intake in Omani camels regressed with body weight

This study provided for the first time data on Omani camel water intake and its relation to feed intake. This information would be useful for rearing camels under feedlot systems

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67. Separation and Characterization of Major Milk Proteins of Algerian Dromedary (*Camelus dromedarius*)

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Introduction

The camel is one of the most important domesticated animals in the arid and semiarid zones of tropical and sub-tropical countries. The present work has been carried out in order to present a more description of the major milk proteins from Algerian dromedary's milk.

Materials and Methods

Two samples of dromedary milk from *Sahraoui* breed were collected in Ouargla and Ghardaia regions. They were defatted by centrifugation 4000g at 4°C for 15 min. Whole casein was obtained from skimmed milk by isoelectric precipitation (pH 4.3) at 22°C using 1N HCl. The supernatant, containing the whey proteins was dialyzed against distilled water and then freeze dried and kept at -20°C until used.

The individual caseins were separated by ion-exchange chromatography on DEAE-Cellulose column (26 mm i.d X 26 cm) equilibrated with 10 mM imidazole/HCl buffer, pH 7.0, containing 3.3 mM urea and 10 mM 2-mercaptoethanol, and the bound proteins were eluted from the column with a linear gradient of 0-1M NaCl.

Fractionation of the whey proteins was performed by gel permeation chromatography on Sephacryl S200 equilibrated with 0.02M Tris-HCl buffer pH 8.6 at room temperature, at a flow of 0.3 mL/min.

Native PAGE according to Hillier (1976) with a 12% (w/v) polyacrylamide gel in 0.75M Tris-HCl buffer, pH 8.9. Samples (2mg/mL) were solubilised in 75mM Tris-HCl buffer, pH 8.9, containing 10% (v/v) glycerol, and 0.01% (w/v) bromophenol blue.

Urea-PAGE was performed according to Andrews (1983) with a 8.2% (v/v) polyacrylamide gel in 75mM Tris-HCl buffer, pH 8.9, in the presence of 4M urea. Samples (2 mg/mL) were solubilised in 75mM Tris-HCl buffer, pH 8.9, containing 4M urea, 5% (v/v) 2-mercaptoethanol, 10% (v/v) glycerol, and 0.01% (w/v) bromophenol blue.

SDS-PAGE was performed on a 4.9% (w/v) polyacrylamide in 0.125M Tris-HCl buffer, pH 6.8 stacking gel and a 15.4% (w/v) polyacrylamide in 0.38M Tris- HCl buffer, pH 8.8 containing 0.1% (w/v) SDS separation gel (Laemmli & Favre, 1973). For all electrophoresis, volumes of 20 µL of samples were loaded in the gel.

In vitro hydrolysis was performed as follows: a) chymotrypsin and trypsin : enzyme/protein ration 1/200 (wt/wt) in 0.1M sodium phosphate buffer (pH 8) at 40°C; b) pepsin: enzyme/protein ration 1/250 (wt/wt) in 0.01N HCl (pH 2) at 37°C; c) papain: enzyme/protein ration 1/800 (wt/wt) in 0.5M Tris-HCl buffer (pH 7) at 37°C and the final concentration of caseins was always 10 mg/mL. The reaction was stopped at different times by diluting the digestion mixture with the same volume of sample buffer (0.125M Tris-HCl buffer, pH 6.8 containing 0.1% (w/v) SDS, 5% (v/v) 2-mercaptoethanol, 10% (v/v) glycerol, and 0.01% (w/v) bromophenol blue, and then heating for 10 min at 100°C. Controls containing whole casein but without addition of enzymes, was also sampled.

Results and Discussion

In order to identify the different whey proteins in camel and bovine milk, native-PAGE electrophoresis of whey camel samples from the tow regions were compared with bovine whey proteins. It was possible to observe Ig, BSA, α -lactalbumin and β -lactoglobulin for cow whey and similar band to BSA and α -lactalbumin for camel whey. This result showed that camel α -lactalbumin can exist in two forms. β -lactoglobulin appears only in bovine milk, since in the SDS-PAGE

electrophoresis no band in the vicinity of 18 kDa was detected in camel whey and four bands of 66.0, 43.0, 29.0 and 14.0 kDa were observed.

Camel whey proteins were separated into 3 fractions on Sephacryl S200 permeation chromatography. As observed by native-PAGE, serum albumin was eluted in fraction 1, the two forms of α -lactalbumin were eluted in fraction 2 and the third peak contained no identified proteins which could correspond to heterogeneous camel milk whey proteins.

The urea-PAGE and the electrophoretic patterns show two sharp and distinguishable main bands in camel milk. According to their increasing electrophoretic mobility, in comparison with cow milk casein, the two bands can be regarded as a possible homologue to bovine. Compared with cow milk caseins, camel's casein presented a lower mobility, than that of their bovine counterparts. Neither a band corresponding to κ -casein could be detected. Molecular masses of the camel casein bands estimated on SDS-PAGE from calibration curve, are 32 000 and 35 500. This is considerably higher than the possible homologous bovine caseins which are estimated at 24 000 for β -casein and 22 000 to 27 000 for α s-casein.

Whole casein from dromedary milk were separated by anion-exchange chromatography on DEAE-cellulose column into four fraction eluted at 0.08, 0.16, 0.23 and 0.26 mol/L NaCl respectively. The electrophoretic pattern suggest that peak 1 contained β -, peak 2 and 3 contained α s1- and peak 4 contained α s2-casein which was co-eluted with α s1-caseins.

In order to study the degree of hydrolysis of camel milk caseins, the enzyme-treated and untreated protein samples of whole CNs were analyzed by SDS-PAGE for pepsin, trypsin, chymotrypsin and papain assays. The α s1-CN was almost fully degraded by both enzymes after 10 min of incubation ; it appears like sharp and diffuse band; whereas hydrolysis of β -CN was complete after 5 min of hydrolysis by pepsin, 30 min by trypsin and papain and 48h by chymotrypsin. β -CN from camel milk were more resistant to trypsin, chymotrypsin and papain digestion, it's very quickly hydrolyzed by pepsin. After 5 min of hydrolysis of camel CNs by chymotrypsin, trypsin and papain, some peptide fragments were still detected on SDS-PAGE, which were stable up to 4h of incubation, but with pepsin, peptide fragments were disappeared completely after 60 min of incubation. Similar peptide fragments were not obtained when CNs were treated with different proteases.

Conclusion

Results of this study performed on Algerian dromedary's milk proteins showed heterogeneity between samples under both quantitative and qualitative aspects.

68. FAR-M®: New Support For Camel Cheese Production

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Camel milk is one of the main economical values of camels and represents one of the primary sources of income for farmers in Africa, Middle East and Central Asia. (Hussen, *et al.*, 2008) In Kenya, which has the fifth largest camel herd in the world, only 12% of camel milk produced is sold commercially and only a small percentage of this milk reaches urban consumers. (Musinga, *et al.*, 2008) Due to its very short shelf life, a lack of infrastructure and processing technologies, handling raw camel milk becomes a very challenging process. This results in camel milk sales price in developing countries higher than processed bovines' milk in Western countries (e.g. 1.5-2 EUR/L in Ethiopia versus 0.6-1.2 EUR/L in EU) (Personal communication).

Transforming camel milk into cheese would significantly prolong the shelf life of the product, allowing periodic collection and transportation of camel cheese from rural areas to urban centres. The resulting development and growth of a camel dairy industry would also stimulate the national economy of countries having the major camel herds.

Currently, most attempts to make cheese from camel milk have revealed major difficulties. Rennetting with bovine chymosin leads to slow curd formation and a weak coagulum. Extensive research at ETH Zürich led by Dr. Farah, allowed the development of fermentation-produced camel chymosin, obtained from the stomach of a young camel. The process has been patented and the product launched on the market in September 2011 by Chr. Hansen A/S under the trademark FAR-M®. During the first field- trials, the product demonstrated high clotting efficiency on camel milk and good yields in producing camel cheese. An extensive programme of trials is on-going with the aim of increasing the knowledge of camel cheese and defining the optimal conditions for the most effective production. Together with Dr. Farah, Chr. Hansen plans to initiate a programme to support the development of a camel cheese industry in developing countries. One of the challenges will be finding the right distribution channels to reach small cheese-producing entities and to transport the product to urban areas for commercialization.

Chr. Hansen (www.chr-hansen.com) is a global biotechnology company that provides natural ingredients to the food, dairy, human health and nutrition, and animal health industries. The company is a leading supplier of food cultures, probiotics, enzymes, colors, and functional blends, which are applied in foods and beverages, dietary supplements, and agricultural products.

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69. Detection Of The Dromedary Camel (*Camelus dromedarius*) Milk Adulteration With Bovine Milk Using A PCR Assay

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Introduction

Milk and dairy products (fermented milk, cheese, yoghurt, etc.) from non-bovine animal species (sheep, goat, buffalo, and dromedary camel) are traditionally produced and consumed in various countries in the world. The dromedary camel (*Camelus dromedarius*) is of a significant socio-economic importance in several arid and semi-arid regions of north-eastern Africa, Middle East, and Indian subcontinent, and its milk constitutes an important component of human diets in these regions. The health-promoting properties of the dromedary camel milk, in particular for diabetes prevention and control (Argawal *et al.*, 2005; Mohammad *et al.*, 2009; Sboui *et al.*, 2010) and as protein source for allergic children to bovine milk proteins (Restani *et al.*, 1999; El-Agamy *et al.*, 2009) constitute a strong boost for sales and market demand and, in certain regions such as the North of Africa and Middle East, they are the driver for intensification of dromedary camel dairying. In this context, issues of adulteration arise due to the seasonal production and the higher price of dromedary camel milk (3 to 4-fold of that of bovine milk in Tunisia for example), generally by the admixture of bovine milk because it is widely available and cheaper to produce. Thus, rapid and reliable methods for detection of milk and dairy products adulteration are indispensable for consumer protection and product quality control. Several analytical approaches, either protein- or DNA-based have been applied for species identification in milk and dairy products during the past two decades (Mayer, 2005; Preira *et al.*, 2008; Bai *et al.*, 2009), however, none of them concerned dromedary camel species. The purpose of the present work was to develop a rapid and sensitive protocol for the detection of bovine milk in dromedary camel milk based on mitochondrial DNA.

Material and Methods

Dromedary camel (raw) and bovine (raw and sterilized) milk samples were purchased from different dairy retail markets. Camel raw milk samples were also obtained from healthy lactating camels by machine milking at the Experimental Station of the Arid Land Institute of Medenine (Tunisia). Sterilized milk samples were prepared from raw milk in the laboratory (121°C, 20 min). Mixtures of dromedary camel milk with increasing quantities of bovine milk in proportions of 0.5, 1, 5, 10, 50 and 100% (v/v) were prepared. DNA extraction from milk was performed using silica protocol (Boom *et al.* 1990). Common forward and specie-specific reverse primers were designed over the *cytochrome b* gene. PCR reactions were performed in a final volume of 25 µl containing 100 ng of template DNA, 2.5 µl of 10X PCR buffer, 1.5 µl of MgCl₂ (25 mM), 1 µl of the four dNTPs (5 mM), 1.0 µl of each primer (10 µM) and 0.5 U of *Taq* polymerase (Fermentas). Amplification was carried out as follows: an initial denaturation step at 95 °C for 1.5 min followed by 35 cycles of 30 s at 95 °C, 30 s at 60 °C, and 45 s at 72 °C with a final extension step at 72 °C for 5 min. The PCR products were resolved by electrophoresis on a 1.5% agarose gel and stained with ethidium bromide.

Results and Discussion

A common forward primer and two specie-specific reverse primers were designed over the mitochondrial *cytochrome b* gene to amplify a fragment of 545 (bovine) and 412 pb (dromedary camel). Primers were designed with similar melting temperatures (T_m: 60°C) in order to obtain efficient PCR amplifications in the multiplex reactions. Specificity of the primers was initially tested in singleplex and therefore in multiplex reactions using DNA from dromedary camel (*Camelus dromedaris*), cow (*Bos taurus*), sheep (*Ovis aries*), goat (*Capra hircus*) and llama (*Lama glama*). No cross-reactivity or additional unspecific bands were observed. To determine the limit of detection (LOD) of the assay, PCR amplification was performed on samples of dromedary camel milk comprising different percentages of bovine milk and the obtained products were detected by agarose gel electrophoresis. PCR products of expected size were obtained from the samples containing 1% of

bovine milk whereas no bands were observed under this limit (0.5%). Thus, the LOD of the assay is 1%. On the other hand, the amplification patterns and detection limits were similar among raw and sterilized milks; indicating that the assay developed also applies to DNA from heat-treated milk and milk products.

The use of PCR greatly improved and facilitated the detection of animal origin of ingredients in food and feedstuff due its simplicity, species specificity and sensitivity. Although several PCR-based methods dealing with species identification in order to detect adulteration of milk from several livestock species (sheep, goat, cow, and water buffalo) have been reported in the literature, none of them concerned dromedary camel species. The assay developed in this study is benefit for the development and protection of the camel dairy industry and is useful for food quality control and fraud detection.

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70. Comparative Study of Milk Clotting Activity of Crude Gastric Enzymes Extracted From Camels' Abomasa at Different Ages and Commercial Enzymes (Rennet and Pepsin) on Bovine and Camel Milk

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Introduction

Most attempts to make cheese from camel milk have revealed major difficulties in getting the milk to coagulate. With the same amount of calf rennet, the coagulation time of camel milk is twice or three times longer than that of cow's milk. The action of rennet on camel milk leads to coagulation in the form of flocks, with no firm coagulum (Mohamed, 1990) Due to the technical difficulties of camel milk coagulation, several researchers are now focusing on the functional properties of the camel milk proteins (Laleye *et al.* 2008), coagulation properties of camel milk proteins (Farah and Bachmann, 1987; El-Agamy, 2000a; El-Agamy, 2000b) fragile and weak coagulum and poor yield of camel milk cheese (El-Zubeir and Jabreel, 2008). However, a few limited studies reported that gastric enzymes extracted from camel have the potentiality to coagulate camel milk (El-Agamy, 2000a; Siboukeur *et al.*, 2005; Wangoh *et al.*, 1993). Therefore, the purpose of this study is to optimize the extraction conditions of the gastric enzyme from the abomasums of camel at different ages and to determine and optimize the flocculation time based on the pH and clotting temperatures.

Materials and Methods

The camel abomasal tissues were obtained from camel slaughterhouse of Ouargla, Algeria. The abomasums were obtained from camels of different ages (1, 3 and 9 years).

The method of crude gastric enzymes extraction from bovine abomasal tissue as described by Valles and Furet (1977) was used with minor modifications.

The method of Bergere and Lenoir (1997) for the proteolytic activity of GECs was used. In addition the clotting activity was optimized by using the method of Shamet *et al.* (1992).

Coagulation of camel milk by GECs

Camel and bovine milk coagulation was carried out by using the method of Ramet (1997). However, the flocculation time was measured visually by the method of Lenoir *et al.* (1997) at different pHs and temperatures.

Results and Discussion

The clotting activity was the highest for the GEC 9 (older camels) at 0.360 RU compared to the GEC 3 at 0.285 RU and GEC 1 at 0.235 RU; In addition, the commercial bovine rennet had higher clotting activity at 0.184 RU compared to the commercial bovine pepsin at 0.163 RU; however the clotting activity for all gastric enzyme extracts from camels at different ages and the two commercial enzymes, rennet bovine and pepsin bovine, were significantly different at $P \leq 0.05$ (Table 1). There was a correlation between the clotting activity and the clotting strength of Soxhlet. The higher clotting activity was correlated with a higher clotting strength (Table not shown). Obviously the clotting strength for all enzymes was significantly different ($P \leq 0.05$).

The crude gastric enzyme preparations from camels (GEC) obtained from the older camels showed better coagulation activity in both camel and bovine milks. Flocculation time data showed that the GECs and bovine pepsin had good specificity towards bovine casein and camel casein. Ramet (1994) reported that the use of bovine pepsin provided a rapid flocculation time in camel milk compared to bovine milk. Therefore, this suggested that the content of pepsin was higher in the older camels (GEC 9), as previously reported by Wangoh *et al.* (1993). This finding was in contrast with the case of bovine chymosin which is extracted in younger calves. It can be concluded that the pepsin

content in older camels (GEC 9) has more coagulating activity than proteolytic activity in camel milk due to the molecular difference in camel proteins and bovine proteins, such as the distribution and size of the casein micelles, various fractions of the casein, sites of the potential cleavage and denaturation, etc. (Kappeler *et al.* 1998).

In addition, the short flocculation time obtained for GEC 9 (older camels) at an optimum temperature of 42°C and a pH of 5.8 thus encouraging the fact that older camels are more available for slaughter in Algeria.

Therefore the production of GEC from older camels could be an excellent substitute for the commercial chymosin for cheese making using either bovine or camel milk. This study focused primarily on the coagulation step on making cheese curd that represents a key step in cheese making. It is recommended that additional research be conducted to purify the extract, to characterize the extract using electrophoreses and finally for the production of various types of cheeses from camel milk.

Table 1: Change in clotting activity (rennet unit: RU) and the clotting strength of Soxhelt (F) according to the nature of the enzymatic preparations.

Enzymatic preparations	Clotting activity (RU)	Strength of Soxhelt (F)
GEC 1	0,235 ^a ±0.002	51.47±0.13
GEC 3	0,285 ^b ±0.001	63.73±0.26
GEC 9	0,360 ^c ±0.02	76.61±0.25
Pepsin bovine (Pb)	0,1630 ^d ±0.002	35.56 ±0.11
Rennet bovine (Rb)	0,184 ^e ±0.002	40.7±0.15

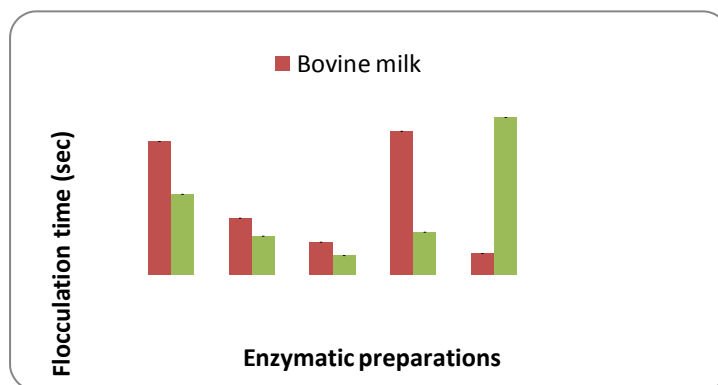


Figure 1: Effect of the enzymatic preparations on the flocculation time of bovine and camel milk

-GEC 1: Gastric enzyme extract of 1 year old camel;
 -GEC 3: Gastric enzyme extract of 3 years old camel;
 -GEC 9: Gastric enzyme extract of 9 years old camel;
 -Pb: Pepsin bovine;
 -Rb: Rennet bovine

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71. Could the Total Mixed Ration Increase the Yield of Camel Milk?

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Introduction

Camels are promising dairy animal (Bakhiet *et al*) which are capable of utilizing low quality grasses and convert then into high quality protein and recycling the ammonia (Hassabo 2010). Pastoral camels are usually giving 1.5 – 2kg of milk /day due to crossing long distances in harsh areas environment. Camel milk can treat many diseases as well as its urine (Maggid and Ali 2011). Camel nowadays suffer more from desertification and social conflicts therefore it is necessary to change its management system and to keep it as dairy animal (Bakhiet, 2006).

Material and Methods

- Ten lactating camels recently calved were divided into two groups and kept in two fenced areas.
- A basic ration was given to group A as total mixed ration (TMR) and a ration of concentrate and roughages were fed separately for group B and the intake was daily calculate
- The animals were milked twice a day in the morning and evening
- Comparison between the two groups was carried out to determine the average daily milk yield and feed intake.
- Statistical analysis was carried out for significance test.

Results and Discussion

The feed intake in group B (92.5) was less than group A (100%). Group B animals refused some of sorghum straw which was unpalatable when eaten separately because of its high fiber content. The milk yield was higher in group A (25% increase) than group B. This may be due to difference in feed intake and feed conversion rate (FCR). The ingredients used were very cheap and available.

Table 1: percentage of the ingredients of the experimental diet

Ingredients	Percentage %	CPgm/kg	ME Mj/kg
Ground nut cake	10.0	45.68	1.2
Dura (Sorghum grain)	15.0	21.00	2.0
Molasses	15.0	7.12	1.7
Ground nut straw	57.0	46.17	4.4
Ca	2.0	-	-
Nacl	1.0	-	-
Total	100.0	119.97	9.0

Table 2: average intake and milk yield

Group	A	B
Offered ration/kg	10	10
Refused/kg	zero	0.75
Intake %	100%	92.5%
Milk yield	8	5

It was concluded that total mix ration increased the milk yield and minimized the production cost due to decreased the wastes. This study recommended to adopt the TMR and to carry out further research using different ingredients.

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72. Compositional Analysis and *In Vitro* Antioxidant Activity of Camel Colostrum and Mature Milk

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Traditionally, the milk of the Arabian one-humped camel (*Camelus dromedarius*) has been used medicinally for centuries in different parts of North-Eastern Africa, Middle East and Central Asia. Studies indicated that ingestion of camel milk is beneficial in infectious diseases, control of blood glucose, and has antiviral and anticancer activities. The present study aims to investigate the chemical composition and antioxidant activity of camel colostrum and mature milk. Colostrum, within 72 hours, and mature milk, after 7 days postpartum; were collected from camels grazing on natural habitat in Butana area, Central Sudan. Samples were freeze-dried and complete chemical analysis and antioxidant activity were conducted on reconstituted samples. Four *in vitro* model systems: ABTS⁺ scavenging, DPPH[•] scavenging, ferric reducing power and iron chelating assays. Analysis data will be presented and results will be discussed.

73. Milk Potencial of the Maghreby Negga (*Camelus dromedarius*) in Tunisia

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Introduction

Studies conducted by the Higher School of Agriculture, Mateur, north of Tunisia were used to estimate milk potential of the Maghreby Negga (*Camelus dromedarius*) and to identify key factors that can influence the quantity and quality of produced milk (Kamoun 1995, 1998a) and the practical approach to determine energy requirements, nitrogen and water lactating female camels (Kamoun 1998b). These studies demonstrated that increased milk production is possible and that intensification can be done with Maghreby Negga. This breed has relatively high potential for milk production. The collection and processing of milk Negga still faces the problem of scattered farms. Milk production during a lactation period of 270 days (Kamoun, 1998b) is subject to variation. Sources of variation are the breed, environment, feed or water shortage, or different management practices. Various mathematical functions were used to describe lactation curves (Wood, 1967).

Materials and Methods

The study was conducted in the experimental Farm of Higher School of Agriculture, Mateur, Tunisia. Throughout the lactation, Negga camels were milked three times a day. Milking was conducted in two districts (one posterior and one anterior). The other two were reserved for the calf and the volume collected was doubled. Dairy controls were made every two weeks. The daily milk yield was recorded and milk samples were used to determine, the physico-chemical parameters (pH, titratable acidity and density), the chemical composition (solid not fat, fat, protein, lactose, ash) and the protein fractions (casein, whey protein, non-protein N). A total of 713 records were used in the analysis. The Gauss-Newton algorithm was used to fit lactation curve (SAS 2009). Daily milk was presented as: $Y_t = a t^b e^{-ct}$. Where: Y_t is the observed milk yield at day t ; a is linked to milk yield at the beginning of lactation, b to the ascending phase before peak yield, and c to the decreasing phase after peak yield. Persistency, peak yield, and DIM at peak yield (DIMP), were calculated as: $-(b+1) \ln(c)$, $a(b/c)^b e^{-b}$, and (b/c) , respectively. The effect of calving year, calving season, lactation stage and lactation order in the day. $Y_{ijk} = \mu + CY_i + NL_j + RT_k + e_{ijk}$; Where; Y_{ijk} = a lactation curve trait based on observation n , CY_i : calving year, CS_j : calving season, μ : overall mean, NL_j : lactation stage + RT_k : lactation ordre in the day + e_{ijk} : residual error.

Results and Discussion

Milking practice affects the amount of milk. Generally, the calf is allowed to suckle for few seconds before hand milking. Milking must be done by a person who is well known to the camel. In the present study when the regular milker was changed, significant milk retention was often observed. It also appears that milking frequency influences daily milk yield. In presence of his calf, milking duration can be more than 3 min. Quantities of produced milk increased with milking rank and changed with lactation number. Quality of produced milk was varied according to the milking order in the day and the lactation stage.

The Monitoring start from the second week after birth and may continue until a late stage. Lactation stage were between 12 and 404 days with an average value of 171 ± 90 . So daily production going from 0.56 to 14.5 L with an average of 6.72 ± 2.46 liter differed among individuals. Milk production peaked approximately 3rd to 4th months postpartum and then decreased. This result was similar to that of Kamoun (1998b). For fresh camel milk, pH ranging from 6.17 to 6.95 with a mean value of 6.32 ± 0.20 , titratable acidity ranged from 13 to 18°D with a mean value of 16.95 ± 1.52 and density going from 1019 to 1032 with an average of 1025 ± 3 . These values are lower than those of cow's milk. The gross chemical composition and protein fraction of camel milk are presented in Table 1. The differences among the values of data undoubtedly reflect differences in breed and stage of lactation. Milk was low in cheesy components such as casein and fat.

Table 1. Daily camel milk production and milk quality (mixture of three milkings)

Variable	Nb	Means	Sd deviation	Minimum	Maximum
Gross composition (g/liter)					
Total solids (g/liter)	181	116.76	11.32	92.00	145.00
Solid not fat (g/liter)	181	80.31	10.96	60.00	94.00
Fat (g/liter)	181	35.67	7.61	20.00	55.00
Lactose (g/liter)	161	43.82	5.68	28.00	57.00
Ash (g/liter)	181	8.21	0.64	5.00	11.00
Total Protein (g/liter)	161	29.45	3.29	20.90	35.9
Protein fraction (g/liter)					
Casein	128	23.37	2.60	17.9	29.2
Whey protein	161	5.10	1.17	2.60	9.60
Non Protein N	161	0.47	0.23	0.20	1.50

Daily milking order affected milk yield and composition ($P < 0.05$). Stage of lactation affected fat ($P < 0.001$), protein, and protein: fat ratio ($P < 0.001$). These constituents became concentrated as lactation proceeded, and protein was substituted by fat. Calving date had a similar concentrating effect on fat ($P < 0.001$) whereas it reduced protein. Low correlation was shown between milk quantity and lactation stage. An important recovery period was found (283 +/- 93 day). Correlation coefficient between persistency indices and total day milk yield indicated a good persistency value calculated for this breed. The high disparity between these various sets of data can probably be explained by differences in genetic potential, climate, feeding conditions and sampling techniques. The result finding that intensification can be a real way to improve camel milk production. In addition, genetic selection using adequate methods (molecular marker) can be a short way to assist this objective.

Conclusion

This study showed that among the population of camels in Tunisia, Maghriby Negga had high potential for milk production. The milk composition changed due to the stage of lactation. Improvement of environment and management of camel can contribute to productive process, as well as providing benefits to agriculture. Genetic selection can be used to identify animal with a high genetic potential.

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75. The Most Important Findings in Camel Milk for Its Export

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Introduction

The camel is a multi-purpose animal with a huge productive potential. In many parts of the world, prejudices and misconception against the camel still exists, but fortunately on the other hand nowadays many people realize that the camel is the most suitable domestic animal for use in climatic extremes. In time of global warming, growing deserts and increasing scarcity of food and water, the camel can be part of a solution to these problems. It is now widely acknowledged that mobile animal husbandry is the only form of land use that can provide long term survival and secure income. Camels are especially suited for this lifestyle. They survive without water for long periods and still provide milk almost all year round in bigger quantities than any other domesticated animal in hot arid zones. Living conditions of the nomadic herdsman and his family can be dramatically improved by selling surplus camel milk even abroad. For this purpose, Central Veterinary Research Laboratory (CVRL) has embarked on several research projects, the results of which are presented during the oral presentation. They include:

Results

1. Evaluation of test kits used in ruminants for the serological diagnosis of infectious diseases in dairy camels. In total more than 1000 sera from dairy camels were tested for 17 infectious diseases using mainly eELISAs, but when it comes to indirect ELISAs, proper evaluation of these ELISAs is recommended when used for camels. The results are presented here (Wernery *et al.*, 2007; Wernery *et al.*, 2008).
2. Foot-and-mouth disease in OWCs. Several experimental infection trials have been conducted with FMD virus serotypes O and A in dromedaries and Bactrians. From these investigations, it is now obvious that dromedaries are resistant to FMD and Bactrians are not (Wernery, 2007; Larska *et al.*, 2008).
3. The most important mastitis pathogens in dromedaries have been investigated. They are the same as cultured from raw cow milk like: *Streptococcus agalactiae*, coagulase negative *staphylococcus* sp. (CNS), *Staphylococcus aureus*, *Streptococcus bovis* (Wernery *et al.*, 2008).
4. Microbiological standards of camel milk have been evaluated and it has been shown that camel milk can meet the international standards applied for cow milk. Camel milk samples with a CMT score of + had SCC values between 40,000 – 250,000 cells/ml, whereas CMT scores of ++ to +++ revealed SCCs between 350,000 to 1,500,000 cells/ml. Raw camel tank milk samples from the camel dairy farm in Dubai revealed a mean SCC of 350,000 cells/ml which meets the EU regulation No 853/2004 for cow milk with less than 400,000 cells/ml. The total plate count (TPC) also met the EU regulation with less than 100,000 cfu/ml.
5. Lactoperoxidase (LPO) is the ideal enzyme for evaluation if camel milk has been properly pasteurized or not. The enzyme activity in raw camel milk is high and the respective value in pasteurized milk is below the detection limit (Lorenzen *et al.*, 2011).
6. As the demand for camel milk increases and its excellent health benefits become more documented, an adulteration with bovine and caprine milk can be expected. Therefore, we developed an analytical method to differentiate between pure and mixed camel milk and its products. Two microsatellites (CVRL 07) for camel milk and INRA 23 for cow and goat milk clearly identified pure camel, cow and goat milk as well as the mixture (Hassan *et al.*, 2008).

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76. Consumption of Camel Milk in Khartoum State

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Introduction

The Sudan has the second largest number of camels of the world after Somalia with about (3.9) million heads (Ministry Of Animal Resource And Fisheries, 2006). At times of global warming, growing deserts and increasing scarcity of food and water, the camel can be part of a solution to these problems (Wernery, 2007). In traditional pastoral and nomadic systems, camel milk is mainly used for feeding calves and for human consumption. Two quarters of the udder are usually selected for milking for human consumption and the other two quarters are left for maintaining the calf (Ramet, 1987 and Ramet, 1994a). Milk for human consumption is usually consumed raw immediately after milking or consumed as fermented milk (Yagil, 1982).

Materials and Methods

A questionnaire was distributed to 13 camel owners and some specialized camel farms in Omdorman and Khartoum North Sudan. Random samples of 30 persons were selected from Khartoum State and were subjected to sensory tests for fresh and fermented camel milk (Gariss) by a questionnaire. Data tabulation by frequency tables and simple percentage method of analysis was followed

Results and Discussion

The study showed that 77% of the families consumed 2-5 liters/day and 23% consumed more than 5 liters/day depending on the family and herd sizes. About 76.9% of she camel calves consumed half of the milk produced, this agrees with (Ramet, 1987, Ramet, 1994a), 23.1% consumed quarter of the she camel milk produced.

The study showed that 56.7% of the consumers who had drunk camel milk were mostly from Omdurman and Khartoum North and all of them or the majority were from western and eastern Sudan. Most of these people originate from camel herding regions.

For the general characters of camel milk, 60% knew them and 40% had no knowledge about them. This suggests more need for extension information on camel milk and products consumption. The study noted full agreement of the consumers for the possibility of using camel milk for human consumption, marketing camel milk and its products at 100% level which suggests more economic and social space for camel milk and products. This agrees with Abeiderrahmane (2007) who indicated that the present wide spread interest in camel milk opens a broad avenue for both developing modern camel dairies and more interest in funding and supporting camel research.

The study reflects the importance and the prospective future of camel milk production and consumption in the Sudan.

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77. In-Vivo Evaluation for Antidiabetic Activity of Kucchi Camel Milk in Wistar Rats

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Introduction

Diabetes mellitus is a chronic, widely spread human disease and is characterized by metabolism disorders and abnormally high blood sugar (hyperglycemia) resulting from a low level of the hormone insulin with or without abnormal resistance to insulin effects (Rogers, 1989). In this connection we have heard of many folkloric stories which describe the use of camel milk in the treatment of type-1 diabetes mellitus. There is also an account in memories of Emperor Jahangir (1579-1627 AD) referring to the usefulness and acceptability of camel milk (Beg, 1986). One of the camel milk proteins has been reported to have similar characteristics to insulin (Khitam, 2003).

Material and Methods

Thirty wistar rats, 8 weeks old, weighing 140-160gm were used for a study. They were acclimatized under laboratory conditions for two weeks by keeping them on standard rodent diet (Amrut feeds, Vadodara). Water was provided *ad libitum*. The animals were deprived of food overnight and their fasting blood sugar levels were estimated. The rats were divided into five groups (Group I, Group II, Group III, Group IV and Group V) of 6 rats each. Diabetes was induced in rats of Group I, Group II, Group III and Group IV by intra-peritoneal administration of Streptozotocin (55 mg/kg body weight). Rats were fasted for 12hr before diabetes was induced using STZ. STZ was freshly dissolved in 0.05M citrate buffer, pH 4.5. For the intraperitoneal injection, the rat was held in one hand in dorsal position, the injection site was swabbed using povidon- iodine solution and the designated amount of STZ was injected in the caudal abdominal cavity using sterile 25g-needle. The rats in Group IV were kept as untreated controls. Whereas, rats in Group V were kept as un-induced control. Fasting blood glucose levels of all these animals were estimated after three days of treatment. For the determination of blood glucose using Glucocheck (Onetouch), whole blood was collected from the tail vein from all the rats. The Group I animals were given 2 ml of raw camel milk orally using oral gavage needle, twice daily for 21 day. Group II animals were given 2 ml of raw goat milk through oral gavage needle twice daily for 21 days. The rats in Group III were given Metformin (100 mg/kg) orally using oral gavage needle once daily for three consecutive weeks. The Group IV was kept as control group and Group V served as un-induced control. Throughout the study period, all the rats were fed with standard rodent chow and water *ad libitum*. The blood glucose levels of all these rats were estimated at weekly intervals for three consecutive weeks. Blood samples were drawn from tail vein from overnight fasted rats.

Results and Discussion

Initial mean fasting blood glucose level of all the 30 animals (Group I – V) was 82.17 ± 1.12 mg/dl prior to induction of diabetes. On third day following streptozotocin administration by intraperitoneal route, the mean fasting blood glucose levels were 195.33 ± 4.33 , 194.50 ± 2.87 , 191.17 ± 6.76 and 200.33 ± 4.07 mg/dl for Group I, Group II, Group III and Group IV, respectively. Whereas, fasting mean blood glucose level for Group V (uninduced control) was 80.33 ± 1.52 mg/dl. In camel milk treated rats (Group I) after 1st, 2nd and 3rd week, mean blood glucose levels markedly dropped to 176 ± 3.12 , 136.50 ± 2.67 and 110.17 ± 1.25 mg/dl, where as in goat milk traeted rats (Group II), the mean glucose level dropped at a lower rate from 184.67 ± 2.03 , 157.83 ± 1.78 and 128.17 ± 4.08 mg/dl. The drop in mean glucose level in Metformin treated rats (Group III) was maximum and it dropped to 130 ± 5.4 , 94.67 ± 2.96 and 82.67 ± 1.58 mg/dl after 1st, 2nd and 3rd week, respectively. The drop in dibaetes induced untreated rats (group IV) was the slowest 194.83 ± 3.44 , 170.33 ± 2.17 and 140 ± 1.21 mg/dl, on 1st, 2nd and 3rd week, respectively. Whereas, mean fasting glucose level in Group V was consistent as 81.83 ± 1.99 , 82.67 ± 1.02 and 86.67 ± 2.69 mg/dl . Overall, there was a highly significant decrease in mean blood glucose level of rats receiving camel milk as compared to rats receiving raw goat milk through oral Gavage twice daily for three consecutive weeks. However, metformin treated rats showed maximum reduction in blood glucose

levels compared to camel and goat milk treated rats. Streptozotocin has been widely used to induce type 1 diabetes in animal models especially rats and mice (Gabel, *et al.*, 1985). The significant increase in blood glucose levels observed in the present study following STZ administration (55 mg/kg) compared to un-induced group is clear indicative of induction of diabetes in rats. It has been reported that a dose ranging from 25 to 100 mg/kg STZ injected intravenously was successful in inducing a dose dependent hyperglycemia (Agrawal *et al.*, 2003). The significant decrease in blood glucose levels following oral administration of camel milk for three consecutive weeks in streptozotocin induced diabetic rats is comparable to values of 98.0 ± 3.37 , 89.0 ± 5.23 and 86.28 ± 12.77 mg/dl after 1st, 2nd and 3rd weeks reported by other researchers (Singh, 2001). The positive effects may be because of high concentrations of an insulin like protein found in camel milk. A 30-35 percent reduction in doses of insulin in patients of type I diabetes getting raw camel milk (Agrawal *et al.*, 2002). Camel milk contains approx 52 units/litre insulin (Agrawal *et al.*, 2003). Oral insulin has been known since many years but the critical drawback is its coagulum formation in acidic media in stomach, which neutralizes its potency. One property of camel milk is that it does not form the coagulum in the stomach or the acidic media; thereby it prevents degradation of insulin in the stomach. It was found that amino acid sequence of some of the camel milk protein is rich in half cystine, which has superficial similarity with insulin family of peptides (Hull, 2004). The lack of coagulum formation allows the camel milk to pass rapidly through the stomach together with the specific insulin like protein/insulin and remains available for absorption in intestine. Radio immunoassay of insulin in camel milk has revealed high concentration i.e. 52 units/liter (Agrawal *et al.*, 2003). The milk of the camel has traditionally been used to treat diabetes (Shalash, 1979). Since blood glucose level is controlled by endocrine, paracrine and autocrine interactions, there might be some other active principle in camel milk compared to cow milk (Baumrucker *et al.*; 2000). Further studies are warranted to fractionate the active principle and to find out its exact mode of action.

In conclusion, the study indicated a significant hypoglycemic effect of camel milk in streptozotocin induced rats. In future, the evaluation of composition of camel milk in detail and further studies on antidiabetic activity testing of camel milk in healthy and diabetic patients may lead to valuable evidence that camel milk could be used as alternative therapy in the treatment of diabetes.

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78. Technology for Obtaining Probiotic Products From Camel Milk

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Introduction

Many developed countries implemented national programs to improve the health of the population through the development and organization of food components and correcting the biochemical composition of food products of mass consumption.

This paper deals with the creation of technology, research, manufacturing variability and increase the range of different products based on camel's milk, with functional properties, due to the presence in their composition useful natural ingredients, dietary fiber, antioxidant vitamins, fatty acids, probiotics and minerals.

Materials and Methods

The material used for the research were: camel's milk from the farm "Daulet-Becket", pure cultures of *Bifidobacterium adolescentis*, strain MS-42 and *Bifidobacterium bifidum*, strain 791; concentrate *Bifidobacterium longum* or *Bifidobacterium bifidum* and lactic acid bacteria *Lactococcus lactis* subsp. *diacetilactis*, *Streptococcus salivarius* subsp. *thermophilus*; concentrate of lactic acid bacteria *Lactococcus lactis* subsp. *lactis*, *Lactococcus lactis* subsp. *diacetilactis* and *Lactococcus lactis* subsp. *cremoris* of (Kazakhstan), whey concentrate with oligosaccharides derived from cheese whey by β -galactosidase, protein obogaditel derived from cheese whey by heat denaturation, fruit purees: of dried apricots, blackcurrant, vegetable puree of pumpkin and carrots on current regulatory documents; stabilizing systems "Palsgaard 5958", "Stabisol JTL" and "Stabisin 3", can be administered to bodies of Sanitary Inspection.

Physico-chemical and biochemical, and microbiological parameters of raw milk and finished products were determined in accordance with the regulations.

Results and Discussion

The lactoglobulin in camel milk was virtually absent. This suggests that camel milk does not contain allergenic properties. It is established that under the action of β -galactosidase synthesis of oligosaccharides maximum recorded at 30°C, the concentration of enzyme in 1 ml 20E serum concentrations of lactose, 40% and the duration of fermentation within 2 hours. Isolated and identified oligosaccharides, which represented 54% of disaccharides, including content allolactose was 34%. Whey concentrate containing oligosaccharides, when adding in a camel's milk in an amount of 5-6% stimulates the growth of bifidobacteria and lactobacilli as a result of induction of synthesis in cultures of β -galactosidase own. Investigation of the process of fermentation of camel's milk with pure cultures of bifidobacteria *B. adolescentis* MC-42 strain, *B. bifidum* strain 791, and the Association of cultures *B. longum*, *B. bifidum* and lactic acid bacteria *Lact. lactis* subsp. *diacetilactis*, *Str. salivarius* subsp. *thermophilus* using growth promoters (protein dresser, whey concentrate, oligosaccharides, lactulose), showed that the effective growth promoting bifidobacteria are whey concentrate with oligosaccharides or lactulose. Chosen flavor and vitamin and carbohydrate supplements for fermented combination product: puree of dried apricots, pumpkin, carrot and blackcurrant purée in an amount of 3.6% of the total weight of components. Defined biological, nutritional and energy value of new dairy products combined with camel's milk, "Improved shubat" and "Bioshubat" which contains all the essential amino acids, vitamins A, E, D, C, B1, B2, B6, B12, PP, pantothenic acid and minerals Na, K, Ca, Mg, P, Fe, I, Mn, Cu and Zn. Energy value of foods is 84,4-92,4 calories, depending on the type of plant component. Based on the results of mathematical modeling identified stabilizing systems "Stabisol JTL" at 0.8%, or "Stabisin 3" in an amount of 0.6% by weight of components for decreasing the shelf life of new dairy products combined functional food based on camel milk. Set period of guaranteed storage (15 days) at temperature 4 - 6°C. Developed regulatory documentation for the new fermented milk product made from camel milk, "Improved shubat" and "Bioshubat."

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79. Utilization of Kachchhi Camel Milk for Manufacturing of Medium Fat Ice Cream

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Introduction

Camel milk contains little fat (2%) which mainly consists of polyunsaturated fatty acids that are completely homogenized and gives the milk a smooth white appearance. Lactose is present in concentrations of 4.8%, and is easily metabolized by persons suffering from lactose intolerance (Hanna, 2001). Camel milk is also known for its medicinal properties which are widely exploited for human health (Mal *et al.*, 2006). Most camel milk is consumed raw, boiled or for preparation of tea. Now a days low-fat dairy products are preferred over full-fat products in several markets. This trend has been particularly visible for ice cream over the last few years. Camel milk, as well as being low in fat also contains Vitamin B, iron and unsaturated fatty acids. Camel ice cream is safe for consumers with lactose intolerance and contains 3 times more vitamin C than cows milk (Chris, 2006). Ice cream and frozen desserts were successfully produced from camel milk (Pathak and Bhagat, 2010).

Materials and Methods

Cream was separated from the milk at 40°C and was used for standardization of ice cream mix. Sagar™ brand skim milk powder (SMP) and whey protein concentrate (WPC) were used. Alginate-S4, Glycerol Mono Stearate (GMS), vanilla, strawberry and pineapple essence were used and brand pineapple and strawberry colour were used as colouring agent for pineapple and strawberry ice cream respectively. The ice cream mix was prepared and frozen in direct expansion type batch ice cream freezer.

Analyses of Ingredients

The fat content of milk and cream were estimated by Gerber method (ISI 1977). The total solids of milk was determined by the standard procedure using a Mojonnier Milk Tester (Model D, Mojonnier Brothers Co., Chicago, USA) (Laboratory Manual, 1959). The titratable acidity of milk was determined by standard method (ISI 1961). The total solids content of ice cream mixes were determined by standard method using 2 g of sample (ISI Handbook of Food Analysis 1989). The fat content of ice cream mix determined by the standard method using 5 g of mix (ISI Handbook of Food Analysis 1989). The protein content of the ice cream mixes was determined by Kjeldahl method (AOAC 1980). Overrun in ice cream was determined as per the method given by Marshall and others (2003). The method given by Loewenstein and Haddad (1972) was employed for evaluating the melting characteristics of ice cream. The hardened ice creams were tempered to $-12 \pm 1^{\circ}\text{C}$ for 1-2 h in retail cabinet before serving. All the samples were coded with a 3 digit random number and samples were served randomly. The ice cream was subjected to sensory evaluation using a 9 point hedonic scale. Fresh samples of ice cream 100 ml cups after 24 h of hardening at $-18 \pm 2^{\circ}\text{C}$ in hardening room were tempered to $-12 \pm 2^{\circ}\text{C}$ for 1-2 h in a retail cabinet for sensory evaluation.

Results and Discussion

The average fat content of camel milk was 3.2 ± 0.2 % and the MSNF content was 8.5 ± 0.1 . The average acidity of camels milk was 0.125% lactic acid. Since the fat content of the camel milk was low, it was decided to prepare medium fat ice cream. Reduced calorie products usually have a low content of total solids compared to standard products (about 30 to 35 % TS as against of 38 to 40 %), which means that they also make considerable demands on the functional ingredients (e.g. fat replacers, bulking agents, stabilizers and emulsifiers) that they contain. To select the optimum level of fat in the tentative formulation which would not have much adverse effect on sensory properties of the frozen product, preliminary screenings were undertaken. It was decided to use milk fat at a level of 6% was in the formulation while the MSNF content 11.5 % (w/w) and WPC 1.5% respectively. Whey protein concentrate (WPC) has been included in ice cream mix formulations for its contribution to favourable sensory and textural qualities (Tirumalesha and Jayaprakasha, 1998). Therefore it was decided to incorporate WPC in the mix. The tentative levels of fat as well as MSNF were based on the

preliminary investigations and reported literature (Marshall *et al*, 2003). The formulation was chosen and used for preparation of medium fat camel milk ice cream. The camel milk had a sharp taste (mineral like) and predominant grassy flavour, with a slightly salty taste. It also had a pronounced fat aftertaste. Therefore, with a view to improve the acceptability of camel milk ice cream, three flavours were used to ascertain which flavour is most acceptable for preparation of camel milk ice cream. Camel milk medium fat ice cream was prepared using three different types of flavouring i.e Vanilla (V), Strawberry (S), and Pineapple (P). All the three experimental ice creams were compared to control, i.e. C. The composition of control ice cream mix was 10.0% milk fat, 11.0% MSNF, 15% sugar, 0.15% stabilizer and 0.2% emulsifier. All the flavouring ingredients, i.e. Vanilla, strawberry and pineapple essence were added at the rate of 3 ml/kg mix. The freshly hardened control (C) and experimental samples viz. V,S and P of ice cream were analysed for their chemical composition. The protein content of all the experimental samples were higher than control. This is quite obvious as WPC was rich in protein content (i.e. 71.09% on dry matter basis). The fat content and total solid content of experimental camel milk ice cream were significantly lower as compared to Control. This is due to the lower fat of experimental samples which leads to reduction in total solids of ice cream mixes. No data is available in literature for camel milk ice cream for comparison. Viscosity has been considered an important property of ice cream mixes and up to a certain extent it seems essential for proper whipping and retention of air cells. The viscosity of mix is also affected by the composition, especially, fat, protein and stabilizer and the quality of ingredients used. Hence, the aged mixes were subjected to viscosity test. The overrun of a frozen dessert is an important property since it directly has relation with the yield and profit. It also affects the body, texture and palatability of the final product. The major physical characteristics of frozen desserts that concerns regulatory agencies is weight per unit volume of the product, and this is affected by the overrun developed in the product. Ice cream should melt down to a liquid of smooth consistency, suggestive of a rich cream. Meltdown is an important property of ice cream affecting its sensory quality. It is important from at least two main points of view – eye appeal and mouth feel – which may differ according to the type of ice cream (Flack, 1988). It is also important that the ice cream is not too hard or should not melt quickly. Deviation in the melting property from ideal condition either extremes can make the ice cream defective (Sommer, 1951). Hence, the melting resistance of control as well as experimental samples were monitored. The camel milk ice cream mixes viz. V, S and P had significantly lower viscosity. The experimental icecreams had higher overrun as revealed from the wt/volume data. Incorporation of WPC in the all the experimental ice creams was found to improve the overrun significantly ($P \leq 0.05$). From the pertaining statistical analysis it can be seen that all the experimental samples had significantly ($P \leq 0.05$) lower melting resistance compared to control. The experimental samples in spite of decreased melting resistance values, were statistically at par with each other ($P > 0.05$). No data is available in literature for comparison of the above physical properties of medium fat camel milk ice cream with regular ice cream. The fate of any food product has always rested on the acceptance of the product by the consumers. The quality of the ice cream judged by consumers rests on its sensory characteristics, viz. flavour, colour and appearance, body and texture and overall acceptability. Keeping in view these aspects, the sensory quality of the ice cream samples were adjudged by a panel of 6 judges using 9-point hedonic scale scorecard. The flavour score of control and P were at par ($P > 0.05$) with each other, whereas samples V and S had significantly lower flavour scores compared to control. The colour and appearance scores of camel milk vanilla ice cream, i.e. V was significantly lower than all the other experimental samples. This was due to the dull /less attractive colour as criticized by the judges. The body and texture scores of all the experimental samples were significantly lower than control ($P < 0.05$). This could be attributed to the lower total solids and fat content and faster meltdown in the experimental samples. However, the overall acceptability of sample P was at par with control. Pineapple flavour reduced the negative impact of the flavour characteristics of camel milk. This could be due to the masking effect of pineapple flavour. The use of pineapple flavour appears to be the most advantageous from all the flavors used which helped in enhancing the acceptability of medium fat camel milk ice cream compared to the other two flavors studied viz. strawberry and vanilla.

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80. Fatty Acid Profile of Sudanese Fermented Camel's (*Camelus dromedarius*) Milk Gariss

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Introduction

Milk fatty acid composition is one of the aspects related to the health effects of camel's milk and its products; however, the fatty acid composition of camel's milk is not well documented (Ulbricht and Southgate, 1991; Farah, 1993).

Human milk fat contains a higher content of unsaturated fatty acids compared with bovine but camel's milk seems to be very different from other mammalian milks in terms of unsaturated fatty acid composition and in its low content of short-chain fatty acids (Bracco *et al.*, 1971; Konuspayeva *et al.*, 2008). It has been reported (Konuspayeva *et al.*, 2008) that the percentage of saturated acids is higher in bovine milk fat (69.9%) than in camel milk fat (67.7%).

Materials and Methods

Fermented camel milk (*gariss*) samples were obtained from three areas of North Kordofan and three areas from Khartoum state, Sudan; the samples were collected from nomads moved around Elobeid (North Kordofan State) and from Khartoum state retailers in February 2010.

From the extracted lipid stored at 4°C according to the method described by Konuspayeva *et al.* (2008) was used to prepare methylation and quantify fatty acids.

The study indicated that the fatty acids profile of fermented camel milk (*gariss*) obtained from Kordofan and Khartoum locations were not different in short, medium and long chains quantity, and while in the individual locations were different in most of them.

Results and Discussion

The objective of the present study was to determine the fatty acid profile of fermented camel milk (*gariss*) obtained from six different locations in Kordofan and Khartoum States in Sudan. The mean values of fatty acids obtained from Khartoum were significantly ($P \geq 0.05$) higher than that from Kordofan in C16:1, C18:1 and C18:2, while all others fatty acids investigated in this work of Kordofan and Khartoum were not significantly ($P \geq 0.05$) different.

In all samples investigated in this work there was only one location in Kordofan region with content of butyric acid (C4:0) of 5.5% were in Khartoum State locations. There were no values of butyric acids detected.

Location KRD1 (from Kordofan area) has no content of Caproic acid (C6:0), while location KRD2 has the highest value followed by KHT3 and KRD3 (those three locations were not significantly $P \geq 0.05$ different) and significantly higher than locations KHT1 and KHT2.

The analyses of the short, medium and long chains fatty acids in Kordofan, Khartoum and individuals of the locations indicated no significant differences between regions.

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81. Protection Against Lead Contamination by Strains of Lactic Acid Bacteria From Fermented Camel Milk

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Introduction

Heavy metals are widely responsible for environmental contamination (3). The pollution of some areas by lead (Pb) is a health hazard for consumers of dairy products because this metal is concentrated throughout the food chain. One of the most frequently described problems in lead toxicity is saturnism, cancer and anemia. Camel milk and fermented *shubat*, its derivative product could be contaminated (4, 7, 8). The lactic fermentation of *shubat* could reduce the availability of lead in the digestive tract of consumers because lactic acid bacteria (LAB) are able to absorb this metal which is then excreted in the faeces (1, 2, 5, 6). Therefore, the present study was carried out to determine *in vivo* the effectiveness of the fermented milk for decreasing the absorption of Lead Nitrate (PB2(NO3)).

Material and Methods

Female cavies (250-300 g) were housed in standard metal cages (10 cavies/cage). They were divided into four treatment groups: (1) cavies not receiving lead and used as control group, (2) treated group with 2 mL of solution containing Lead Nitrate (0.5 ppm) and named Lead Nitrate treated cavies, (3) cavies treated with 2 mL of milk product fermented by 4 different LAB strains having proved capacity to absorb Pb (9, 10, 11, 12), (4) cavies treated with 2 mL of milk product fermented by 4 different LAB strain in which the same concentration of Lead Nitrate than group 2 was dissolved. Cavies were orally administered their respective doses every day for 21 days. Water and food were provided *ad libitum*. Heart, lungs, liver, kidney, spleen and blood were collected and analyzed for lead quantity. Faeces were collected every 7 days and also analyzed for lead quantity.

Results

Levels of 0.32, 0.12, 0.32 and 0.1 ppm of lead concentration were found in milk, water fodder and HNO₃ respectively. There was no difference between control group (1) and group (2) for the Pb content in the faeces of cavies, except for 4th week where higher concentration (1.57 ppm) was observed. These results need to be confirmed (Figure 1). The lead concentration in faeces is higher in the groups 3 and 4 compared to control group (Figure 2). However, in the 3rd group which was not treated by lead, the quantity of this metal is also higher than in control group. The highest quantity of Pb was in 4th group, but the fecal content of lead in those groups 3 and 4 changed during the study.

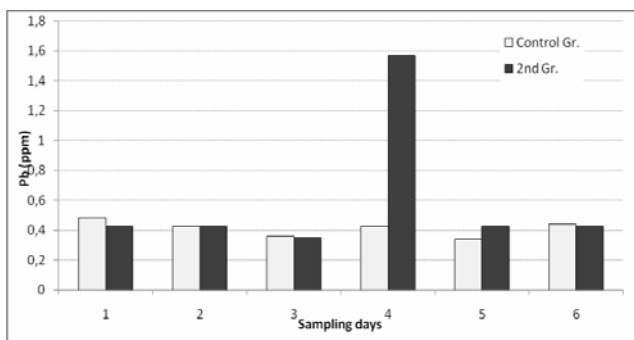


Figure 1. Lead concentration in feces of control and lead nitrate groups

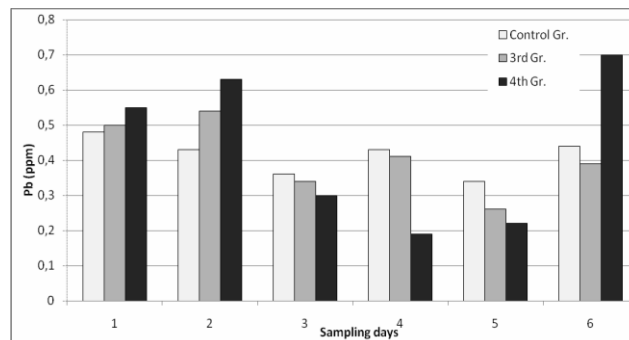


Figure 2. Lead concentration in feces of control, 3rd and 4th groups

In the different cavies' organs of group 2 (receiving enriched Pb solution in water), the higher concentration of heavy metal was observed in spleen (1.04), heart (0.65), kidneys (0.58), blood (0.46)

to be compared to 0.82, 0.2, 0.58 and 0.31 respectively in control group (Figure 3). In groups treated with fermented milk without and with Pb, the lead concentration decreased in targets organs (spleen, kidneys, liver and lungs). The Pb concentration in blood and heart was similar in control, 3rd and 4th groups (Figure 4) in spite of the lead treatment in the 4th group.

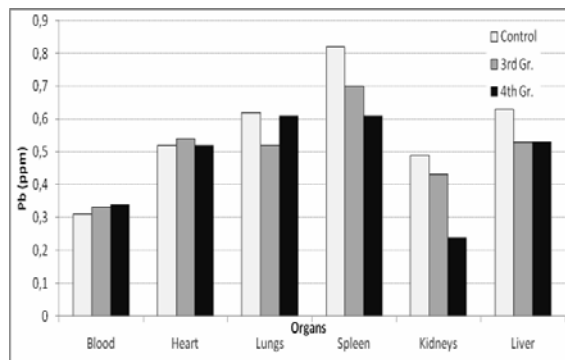


Figure 3. Lead concentration in organs of control and lead nitrate groups

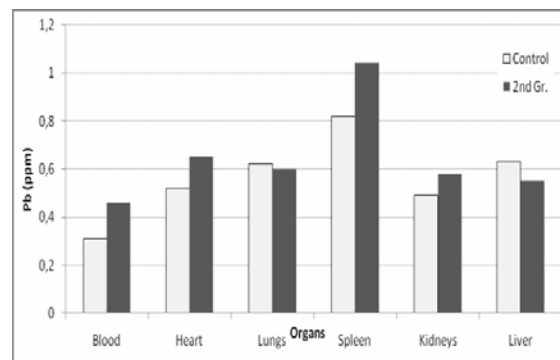


Figure 4. Lead concentration in organs of control, 3rd and 4th groups

Discussion and Conclusion

The lead concentrations in feces of control group and lead nitrate treated group were almost the same. The fecal lead concentration increased in groups treated by milk fermented by strains of LAB. However, the fecal excretion of Pb was not constant. Although the 3rd group wasn't treated, the quantity of fecal Pb was higher than in control group. It's quite possible that Pb formerly existing in organism was eliminated due to the absorbing effect of LAB strains. Lead was concentrated mostly in spleen, blood, heart and kidneys. In groups treated with fermented milk the Pb concentration decreased in organs. Even if cavies were treated, the Pb concentration in heart and blood remain similar to control group.

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82. Milk Components Relationship and Energy Corrected Milk Standardization for Dairy Camels

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Introduction

The energy content of milk varies largely according to species, breed, individual and stage of lactation, making necessary its standardization in practice (i.e. rationing, breeding evaluation). Milk energy content can be estimated with a high degree of accuracy from the standard caloric values of its components (fat, 9.5; protein, 5.7; and lactose, 4.0 cal/g), as stated by Perrin (1958). Fat correlates highly with milk energy due to its caloric value and the accuracy of fat analysis. So, milk is usually standardized for a fixed energy content (i.e., 750 kcal/kg) or an equivalent milk fat percentage (i.e., 4% fat) as in the known Overman and Gaines' equation ($y = 0.15x + 0.4$).

The purpose of this work was to study the correlations between the major components of camel's milk and to determine its energy value with the aim of proposing the appropriate energy- and fat-corrected milk equations for dairy camels.

Materials and Methods

One-hundred and eighty lactating she-camels (*Camelus dromedarius* L.) of 4 indigenous breeds (Majahim, 58; Maghatir, 49; Shu'l, 39; Sufer, 34) from different dairy herds at the Riyadh region (Saudi Arabia), were used through lactation (29 to 372 days in milk). Hand-milking was done twice daily and milk samples collected (n = 720) by udder quarter at the morning milking. Only samples from apparently healthy udders (no visible lesions or changes in milk appearance) were used. Prior to sampling, teats were washed, dried, foremilk stripped and first milk jets discarded. Samples were collected in sterile bottles (100 mL), without preservative, and immediately transported in ice to laboratory. Milk fat, protein, lactose and total solids (TS) contents were measured using a Lacto Star milk scanner (Funke-Gerber, Labortechnik GmbH, Berlin, Germany) calibrated for camel milk. Mineral content was analyzed from milk white ashes (550°C) by atomic absorption spectrometry (Analyst Spectrophotometer 300, Perkin-Elmer Inc, Shelton, Connecticut, USA). A subset of 225 samples (40 mL each), carefully chosen according composition, were freeze dried (-45°C and 0.1 mbar) and 2 g milk powder used for gross energy determination using an adiabatic calorimeter (IKA calorimeter, Janke & Hunkel, Heitersheim, Germany). Energy values were corrected for sample dry matter. All analyses were made in duplicate. Data were analyzed for simple and multiple linear regressions by the REG procedure of SAS (SAS version 9.1, SAS Inst. Inc., Cary, NC).

Results and Discussion

Milk composition widely varied across the samples collected (Table 1) but, on average 79% milk samples showed inverted fat and protein contents (fat < protein). This may have been a consequence of an incomplete milk letdown (i.e. milk without stimulatory calf suckling), the milk sampled mainly corresponding to available cisternal milk. Nevertheless, the incidence of fat depression syndrome (consequence of a low proportion of forage in the diet) should not be discarded and would need further research.

Table 1. Milk composition of dairy camels in Saudi Arabia.

Milk component	Overall (n = 720)		Selected subset (n = 225)	
	Mean ± SE	Range	Mean ± SE	Range
Fat, %	2.94 ± 0.03	1.35 – 5.85	2.88 ± 0.05	1.39 – 5.63
Protein, %	3.45 ± 0.01	2.45 – 4.40	3.44 ± 0.02	2.72 – 4.31
Lactose, %	4.98 ± 0.02	3.56 – 5.99	4.99 ± 0.02	3.93 – 5.97
Total solids, %	12.1 ± 0.1	9.0 – 15.6	12.1 ± 0.1	9.6 – 15.6

Ash, %	0.74 ± 0.01	0.59 – 0.95	0.74 ± 0.01	0.61 – 0.88
Ca, mg/L	9.03 ± 0.07	5.01 – 13.03	9.25 ± 0.13	5.06 – 13.00
Na, mg/L	3.57 ± 0.04	1.08 – 8.01	3.73 ± 0.09	1.07 – 8.02
K, mg/L	8.72 ± 0.11	3.06 – 19.41	9.55 ± 0.21	3.33 – 19.41
Energy, kcal/kg				
Measured	-	-	626 ± 6	403 – 890
Estimated ¹	655 ± 3	447 – 928	667 ± 5	458 – 942

¹According to Perrin (1958): Energy (kcal/kg) = 95 × Fat (%) + 53 × Protein (%) + 40 × Lactose (%).

Correlations between milk components were low for the overall data (fat vs. protein, $r = 0.21$; lactose vs. Na, $r = -0.34$; Na vs. K, $r = 0.62$; fat vs. TS, $r = 0.69$; protein vs. TS, $r = 0.84$) but improved in the selected subset (fat vs. protein, $r = 0.39$; lactose vs. Na, $r = -0.18$; Na vs. K, $r = 0.61$; fat vs. TS, $r = 0.82$; protein vs. ST, $r = 0.84$) agreeing on their adequacy. Milk K:Na ratio were 2.53 ± 0.02 and 2.68 ± 0.04 in the overall and selected samples, respectively, indicating that a displaced equilibrium (with a greater Na content) is usually present in the camel's milk when compared to cow's milk (K:Na ~3), as also shown by Ayadi *et al.* (2009). This may be also related to the high reactivity of camel's milk to the CMT test reported by Aljumaah *et al.* (2011).

Equations for milk energy obtained by regression analysis from the measured (calorimeter; $R^2 = 0.73$) and the estimated (Perrin; $R^2 = 0.89$) data showed divergence at the intercept (Figure 1) which will need further research. The proposed fat-corrected milk (FCM at 3% fat) equation for milk standardization (1 kg FCM_{3%} = 642 kcal or 153 kJ) in dairy camels from our data differed from that of Overman and Gaines and was: FCM_{3%} = $0.197 \times \text{Fat} (\%) + 0.408$.

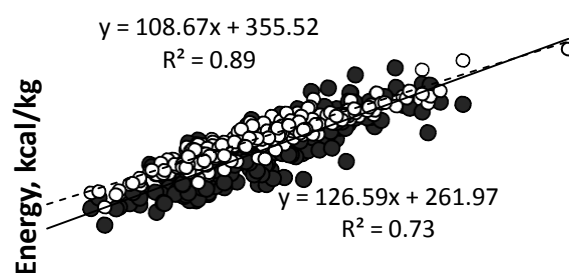


Figure 1. Energy content of camel's milk (‘‘○’’, estimated; measured, –●–) according to milk fat.

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83. Place Bacteriocins (Nisin Type), In The System Self-Purification of Camel Milk

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Introduction

Camel milk is characterized by a relatively powerful protector system compared to milk of other species (RAMET, 2003). The latter is related to the existence of inappreciable quantities of protective proteins contained in whey (lysozyme, immunoglobulins, LSPsystem, lactoferrin, hydrogen peroxide and the component 3 of proteose-peptones)

This study shows that this natural system is reinforced by the action of nisin produced by the species *Lactococcus lactis subsp. lactis*. This bacteriocin is particularly effective against one species may accidentally contaminate the milk: *Staphylococcus aureus*, which have developed a resistance to antibiotics according to many authors.

The propagation of bacteria, their resistance to antibiotics and the demand for more products containing the least of chemicals substance, is responsible for finding new alternatives to reduce the misuse of therapeutic antibiotics. In this context, bacteriocins, nisin in this case are shown to prevent the growth of undesirable bacteria in food products, cosmetics.

Materials and Methods

Four samples of camel milk as mixtures from camels living in extensive in the region of Ouargla are used. They are transported to the microbiology laboratory in a cooler. They were used for isolation, identification and purification of strains of interest.

For the culture of the strain of *Lactococcus lactis subsp. lactis*, producer of nisin, we used the M17 medium (KELLY *et al.*, 1998; KERAMANE, 2009). Seeding is carried on the surface because the strain is aerotolerant (DELLAGLIO, 1994). The strain targeted belongs to the species *Staphylococcus aureus* isolated from mastitis milk on Chapman medium. Given its halotolerant, it is susceptible to be part of the flora of camel milk contamination due to its salinity more or less pronounced.

After incubation for 18 hours, the culture of nisin-producing strain, followed by centrifugation at 8000 rpm for 10 minutes at 4 °C, the supernatant may contain the desired bacteriocin (nisin) is recovered. It is then neutralized to pH 6.5 with 5 N NaOH to raise the antibacterial activity may be exerted by organic acids (NYKANEN *et al.*, 2000). The diffusion test in agar by the disc method was used to search for the antibacterial activity of nisin produced by *Lactococcus lactis subsp. lactis* against strain of *Staphylococcus aureus*.

Results and Discussion

The diffusion test in agar by the disc method allowed, to demonstrate the presence of antagonism. The appearance of a variable diameter between 6 and 8 mm, indicates that there is an antibacterial effect against the strain of *Staphylococcus aureus* isolated, inhibition due to the production by lactic acid bacteria of organic acids and H₂O₂ has been waived by the neutralization of the supernatant and catalase + property of target strain. Since the system self-purification of camel milk is due to whey protein role in antibacterial, reported by many authors, the results can be explained the part of bacteriocins (nisin type) produced by *Lactococcus lactis subsp. lactis* on a species halotolerant susceptible to contaminate milk camels due to its salinity caused by grazed plants, mostly halophytes. This is especially important given that clinical cases of mastitis in the camel are infrequent (KANE *et al.*, 2003).

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84. Milk Fat Content of Conjugated Linoleic Acid (CLA) In Dairy Camels Fed Different Levels of Sunflower Oil

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Three experiments were carried out to study the effect of sunflower oil (SFO) supplementation on nutrients digestibility (Exp.1), in vitro degradation kinetics of organic matter and fiber fractions (Exp. 2); and milk composition and fatty acids profile in milk fat of dairy camels (Exp.3). Chemical composition of the basal diet was 92.3%, 14.1%, 29.1%, 12.9% and 2.1%; of organic matter (OM), crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF) and ether extract (EE), respectively. The SFO was added at the level of 0, 2 and 4% of DM for basal diet. Experimental diets were basal diet (SF-0) and basal diet with 2% SFO (SF-2) and basal diet with 4% SFO (SF-4). In digestibility trial (Exp.1), dry matter intake (DMI) and digestibility of NDF, ADF and N were significantly decreased ($P < 0.05$) by diet SF-4, but not with SF-2. Adding SFO at the level of 4% of DM negatively affected the ruminally degradable fraction and degradation rate of OM, NDF and ADF. Milk yield was significantly decreased ($P < 0.05$) when dairy camels were fed SF-4, however, no significant differences were detected on DMI and milk composition for either SF-2 or SF-4 (Exp.3). The principal aim of this study was to study the effect of different levels of SFO on the concentration of cis-9, trans-11 C18:2 in milk of dairy camels. The provision of SF-2 and SF-4 to dairy camel had no significant effect on the concentrations of capric acid (C10:0) and lauric acid (C12:0) of milk fat. Myristic (C14:0) and palmitic acid (C16:0) contents of milk fat of animals fed added-oil diets (i.e., SF-2 and SF-4) were decreased ($P < 0.05$) compared with SF-0. The concentrations of total short and medium chain FA (i.e. C10:0 to C16:0) were reduced by 38% and 48% with SF-2 and SF-4 than SF-0. A positive response was observed for cis-9, trans-11 conjugated linoleic acid (CLA) content in milk fat, which significantly increased ($P < 0.05$) by about 5 folds in animals fed SF-2 compared to SF-0. However, no significant difference was found between SF-0 and SF-4 in this respect. Total CLA isomers of milk fat were significantly ($P < 0.05$) higher in SF-2 than in other treatments, since the values were 0.94, 3.80 and 0.60 g/100 g fat for, SF-0, SF-2 and SF-4 respectively. Therefore, CLA content of dairy camels milk could be increased by the addition of SFO at the level of 2% of DM of the diet with no adherent effect on nutrients digestibility and daily milk production.

85. Antiulcerogenic Effect of Camel Milk Against Ethanol- and Aspirin-Induced Gastric Ulcers in Rats

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Introduction

Camel milk contains many useful components such as: minerals (sodium, potassium, iron, copper, zinc and magnesium), vitamins (C, B₂, A and E), low protein, low cholesterol, low sugar, and high concentrations of insulin (Rao, *et al* 1970). It has been used therapeutically against dropsy, jaundice, problems of the spleen, tuberculosis, asthma, anemia, piles and diabetes (Agrawal *et al* 2002; Mohamad *et al*, 2009), gastric ulcer (Sharmanov *et al*, 1982) and renal and hepatic dysfunction (Saltanat H *et al*, 2009).

The aim of this work: is to investigate the effect of camel milk on ethanol- and aspirin -induced gastric damage in rats.

Material and Methods

Ethanol induced gastric ulceration

Gastric ulcers were induced on three groups of Sprague-Dawley rats (150-200 g/BW); control, saline- treated, camel milk- treated and rantidine (100mg/kg) -treated. Two doses were given at the first day and a third dose was given in the second day 90 min before ulcer induction using alcohol 80% (10ml/kg orally) (Glavin *et al* 1976). The following parameters were used to evaluate the antiulcerogenic effect of camel milk: Number of long ulcers, length of ulcer (mm), ulcer index, curative ratio (%), volume of gastric juice (ml/100g), pH of gastric juice and total protein in the gastric juice (g/L).

Aspirin induced ulceration:

Fifteen male Sprague-Dawley rats (150-200 g/BW) were kept under standard conditions before their use. Rats were randomly allocated into 3 equal groups. The modified method of (7) was used for the production of experimental gastric ulceration in three groups of male Sprague-Dawley rats difference. Two doses of distilled water, camel milk (5 ml/kg) and rantidine (100 mg/kg) with 6 hours in between them were given daily to control, camel milk and rantidine-treated groups respectively. Three hours after the first dose, carboxymethylcellulose 1% was given to control group and aspirin (200 mg/kg) was given to the 2nd and 3rd group. The volume of gastric juice, the number of ulcers was counted and the total length was measured. The curative ratio was calculated as mentioned before. Total protein (g/dl) in the gastric juice was determined by the Biuret Reagents.

Statistical analysis:

Difference between groups was tested for significance using ANOVA followed by Duncan's multiple range test.

Results and Discussion

The effect of oral administration of camel milk against ethanol – induced and aspirin-induced gastric damage in rats is recorded in Tables 1 and 2 and show in Fig. 1.

Table 1: Antiulcerogenic effect of camel milk (5ml/kg) against ethanol – induced gastric damage in rats (Mean ± SD, n = 5)

	Number of long ulcers	Length of ulcer (mm)	Ulcer Index	Curative ratio (%)	Volume of gastric juice (ml/100g)	pH	Total protein g/L
Control	4.50±1.11 ^b	4.24±0.88 ^b	1.02±0.4 ^b	--	1.61±0.25 ^b	7.40±0.55 ^a	14.67±4.27 ^{ab}
Milk	1.8 ±0.27 ^a	1.26±0.59 ^a	0.32±0.2 ^a	70.70	1.15±0.27 ^a	6.60±0.55 ^a	17.80±4.6 ^a
Rantidine	4.60±1.14 ^b	5.26±0.27 ^b	1.36±0.4 ^b	45.12	1.89±0.39 ^b	7.0±0.71 ^a	11.97±2.83 ^a

Means with different letters in the same column are significant at P<0.05

Table 2: Effect of camel milk on aspirin-induced gastric ulcer in rats (Mean \pm SD, n = 5)

	Number of ulcer	Ulcer index	Curative ratio (%)	Volume of gastric juice MI/100 g	pH	Total Protein g/L
Control	4.4 \pm 1.14 ^b	3.43 \pm 0.67 ^c	--	2.24 \pm 0.33 ^b	5.75 \pm 0.96 ^a	5.64 \pm 1.43 ^a
Milk	0.6 \pm 0.55 ^a	1.2 \pm 0.51 ^a	65.03	1.87 \pm 0.27 ^a	5.6 \pm 1.34 ^a	104.27 \pm 2.94 ^b
Rantidine	1.8 \pm 0.34 ^a	2.26 \pm 0.49 ^b	34.03	2.04 \pm 0.11 ^{ab}	6.8 \pm 1.10 ^a	11.29 \pm 3.36 ^b

Means with different letters in the same column are significant at P<0.05

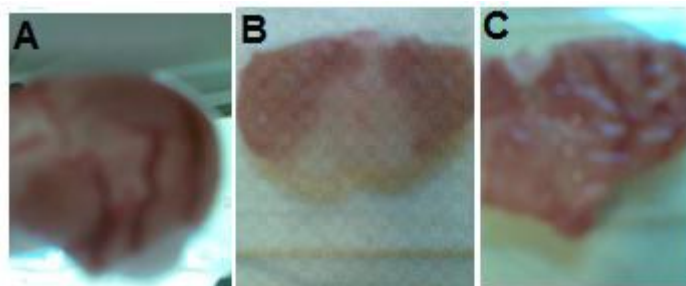


Figure 1: Stomach of rat treated with salicylic acid alone (A), salicylic acid + camel milk (B) and salicylic acid + rantidine (C).

The antiulcerogenic effect of camel milk is attributed to its content of vitamins C, A, B₂ and E as well as to its content of magnesium and Zinc which have an antioxidant effects reducing the oxidative stress.

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86. Effects of Season on Haematological Parameters in Omani Camels (*Camelus dromedarius*)

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Introduction

Normal haematological parameters in healthy camels have been reported from different geographic zones of the world. These haematological values differ due to the method of analysis, season, age, sex and nutritional status. The haematological and biochemical values obtained in one geographical zone cannot be taken as a standard reference value in an other zone due to varying climatic conditions. Hence this study was carried out to examine the effect of season (winter vs. summer) on haematological values in apparently healthy Omani dromedary camels.

Materials and Methods

This study was carried out on forty healthy, 2 to 12 years old dromedary camels. These animal were kept in pens of the Royal Camel Corps, Royal Court Affairs, Muscat, Sultanate of Oman (latitude 23° 36' N: longitude 58° 37' E). They were fed fresh green grass/dry fodder and had free access to water and mineral salt lick blocks. Blood samples were collected in the morning before feeding from the jugular vein into vacutainer tubes containing EDTA during winter (October to February) and summer (April to August). Haematological values were measured using automated blood analyzer (Cell Dye 3700, Abbott Co. Illinois, U.S.A) specially set for camel blood. These included total leukocyte count (WBC), differential leukocyte, erythrocyte count (RBC), hemoglobin (Hb), hematocrit, mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and platelets. All statistical analysis was carried out using SPSS 15.0 software (SPSS Inc, Chicago, IL, USA). Student's t test was used to test significance between the groups.

Results and Discussion

The mean (\pm SD) haematological values of Omani camels during winter and summer are presented in Table 1. The season did not affect the WBC, RBC, Hb, haematocrit, MCV, MCH and platelets count in the present study. However, in differential leukocytes, (the lymphocytes) count was higher in summer than winter (27.4 ± 8.2 versus 23.7 ± 5.4). Similar findings were reported in racing dromedary camels (Salman and Afzal, 2004). Heat stress is one of the most important stressors especially in hot regions of the world. Higher lymphocytes in the present study during summer might be attributed to heat stress. The haematological values reported in the present study were similar to those reported in earlier studies (Abdelgadir et al., 1984; Higgins and Kock, 1986). In conclusion, the season did not affect the haematological parameters other than lymphocytes. The haematological values obtained in this study are useful for the diagnosis of diseases in Omani camels. Effect of heat stress on lymphocytes even in the dromedary which is known to be a heat-tolerant species is of interest for future research.

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Table 1: Mean (\pm SD) values of haematological parameters of Omani camels during winter and summer.

Parameter	Winter	Summer	P value
WBC ($10^3/\mu\text{L}$)	8.2 \pm 2.2 (4.5 – 15.6)	8.0 \pm 2.4 (3.6 – 12.8)	0.68
Neutrophils (%)	64.6 \pm 8.9 (23.3 – 74.4)	60.9 \pm 7.6 (40.5 – 72.0)	0.06
Lymphocytes (%)	23.7 \pm 5.4 (16.5 – 44.4)	27.4 \pm 8.2 (4.2 – 47.8)	0.01
Monocytes (%)	1.5 \pm 1.5 (0.2 – 5.8)	2.1 \pm 1.7 (0.3 – 7.3)	0.10
Eosinophils (%)	9.0 \pm 3.9 (0.1 – 18.8)	9.2 \pm 3.5 (2.8 – 16.8)	0.82
Basophils (%)	0.4 \pm 0.3 (0.0 – 1.4)	0.4 \pm 0.4 (0.0 – 1.4)	0.84
RBC ($10^6/\mu\text{L}$)	9.1 \pm 1.0 (6.8 – 11.8)	8.9 \pm 0.9 (6.7 – 11.2)	0.42
Hemoglobin (g/dL)	13.0 \pm 1.2 (10.7 – 17.2)	12.7 \pm 1.2 (9.3 – 15.7)	0.37
HCT (%)	24.8 \pm 2.0 (20.3 – 30.5)	24.7 \pm 2.2 (18.7 – 30.7)	0.96
MCV (fL)	27.1 \pm 1.8 (23.9 – 33.6)	27.7 \pm 1.7 (25.0 – 32.5)	0.13
MCH (pg)	14.2 \pm 0.8 (12.5 – 16.5)	14.3 \pm 0.9 (12.9 – 16.6)	0.63
Platelets ($10^3/\mu\text{L}$)	297.5 \pm 128.1 (58.8 – 640.0)	280.2 \pm 156.0 (55.1 – 729.0)	0.58

P- Value represents the comparison between winter and summer.

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