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Original article

Observations on dromedary (Arabian camel) and its diseases

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Abstract

This article describes some facts regarding the dromedary, its classification, distribution and population in the world. In addition, the diseases of camels and its classification according to OIE is also described. Since, little is known about the health problem of Iraqi camels, this article plays a magnificent role in filling the knowledge gap and drawing attention towards the improvement of camel health care and its management practices. Much emphasis is given to the occurrences of abortion in the herd of camels in Iraq. Subsequently, the authors would like to give more attention to the Iraqi camels herd and enhancement its future and production performances as camels consider as the animals of the future.

Keywords: Camels, Iraq, OIE, population, abortion

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Introduction

Camel is the common name for large, humped, long-necked, even-toed ungulates comprising the mammalian genus Camelus of the Camelidae family. There were over 19 million camels worldwide according to FAO statistics 2008, of which: 15 million are found in Africa and 4 million in Asia. Camel is considered as one of the highly mulch animals, although they are living in the harsh desert environmental conditions (Knoess, 1984; Abbas and Tilley, 1990; Schwartz, 1992).

According to taxonomy, physiology or behaviour, the camelids are not ruminants. They are a polygastric animal, but not a true ruminant (Fowler, 1996). True ruminants have four compartment stomach, whereas there are three compartments in the camel stomach. Since after feeding, the camel also ruminates, therefore, it is called a special ruminant or sometimes as a pseudo-

ruminant. Camelids differ from ruminant in susceptibility to infectious and parasitic diseases according to Fowler, (2010). The differences between camelids and ruminants should exclude camelids from being classified as ruminants. Despite that, camelids have been located in various categories, such as "exotic animals," "wild animals," "other livestock species," Two genera are comprised in the family Camelidae (Figure 1), these are:

- The genus Camelus (Linnaeus, 1758), includes two species. The first species is *C. dromedarius*, the dromedary or one-humped camel, the world population of which is estimated to be 15,368,000, with approximately 80% in Africa and 20% in Asia. The second species is *C. bactrianus* (Linnaeus), the bactrian or two-humped camel, of which there are some 1.7 million in their natural habitat in Asia.
- The genus Lama comprises *Lama glama* (the llama), *Lama pacos* (the alpaca),

Lama guanicoe (the guanaco), and *Vicugna vicugna* (the vicugna). Only the first two have been domesticated. They are raised in herds in the Andes at altitudes above 2,500 m. Their population is estimated to be 7,165,000 (Bisby *et al*., 2011).

Figure 1. Shows the Complete Classification of the Camels including the higher taxa **(Source: Simpson G.G 1954**; **Classification of mammals .Bull. Amer. Mus. Nat. Hist.85, 1-350)**

Usually, camels raise in the dry desert conditions. The severity of the desert conditions particularly during the long dry season put the camels under severe stress conditions and make them susceptible to many diseases and illness (Abbas *et al*., 1993; Agab, 1993). Scarce of the studies on the camel disease in the past

led some scientists to consider camels, as resistant to many disease causing factors (Zaki, 1948; Dalling *et al.*, 1988). However, the camels have proved as other livestock, being susceptible, to the common disease causing pathogens affecting other animal species (Wilson 1984; Abbas and Tilley, 1990; Abbas and Agab, 2002). Little is known about the camels and its health problems in Iraq compared to other livestock. The depth of information on Iraqi camels and camel production and disease has not been adequate to solve its multifaceted problems. Consequently, this review article intends to describe some facts regarding the dromedary, its classification, distribution and population. In addition, to describe the diseases of camels and its classification according to OIE and to give attention towards the improvement of health care and management practices of camels in Iraq.

History of Origin and domestication of camels

About 50-60 million years ago, camel-like animals are thought to have originated from North America. Before their extinction in their native land, camels spread across the Bering land bridge, moving the opposite direction from the Asian immigration to America, to survive in the Old World and eventually be domesticated and spread globally by humans. Throughout the years, they develop into two main types: The Bactrian camel, which has two humps and mainly lives in the cold deserts of China and Mongolia, and the dromedary, which is one humped and is found in the hot deserts of Africa and the Middle East. It is thought that the dromedary was first domesticated in southern Arabia about 5,000 years ago. It is used for transport, as a beast of burden, and for meat, milk and hides and, in some communities, for its blood too. In addition, cylinder seals from Middle Bronze Age Mesopotamia showed riders seated upon camels , these are approved the domestication of camels in Mesopotamia.

Facts on Dromedary

The camel, unlike other domestic animals, has no less than 20 specific adaptations of its body that help it survive extreme heat and go without water for long periods. Camels can travel to remote pastures over a tremendous area camels can walk up to 60 kilometres in a day – and go on giving milk during drought when other animals stop lactating or even die. Camels will also eat everything, fresh plants, dried plants, very salty plants, bones, fish and meat, even leather. The ‘anatomical adaptations’ of camel’s body that help its surviving in the desert are include:

1. Long legs that lift it well above the hot ground, and sternal pads – very hard skin pads at the back of its front leg joints, and the front of its back leg joints – that keep its body clear of the ground when seated, allowing air to circulate around it and keep it cool .
2. Camel’s nostrils can close against dust; large padded feet to support its weight in sand; protruding frontal orbit and long eyelashes that shadow the eye against the sun; a membrane also found in other animals, that moves

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like a very thin third eyelid across the eye and brushes away sand from the eye; the ears are small and covered in hair, including the inside of the ear, which helps keep out sand and dust.

3. Camels can live for 40 years, but the productive lifespan is between 20 and 30 years.
4. Camels have been used for long distance travel, for trade, exploration.
5. A unique fore-stomach (rumen) which has only three chambers (rumen of other ruminants has four chambers) and contains so-called glandular sacs that produce a saliva-like liquid; such glandular sacs are not found in the rumen of any other ruminant.
6. Body Length about 300 cm / 10 ft ; Shoulder Height about 180-210 cm / 6-7 ft; Weight range from 600 to1000 kg / 1320-2200 lb ; males are larger than females and camels can drink 26 to 40 gallons (100 to 150 liters) of water at one time.
7. Gestation period are 12-13 months and usually give to one calf/ per birth and the weaning occur at 1-2 years. In addition, sexual maturity for females occur at 3-4 years and males at 5-6 years.

Diseases of Camels and OIE Updated classification on diseases of camelids

Camels were previously considered resistant to most of the diseases commonly affecting livestock, but as more research was conducted, camels were found to be susceptible to a large number of pathogenic agents. Indeed camels are more susceptible for some diseases such as pox, mange, and enterotoxaemia, and manifested more severe signs than other ruminants in the same localities (Abbas and Omer, 2005). The clinical reaction of camels to diseases is usually not very pronounced nor is it predictable. Illness may pass unnoticed. There are many workers believed that: the low density of camel populations, the environments in which they are bred, the long intervals between drinking , all these factors keep camels from frequent contact with other animals, thus diminishing the chance of acquiring infectious diseases. The diseases of camels are classified according to the report released by the second meeting of the OIE ad hoc group on diseases of camelid paris, 3–5 may 2010. Diseases are presented in a list divided into three categories: Viral diseases, Bacterial diseases and Parasitic and Fungal diseases. For each category, the diseases were listed by family of camelids (dromedary camels, Bactrian camels and New World camelids) and classified into three groups for each of these families with Group I: Known to produce significant diseases, Group II: diseases for which camelids are potential pathogen carriers, and Group III: Minor diseases (Figure 2). Some changes are made for each category. Foot and mouth disease (FMD) was removed from the "Viral diseases", dromedary camels and New World camelids as they were not susceptible, while Bactrian camels were susceptible to FMD (Figure 3). However this finding would need to be further investigated with regard to the serotypes involved and the role of camelids as potential carriers. The OIE ad hoc group were suggested a further research would therefore be necessary, especially on diagnostic techniques and for the identification of virus receptors. Influenza A

infections were added to Group I of viral diseases for Bactrian camels based on a scientific publication (Yamnikova *et al.*, 1993).

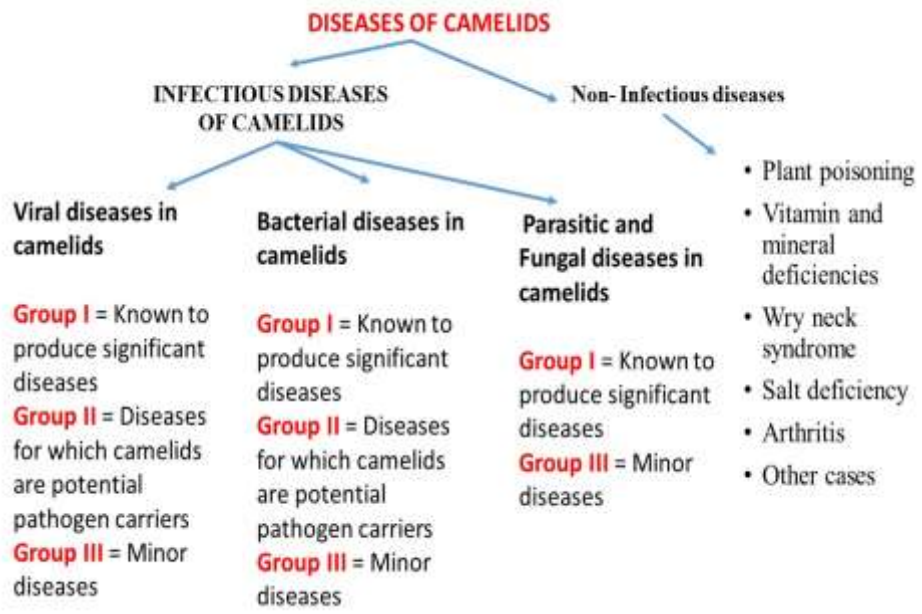

Figure 2. shows the classification of diseases of camels according to the report released by the second meeting of the OIE ad hoc group on diseases of camelid paris, 3–5 may 2010.

Within the category "Bacterial diseases", the Group agreed that Brucellosis appeared to be one of the most important bacterial diseases of camelids (caused mainly by *Brucella abortus* for Bactrian camels contrary to dromedary camels and New World camelids where *B. melitensis* is predominant). Dermatophilosis was added to Group I of bacterial diseases for dromedary camels (Figure 4).

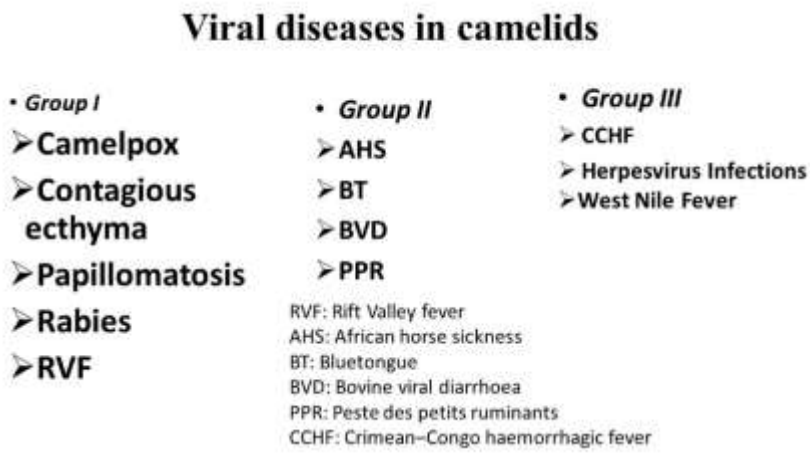

Figure.3: shows the classification of viral diseases in camelids according to the report released by the second meeting of the OIE ad hoc group on diseases of camelid paris, 3–5 may 2010.

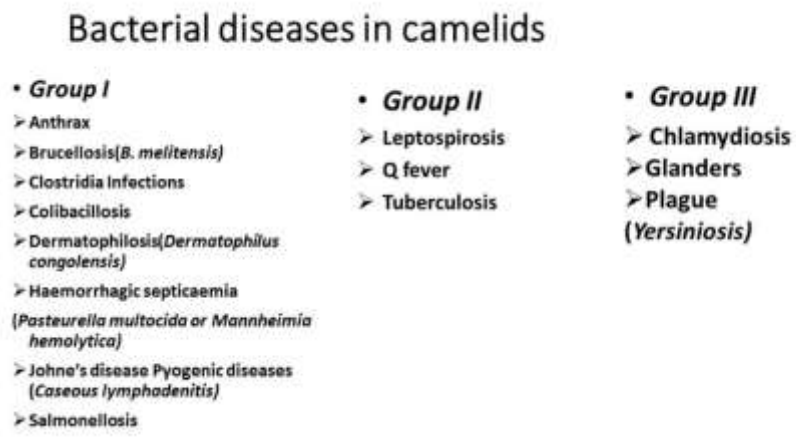

Figure.4: shows the classification of bacterial diseases in camelids according to the report released by the second meeting of the OIE ad hoc group on diseases of camelid paris, 3–5 may 2010.

In the category "Parasitic and Fungal diseases", gastrointestinal parasitoses were added to Group I for dromedary and bactrian camels as these diseases, caused by several different parasites (Trichostrongylus, Haemonchus, Taenia etc.) have a significant economic impact. For the same reason, ring worm was added to Group I of parasitic and fungal diseases for the dromedary and bactrian camels and to Group III for the New World camelids. Coccidioidomycosis (emerging fungal disease) was added to Group III for New World camelids (Figure 5).

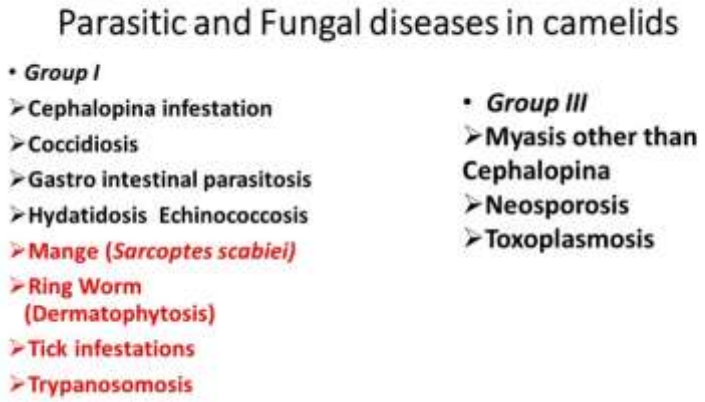

Figure.5: Shows the classification of parasitic and fungal diseases in camelids according to the report released by the second meeting of the OIE ad hoc group on diseases of camelid paris, 3–5 may 2010.

Camels in Iraq

According to FAO statistic 2011, Iraq owned a total of 58,000 camels (Tara, 2011). All are one-humped camels and are commonly found in certain parts

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.The greatest proportion of this population is present in the middle and south and west parts of country (Figure.6).

Figure.6: Shows the distribution of camels in Iraq

The Iraqi people that are living in the desert with its diverse ecozones throughout Iraq and own camels, are called "Bedouin" groups and communities (pastoralists and nomads, Figure 7). This reliance consists of utilization of camel milk, meat, and leather and wool. In addition, they used camels for packing, transport and riding.

Figure. 7: Shows the Iraqi camels and camel's breeder (photo captured at Najaf Desert, 2013

Systematic studies of the disease conditions of camels in Iraq are scarce. Review of published literature revealed that camel diseases classified into: Common, less common and rare. Details of all camels' diseases are presented in (Figure 8).

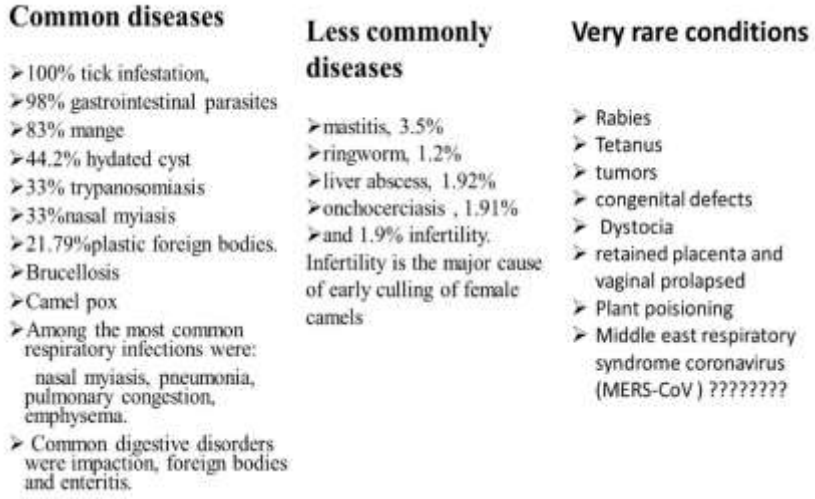

Figure. 8: Shows the classification of diseases of camels in Iraq

Abortion in Camelids

Pregnancy loss is one of the common complaint in camelid practice in Iraq nowadays. The general approach to diagnosis is similar to that in other species. However, camelids have several unique features of placentation and pregnancy. In nearly all pregnancies, the fetal horn is the left uterine horn, and the placenta is epitheliochorial, microcotyledonary diffuse (such as in the horse) but the allantochorion adheres to the amniotic sac. Published literature regarding abortion in camels in Iraq are scarce. The causative agents of abortion of camels are presented in (Figure.9) according to Radostits *et al*., (2007).

Only few studies have done regarding camel brucellosis in Iraq (Al-Ani *et al.*, 1998). One serological study using Rose Bengal test found that the percentage of positive animals was 6, 73% between 104 serum samples collected from different age groups of camels (Rodhan *et al.*, 2006). There are many difficulties that arise in diagnosis of camel brucellosis, because as this disease shows only few clinical signs in compare to its clinical appearance in cattle (Al-Salihi, 2013; Mousa *et al.,* 1987). In addition, camel herds usually raise in a remote area synchronizes with missing infrastructure.

Future of the camel

Camels are considered as the animals of the future. Cancer gene therapy from camels has approved by the scientists at the Department of Pharmaceutics and Analytical Chemistry, University of Copenhagen. Nanobodies produced by camels have unique properties, which can be used in future drug development. New research published in the Journal of Controlled Release, confirmed that these nanobodies can help scientists in the fight against cancer. Members of the camelid family have particular heavy-chain antibodies in their blood known as nanobodies that may serve as therapeutic proteins. One of the most powerful

advantages of nanobodies is that they can be easily attached to other proteins and nanoparticles by simple chemical procedures.

Identification of Camel-Derived Antibodies for Breast Cancer Patients has been described by Prof. Serge Myldermans (Belgium) (2012). 3rd International Conference of the Society of Camelid Research and Development, Muscat 29 January-1 February 2012. In addition, a team of researchers are reported to have made a scientific breakthrough by developing a medical formula for treating cancer using camel's milk and urine.

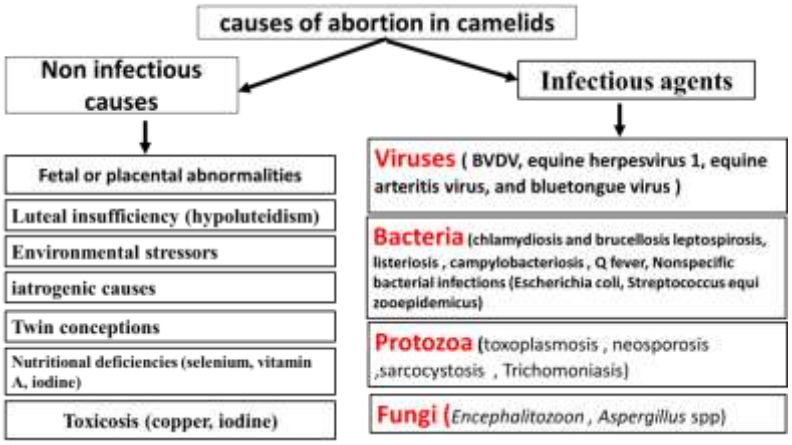

Figure. 9: Shows the causative agents of abortion in camels

The experiments were conducted in Sharjah University and the Cancer Institute in Baghdad. The Camel's milk was reported by several research to treat diabetes. However, the milk of the camel has traditionally been used to treat diabetes long time ago. Surprisingly, camel milk does seem to contain high levels of insulin or an insulin-like protein which appears to be able to pass through the stomach without being destroyed. Several research are considered the camels as the animals of the future in a changing climate.

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Original article

Anatomical and histological studies of oesophagus of one-humped camel (*Camelus dromedarius*)

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Abstract

This study was designed to describe the anatomical and histological features of the normal oesophagus in one-humped dromedary camel (*Camelus dromedarius*). Twelve adult male camels were used for this study. Anatomical features were described and samples were collected from 8 animals. Samples were kept in 10% neutral buffered formalin and processed with routine histological procedures. The present study revealed that the length of the oesophagus of camel was 148±2.3 cm. The oesophageal outer diameter began in the cervical portion at 2.6 ±0.5 cm and gradually enlarged to 4±0.2 cm in thoracic inlet. In the cranial part the oesophagus of camel lied dorsally to the cricoids cartilage of the larynx and trachea. However, the cervical region deviates to the left of the trachea and maintains this relation until it reaches to the end of cervical region, where it again slopes to the dorsal region of the trachea. Later on, the oesophagus continues caudally in thoracic cavity and passes through the oesophageal hiatus of the diaphragm and after a short abdominal part it joins to the cardiac region of the stomach. The histological study showed that the oesophagus of camel composed from many layers. It is arranged from internal to external in order: the mucosal layer consist of keratinized stratified squamous epithelium, the lamina propria (contain a relatively dense connective tissue with amount of elastic fibers), the Muscularis (consist from two layer of smooth muscle bundles that are relatively large). The sub mucosal glands abundant throughout the esophagus (this gland were less numerous towards the caudal end of the oesophagus), while the number of lobules of sub-mucosal glands found in each region of the oesophagus ranged from 42 in the cranial cervical region to 31 in the middle thoracic region. The tunica muscularis of the oesophagus are stratified muscle and it is occurred in two general layers inner circular muscularis layer and outer longitudinal muscularis layer.

Keywords: Camel, Oesophagus, Histology, Anatomy

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Introduction

The one-humped Dromedary (*Camelus dromedar*ius) is the largest mammalian species. It is adapted to the desert where thorny plants with rough and hard stems grow and with its high temperatures and extreme desiccation (Bello *et al.*, 2012).

The oesophagus connects the oral cavity with the stomach and serves as a passage for food. The architecture is that of a typical hollow organ with four layers: mucosa, submucosa, muscularis externa, and serosa/adventitia (Adnyane *et al.*, 2011). The camel's mouth and oesophagus is very sturdy and is developed to maintain efficient feeding of these plants and is rubbery so that thorns and branches won't damage it (Bello *et al.*, 2015; Bello *et al.*, 2014). Oesophageal anatomic differences among species reflect phylogenetic adaptation for different foodstuffs consumed by the different species and behavioural adaptations (Bello *et al.*, 2014). Camel oesophagus is a long tube of large capacity, in camel it can be 1 to 2 m long. It is lined by glands which secrete mucus helping to lubricate the often rough forage consumed by the camel (Al-Ani and Qureshi, 2004; Nabipour *et al.*, 2001).

The number of oesophageal glands that present in the sub-mucosa and distribution of the mucus secreting glands are varying considerably in different species; the lamina Muscularis mucosae present throughout the entire length of the oesophagus in the ruminants but are incomplete. The tunica muscularis externa usually consists of inner circular and outer longitudinal muscle coats, the muscle being striated in the entire oesophagus in the ruminants and for the greater part of its length in the horse (Dellmann & Brown, 2007).

This study designed to describe the gross and microscopic features of the sub mucosal glands and muscle fiber type of the one-humped Dromedary (*Camelus dromedarius*) oesophagus.

Materials and methods

Oesophagus of twelve healthy adult male camels were used in this study. These adult camels ranged in age from 2 to 9 years (with mean age 6.5 years) and weight from 98.2 – 186.4 kg (with mean weight 147.3 kg). The specimen were collected in January from the Basra slaughterhouse.

Gross Anatomy

The oesophagus was observed after exposed along the entire length. The cervical, thoracic, abdominal and total lengths of the oesophagus were measured in situ. The cervical part length was done from the initial entrance of the oesophagus into the neck to the flexure at the thoracic inlet, while the thoracic oesophageal length was from the thoracic inlet to the diaphragm, and the abdominal oesophagus was from the diaphragm to the expansion of the wall of the first compartment of the stomach.

The outer oesophagus diameter was measured at three levels: (1) cranial cervical, (2) thoracic inlet, (3) caudal thoracic. Cranial cervical was the first part of

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oesophagus in the neck; thoracic inlet was defined as part between the first ribs and the caudal thoracic was directly below the diaphragm. Each level was then marked and the oesophagus removed intact from the body.

Histology

Oesophagus specimens were collected form eight adult healthy one-humped Dromedary for histological study. The Specimens were washed with normal saline solution (0.9%) and 3 samples from different regions of each part of the oesophagus were taken and fixed by 10% phosphate buffered formalin for 24 hours at room temperature. The samples were treated by routine histological process (Luna, 1968). Later on the samples were embedding with paraffin wax (58-60C°) and sectioning to 5-6µm. The sections were stained with Haematoxylin and Eosin stain. Ocular micrometre was used to adjust the thickness of the all sections of the tunicae of each part of oesophagus in each sex. The mean (M) and the standard error (SE) were calculated for 5 slides for each part of the oesophagus (Al-Rawi and Kalaf-Allah, 1980).

Results

Anatomical study

In the present study, the gross examination of the oesophagus revealed a long, muscular, longitudinally folded tube, the oesophagus of dromedary camel consists from three parts (Figure. 1) the cervical oesophagus place dorsal and somewhat to the left of the trachea. As the oesophagus passed through the thoracic inlet it occurs dorsal to the trachea. (Figure.2)Within the mediastinum, while the thoracic oesophagus crossed to the right of the arch of aorta dorsal to the base of the heart. Camel oesophagus grossly showed very irregular lumen on mucosal layer (Figure.3).

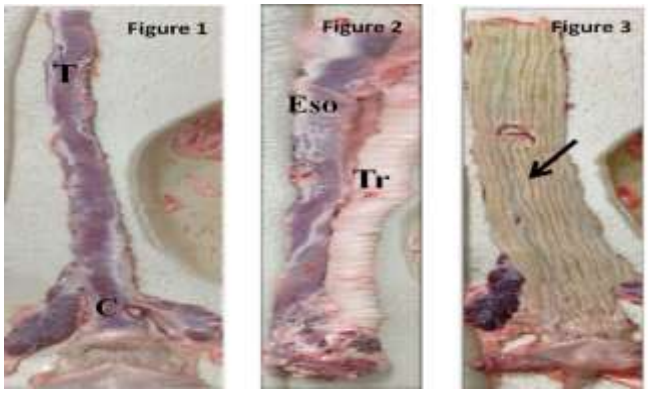

Figure.1: Shows the oesophagus of dromedary camel cervical region(C) and thoracic region (T)
Figure.2: Shows the oesophagus (Eso.)Of dromedary camel occurs dorsal to the trachea (Tr.)
Figure. 3: Shows the irregular lumen on mucosal layer arrow

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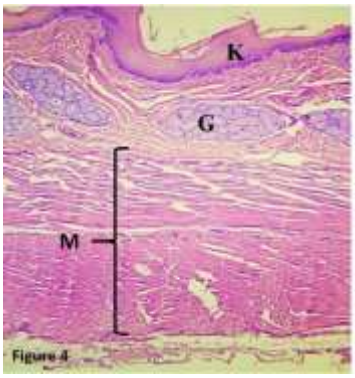
In adult camel, the total length of oesophagus was approximately 148 cm, where the cervical portion was approximately 92 cm and the thoracic portion was approximately 52 cm long (Table.1). The length of the abdominal portion was very short, approximately 4 cm, because the placing the cardiac region of the stomach in close contact with the diaphragm. Oesophageal outer diameter began in the cervical portion at 2.6 ±0.5 cm in cervical region and gradually enlarged to 4±0.2 cm in thoracic inlet.

Table. 1: Shows the length and outer diameter of the oesophagus of the camel. A, B, C: Means with different superscripts are significantly different in oesophageal diameter between regions (P≤0.05).

Oesophageal segments	Length (cm)	Outer diameter (cm)
Cervical	92.21 ± 3.12	2.6 ± 0.5 A*
Thoracic	52.16 ±4.55	3.78 ± 0.76 B*
Abdomen	4.1 ± 3.78	4.1 ± 0.2 C*
Total	148.47± 5.65	

Histological study

The structures of all oesophagus regions (cervical, thoracic and abdominal) were similar and their walls composed of four layers: Tunica mucosa, Tunica sub-mucosa, Tunica muscularis and Tunica adventitia (serosa) (Figure. 4). The oesophageal epithelium was a keratinized stratified squamous epithelium along its length. The stratum corneum of the epithelium was composed of approximately 9-12 cell layers. The outer surface cell was revealed a lacked nuclei (Figure. 5).



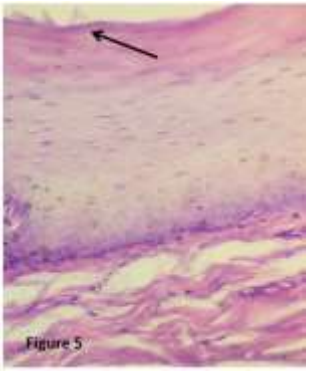


Fig.4 showed the layer of oesophagus (K) keratinized epithelia,(G) oesophageal gland, (M) muscularis externa ×100 H&E Stain.
Fig. 5 Showing keratinized stratified squamous epithelium (arrow), outer layer loss the nucleus ×100 H&E Stain.

The epithelium and the lamina propria were separated by the basal lamina. The lamina propria was consisted of connective tissue, scattered lymphocytes and vascular structure. There were many of dermal papillae that appeared as finger-

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like extensions. The lamina propria was appeared interdigitated with the epithelium (Figure.6). The muscularis mucosa was located between lamina propria and sub mucosa and it was identifiable along length of oesophagus. It was consisted of a few thin scattered strands of smooth muscle (Figure.7). The Sub mucosal glands were abundant and found throughout the length of the oesophagus (Figure. 8). The glands less numerous towards the caudal end of the oesophagus; the number of lobules of sub mucosal glands found in each region of the oesophagus ranged from 35 in cross section of the cervical region to 26 in the thoracic region (Table. 2).

Table. 2: The thickness of tunica muscularis and the number of lobules of submucosal glands in each region of the camel oesophagus. A, B, C Within columns means with different superscript letters are significantly different (P ≤0.05).

Criteria	Cranial cervical	Cranial Thoracic	Caudal thoracic
Thickness of tunica muscularis (mm)	3.90 ± 0.30 A	4.40 ± 0.5 B	4.98 ± 0.3 C
Number of lobules of Submucosal glands per cross section	42± 2 AB	34 ± 1 BC	31 ± 2 C

The glands were oval or elliptical in shape. In addition, large and small groups or lobules of tubule-alveolar mucous glands were also found (Figure 9). In each cross section throughout the oesophagus, the glands were equally distributed around the wall of the oesophagus. Tunica muscularis was composed of striated muscle throughout the length of the oesophagus. The thickness of tunica muscularis in thoracic segment was greater than that of the cervical segment (Table 2). Myenteric plexus was noted between the layers of the tunica muscularis (Figure 10). The adventitia was located at the outer layer of cervical and thoracic region. It was composed of loose connective tissue. The tunica serosa composed of loose connective tissue and a mesothelium layer and it was noted in outer layer of abdominal region (Figure 11).

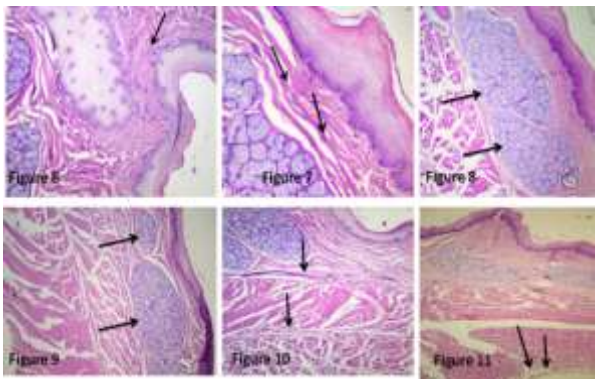

Figure.6: shows dermal papillae (arrow) Finger-like extensions ×400 H&E
Figure.7: Shows the muscularis mucosa (arrows) ×400 H&E
Figure.8: Showed the Sub mucosal glands oesophageal gland (arrow) ×100 H&E
Figure.9: Shows the oesophageal gland large and small groups (arrows) ×100 H&E
Figure.10: Shows the Myenteric plexus (arrow) ×100 H&E
Fig.11 showed the adventitia (arrow) ×100 H&E.

Discussion

The present study revealed that the length of the oesophagus cervical portion of the dromedary camel was approximately twice that of the thoracic portion. This result is compatible with previous study (Schummer *et al.*, 1979). Anatomically, the camelids have a long neck and consequently the cervical portion of the oesophagus is long and this result is in agreement with previous study (Sukon *et al.*, 2009). Sukon *et al.*, (2009) showed that the total length of lama oesophagus is approximately 120 cm. Moreover, the length of oesophagus cervical and thoracic portion are approximately 70 cm 50 cm respectively. The results of this study is also in agreement with the observations of (Murray *et al.*, 1988), who reported the total oesophageal length in cow. According to Murray *et al.*, (1988), the total oesophageal length in cow is approximately 90-95 cm and it is divided into the cervical and thoracic portion with approximately length reach 42-45 cm and 48-50 cm respectively.

The results of this study is also compatible with Smith *et al.*, (1992). They showed that the outer diameter of the llama oesophagus like that of the cow and sheep with significantly increases from the cranial portion to the caudal portion. The oesophageal diameter in the llama is 2.5 cm in the cranial cervical portion and 3.9 cm in the caudal thoracic portion. These measurements are smaller than that of the cow which were 3-4 cm and 7 cm in the neck in the caudal thorax portions respectively.

The results of this study also showed that the sub mucosal glands were abundant and found throughout the length of the oesophagus. This result is disagreed with (Dellmann, 1971; Dellmann and Brown, 1976). These studies mentioned that the sub mucosal glands in the ruminants were only seen in the pharyngeo-oesophageal region. The muscularis mucosa was seen to be located between lamina propria and sub mucosa and it was identifiable along length of the oesophagus. It was consisted of a few thin scattered strands of smooth muscle. This results are in disagreement with (Jamdar and Ema, 1982), who showed the presence of lamina muscularis mucosae in the form of a few scattered strands of smooth muscle, only in the caudal oesophagus of the camel, and this results is also contrary to that found in the ruminants.

The results of this study is in agreement with (Salimi *et al.*, 2012), who revealed that the tunica muscularis of oesophagus of the camel composed of entirely striated muscle fibers and divided into two layers: the inner (circular) and outer (longitudinal) and it is similar to the ruminants.

In conclusion, this study presented information regarding the gross and microscopic features of the oesophagus of one-humped Dromedary (*Camelus dromedarius*). The authors considered that this information can be used as a basis for further studies of dromedaries' oesophageal. In addition, to determine any pathological changes in this species, Moreover, this could be aid in surgical treatment of oesophageal obstruction in camels.

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Original article

Morphological, Histological and Histochemical Study of trachea of One Hump Camel (*Camelus dromedaries)* In South of Iraq

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Abstract

The objective of this study was to describe the morphological, histological and histochemical structural features of the trachea of the camel (*Camelus. dromedaries*) Tracheas from 10 adult male camels aged between 3-5 years were collected from slaughter house in Al- samawa and Al- zubair distract. This study were performed at college of veterinary medicine / university of Basra. Clinically, all camels were appeared normal and healthy. The length, and the number of tracheal cartilage rings were measured and processed for histological study. The morphological study revealed that the mean length of the trachea was 95 ± 0.77 cm, while the mean number of the cartilage rings was 75.6 ± 0.74. The histological results revealed that the wall of trachea consist of mucosa, submucosa, hyaline cartilage and adventitia. The mucosa was lined by respiratory epithelium (pseudostratified ciliated columnar epithelium) with numerous goblet and basal cells, while the lamina propria was consisted of loose connective tissue. Muscularis mucosa was very thin layer, while the submucosa appeared as a layer of loose connective tissue and contained tubulo - acinar submucosal glands, which were very few in number and small in size. The hyaline cartilage layer was surrounded by perichondriun with the dense fibroblastic tissue presented between the cartilaginous rings**.** The adventitia was consisted of connective tissue with numerous elastic fibers. On the other hand the Periodic acid–Schiff stain (PAS) showed a positive reaction of goblet cells and submucosl gland.

Key word: One humped camel, Trachea, Histology, Periodic acid–Schiff stain

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Introduction

Camels are in the taxonomic order Artiodactyls (even toed ungulates), sub order Tylopoda (pad-footed), Family camelids which has two species *Camelus dromedarius* (one humped) and *Camelus bacterianus* (two humped) (Klingel, 1990).The camel is considered as a very important animal, but it had received little attention when compared with other species of animals **(**Khattal *et al.*, 2015**)**. Respiratory system plays important role in olfaction, phonation and regulation of body temperature (Sellnow 2006; Baba and Choudhary, 2008).

The lower respiratory tract include the trachea, bronchi, bronchioles and the lungs. Trachea is a flexible tube composed of cartilaginous rings, connected by a fibromuscular membrane and lined internally by mucosa. It is composed of several of C-shaped tracheal cartilages in different species, which are open dorsally and the space is bridged by tracheal muscle (Dabanoglu and Kara, 2001). The structures of respiratory tract are varied among species and within each species (Legaspi, 2010) .The trachea is composed of respiratory epithelium that surrounded by a submucosa and well-developed subtending adventitia with incomplete cartilaginous rings (Samuelson, 2013).

The purpose of this study was to describe the morphological, histological and histochemical structure of trachea of *C. dromedarius* using the routine and special histological stains.

Materials and Methods

Tracheas of ten adult male camels (*C. dromedarius*) were used for this study. The trachea of apparently normal and clinically healthy camels were collected from Al Samawa and Al Zubair abattoirs. These tracheas were dissected and flushed with normal saline. The trachea was dividing into three equal parts (proximal, middle and distal part) for morphological study. Lengths of the trachea were measured from the cranial border of the first tracheal ring to the tracheal bifurcation. In addition, the number of tracheal rings were also counted. By incising the tracheal annular ligaments, the transverse diameters, vertical diameters, and cartilage thickness were measured by using a ruler and digital Caliper with an accuracy of ±0.02mm. (Tempest, 1980). For histological examination, the samples were fixed in 10% neutral buffer formalin for 72 h. Tissue samples were then dehydrated in a graded alcohol, cleared in xylol and embedded in paraffin wax. Each paraffin block was sectioned at (6µm) micrometers thickness and stained with haematoxylin and eosin, Masson's trichrome and Van Giesson for collagen fibers, and periodic acid schiff stain (PAS) for histochemistry of muco-substances.**(** Luna,1968)

Result and Discussion

The results of this study showed that the trachea consisted of the installation of tubular shape made up of sequentially series of cartilaginous rings incomplete dorsally in the gross examination. The rings were connected with each other by

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annular ligament and their ring edges were close by the tracheal muscle at their internal surface (Figure.1).

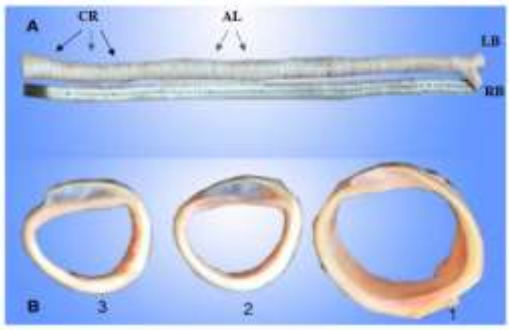

Figure .1: **A-** Shows the dorsal view of treachea, showing: (CR) cartilage ring, (AL) annular ligament, (LB) left primary bronchi, (RB) right primary bronchi. **B-** Shows the cross section of three part of trachea, showing: (1) proximal part was semi-oval shape and the end of rings have relatively large opening laterally to appear as C-shape,(2) middle part of treachea the end of the rings is overlapping the left end on right end ,(3) distal part treachea the end of the rings is overlapping the left end on right end .

Trachea was lined with relatively thick mucous membrane. The length of trachea from the first to the last tracheal ring was 92-101cm with a mean value of 95 ± 0.77 cm. These results are disagree with previous study (Al-Zghoul *et al*, 2007). Al-Zghoul *et al.,* (2007) reported the tracheal length (87 ± 0.83 cm) in young Arabian camels with differences due to variation in the age. The number of the tracheal rings were varied from 72-79 with a mean value of 75.6 ± 0.74. This result is compatible with similar values which was reported previously for the adult Indian camels (Kumar *et al.*, 1992). However, this result is disagreed with (Cano and Perez, 2009), who described the trachea of giraffe and mentioned that it has (87-100) ring due to the length of the neck. The variation in numbers of tracheal rings between specimens was due to individual anatomical variations (Nickel *et al.*, 1979). The diameters of tracheal rings was determined by calculation the mean diameter for three tracheal region. The means of proximal transverse, proximal vertical, middle transverse, middle vertical, distal transverse and distal vertical were 34.46±0.48 mm 41.98±0.32 mm, 29.85±0.25 mm 30.48±0.18 mm and 24.72±0.09 mm and 26.68±0.24 mm respectively. The mean value of tracheal rings thickness for three part (proximal, middle and distal) are 6.55±0.03, 5.19±0.12, 3.92±0.07 mm respectively. The lumen of the trachea narrowing toward distal part with relatively degrees in thickness and bounded by bone such as first pair of ribs, vertebra (thoracic vertebra) and sternum which acts to facilitating movement of neck . Tracheal ring fusion with neighbouring rings was observed within all different tracheal regions. Fusion of the tracheal rings occurred mostly in the cranial cervical region. It has been suggested that tracheal rings of this region are most affected by neck movements resulting in its fusion over time (Morgan *et al.*, 1986). The shape of tracheal rings in the proximal part was semi-oval and the end of rings have relatively large opening laterally to appear as C-shape. In the middle part of trachea, the end of the rings was overlapping the left end on right end continuously with the distal part of the trachea, and each ring connected with next ring.

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The histological examination from the proximal, middle and distal part of the trachea revealed that the wall of the trachea consist of mucosa, submucosa, hyaline cartilage and adventitia, (Figure. 2). The luminal surface was completely covered by cilia, which is similar to cattle, goat and neonatal kids (Abdel-Rahman, 1999). The mucosa was lined by pseudostratified ciliated columnar epithelium with numerous goblet and basal cells, goblet cells and basal cells. All these cells were rest on the basement membrane but not all of them reach the luminal surface, and their nuclei disposed at different levels (Figure. 3).These results are similar to those observed in most mammalian species (Ibe *et al.*,2011) , in the sheep (Mariassy *et al.*,1983) ,in the goat (Kahwa and Purton,1996). The ciliated columnar cells were one of the most abundant cell types appeared as a tall columnar cells, with cilia covering their apical surfaces and extending into the tracheal lumen (Figure.2). Their cytoplasm was slightly stained with large oval shaped nuclei located near the epithelial surface (Figure.2). Similar features was observed in Yak (Yang *et al.*, 2010). Goblet cells produce exclusive amounts of acidic and neutral muco-substances (Figure.3).

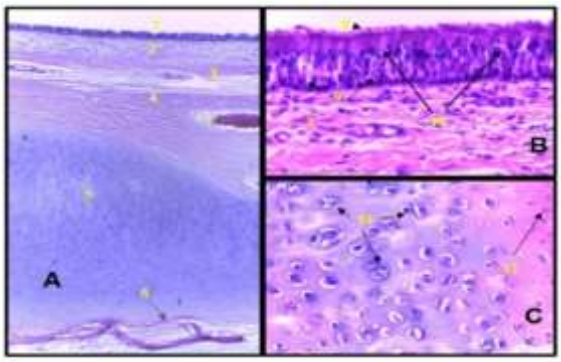

Figure. 2: Cross section of trachea of adult camel showing**: A-** The wall of the trachea.1- pseudostratified ciliated columnar epithelium. 2- Lamina propria. 3- Muscularis mucosa. 4- Submucosa consist of loose connective. 5- Hyaline cartilage. 6- Adventitia. 7- Blood vessel. (H&E stain 40X). **B-** 8-cilia. 9- Basal cell. 10- Goblet cell. (H&E stain 400X). C – Hyaline cartilage 11- chondrocytes inside the lacuna. 12- Perichondrium. (H&E stain 400X)

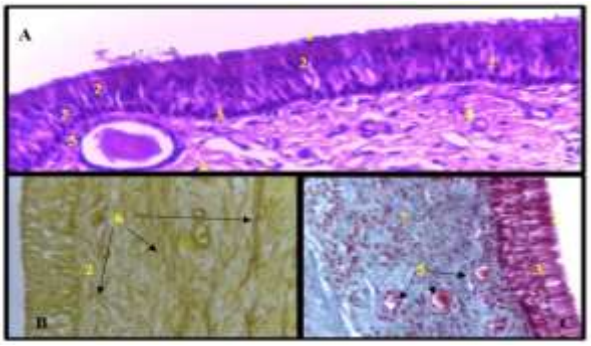

Figure (3) Cross section of trachea of adult camel showing:
A-1 – pseudostratified ciliated columnar epithelium
2- goblet cell 3- Basel cell 4- blood vessel 4- lamina propria .(H&E 400X)
B- 6- Lamina propria with elastic fibers. (Van Gieson stain.400X).
C-7- Lamina propria with prominent collagen fibers, (Masson's trichrome stain. 400X).

In contrast, goblet cells in goat produce acidic mucosubstances, which is observed by Kahwa and Purton, (1996). The goblet cells showed appositive reaction toward PAS stain and revealed purple color due to mucopolysaccharide contents (Figure.4) .Similar finding was observed by Raji and Naserpour, (2007). The mucous produced by goblet cell act as a protective barrier for the epithelium by lubricating, insulating and providing an appropriate condition for mucociliary clearance (Buchner and Maxwell, 1993). Lamina propria were loose connective tissue with prominent collagen and elastic fibers, blood vessels and lymphatic vessels (Figure.4). These features are similar to the histological features of cats and goats (William, 1990). The muscularis mucosa was very thin layer consist of few smooth muscle fibers (Figure.3) and such result comparable with the those found in cat Nasser(2012). The tunica submucosa appears as a layer of loose connective tissue contains different connective tissue cells, lymphocytes, monocytes, macrophage and plasma cells, blood vessels and the submucosal glands were very few in number,small in size and appeared as tubulo - acinar mucus type glands that were appositively reacted with PAS (Figure.4) .The glands opened into the lumen of trachea by a slit shaped duct (Figure.4). Similar features was also reported previously by Choi and Finkbeiner, (2000). The tracheal muscle was smooth and lied internal to the open end of the horseshoe-shaped hyaline cartilage as seen in other ruminants. It is noteworthy that tracheal muscle lies external to the cartilages in the carnivores (Nickel and Schumer, 1979). (Figure. 4). The hyaline cartilage layer was surrounded by perichondriun with the dense fibroblastic tissue present between the cartilaginous rings, it contain the chondrocytes inside the lacuna within an amorphous matrix (Figure.2).The adventitia was consisted of connective tissue with numerous elastic fibers that are similar to cat (William, 1990).

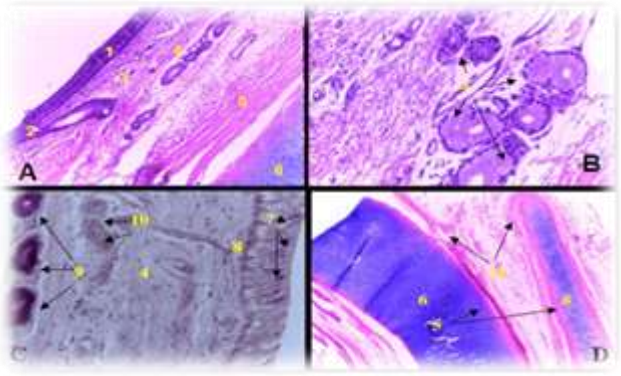

Figure (4) Cross section of trechea of adult camel showing:
1- The ciliated columnar cells. 2- Slit shaped duct of submucosal gland 3- Lamina propria. 4- submucosal gland which tubulo - acinar mucus type. 5- Perichondrium. 6- Hyaline cartilage. (H&E 40X).
B- 4- submucosal gland which tubulo - acinar mucus type. (H&E 400X).
C- 7- goblet cell, which appear positive reaction for PAS giving rise to purple color. 8- Basement membrane. 9- Positive reaction for PAS of submucosal gland. 10- Blood vessel. (PAS 400X)
D- 11- Trachealis muscle was smooth muscle fiber and lied internal to the open end of the hyaline cartilage. (H&E 100X).

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Original article

The reality of camel breeding in Basra governorate

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Abstract

Camel is unique animal. In Holy Quran, Allah Almighty remember people about the creation of camel (AL-GHASHIYAH 17 (Then do they not look at the camels - how they are created?). This verse remind us about the different aspects of the camel creation, which have aroused the attention of researchers around the world. The camels have gained reputation as the ship of the desert, since ancient times because they have superior ability to withstand thirst for long periods. Basra is one of the important governorate in Iraq and it is located in the south. Basra has very severe weather and low levels of the rainfall especially at al-Zubair desert resulted in a lack of vegetation and the deterioration in the soil. These environmental factors have a negative impact on the breeding of camels in Basra. This study intended to focus on the reality of camel husbandry and field's problem the in Basra governorate. Continuous veterinary work teams and follow up for camels and its behaviours and preview the seasonal movement of Camel herders accompanied by their animals were reported. In addition, some common diseases, especially internal and external parasites, were also reported. In conclusion, this study described the camel's herds in Basra governorate with special focus on the most important problems that face the breeding of camels in this governorate.

Key word: Basra, Camel**,** external parasites**,** ship of the desert**.**

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Introduction

There are a good old relationship and respect between a camel and the Arabian people. The location of the first masjid in world (AL medina) was determined according to the sitting place of the camel of Prophet

Mohammed, when they allowed this camel to walk freely. The means of life have developed over the years which lead to decrease the importance of the camels. However, the Arabian people still have interest in keeping and raising camels especial the pure and expensive breeds and that reflect the respect, appreciation and faithfulness to these animals.

The census of camels at Arab world is over 15 million and accounts for about 60% of the total population of camels in the world, however, only scarce studies and research have done. These aspects also have limited support and absence of a coordination and strategy with clear specific objectives and projects, although there are many individual research and efforts. In Iraq, the estimated number of camels up to 58,293. Camels distributed in 51%, 47% and 2% in Al jazeera, south and Northern deserts respectively. The vast areas of the southern desert are barren land and some of these areas are depend on water wells (groundwater), with an estimated rainfall up to 120 mm / year (Abdullah, 2012). Camels are considered as important source of meat and milk. The interest in raising camels in the Arab world began to decline as a result of changes in the social customs of Arab citizens and consumption patterns that made the camel as a secondary animal. Camels are one of the important livestock in Basra governorate / Iraq. Review of literature revealed scarce information regarding breeding and raising camels in Basra. Therefore, this study was designed to focus on the reality of camel husbandry and different aspects of the field's problem that face breeding of camels in Basra governorate.

Brief history

All Arab tribes are a famous and having the original breeds of the camels. The owners of the camels are proud and distinguish themselves from the owners of sheep herds according to the social custom in the desert communities. There are a famous Arab proverb regarding the camels (milking sitting down and drinking standing up), which mean that people wish that the camel owners will lost his camels and become a sheep owner if they hurt them and this would be a big ashamed (Ahli and Yusuf, 2012).

Most scientific studies and references stating that all kinds of the present camels are originated about 50-60 million years ago, from a camel-like animals which lived North America. The Arab was tamed the camels about 5000 years ago in the Arabian Peninsula areas including Hadramout, South Yemen and Oman. The camel has become an integral part of the of the nomadic culture that has spread across the history of the Middle East to North Africa and the Sahara desert and other African countries. The camel is called "ship of the desert". This is a perfect description used to explain the abilities to be patient and resist the hardship, in addition, to serve and obey his owner during his long and severe journeys in the desert especially during summer season. Camels occupied a prominent place of the Arab interest and still has great fortune in the recent years to be one of the animals that gets a big care. Moreover, most Arab countries in the Arabian Peninsula give a camel a special position and respect according to the Islamic religion and Hadith of prophet Mohammed the messenger of Allah

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(bless him and his family). Prophet Mohammed mentioned to the camels about 109 times in his honest Hadith and said (Camels give A Glory to their owner) (AL sanae, 1983).

Scientific classification

The (Class) Mammalia have most highly developed nervous systems in animal kingdom. Most do not lay eggs, and instead, embryos develop inside the mother and are not released until nearly or fully developed. Mammals have milk glands that provide nutrients for infants. The (Order) *Artiodactyla* have weight of body borne equally by third or fourth foot, rather than most or entirely by third toe. The (Family) *Camelidae* are large animals with slender necks and long legs, and are strictly herbivorous. They have a three-chambered digestive tract. The genus Camelus has bear distinctive fatty deposits, known as humps, on their back. This is including two species: dromedary camels or Arabian camel (*Camelus dromedarius*), which have one hump, and Bactrian camels or Asian camel (*Camelus bactrianus*), which have two humps (Al tabary and Onoasy, 1997).

The geographical boundaries of Basra governorate

Basra governorate is located in the far south of Iraq. It is the second largest governorate in terms of population. It is bordered by Kuwait and Saudi Arabia to the south, Iran to the east and share local borders with all of the province of Dhi Qar, Maysan in the north, and Muthanna to the west (Figure. 1). Basra is located on the ground mixed from terrain between the mountain, hills and desert plain with an area of 19 070 km^2 and a population of about 3.8 million people (according to 2009 statistics) (http://hhcom1.co.cc/english/Basrah.htm.). Al Jasham, Al Sadoun, Al Wardan, Al Sawalm, Al Rafeae and Al Bdour are the famous tribes' names that are interested in breeding of the camels (Technical Report, 2015).

Figure.1: Shows map of Basra governorate

Table.1. Shows the geographical distribution of camels herd in Basra governorate

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No.	Area name	E	N
1	Allhis	46.97867	30.58380
2	Al legah	46.57133	29.32578
3	Artawi	47.09182	30.58068
4	Salely	46.35131	30.45004
5	Alrgi	47.04055	30.05551
6	Al butain	47.01324	30.15424
7	Ghelaoh	46.47151	29.58197
8	Al toy	46.86827	29.58483
9	Ghazlani	46.71913	30.11908
10	Ruwaih	46.85419	30.10371

The most important diseases of camels in Basra

1. Camel pox

Camel pox is one of camel diseases known from ancient times. Camel pox occurs in almost every country in which camel husbandry is practiced (Bhanuprakash *et al.*, 2010). In Iraq, camel pox was isolated by (Falluji *et al.*, 1977) from skin pox-like lesions, when a highly contagious skin disease occurred in the camels in the Iraq-Iran border regions. The virus was identified by serological tests and it revealed similarity to that isolated in Iran, Egypt, and Kina. The occurrence of camel pox is variable in Basra governorate and depend on different environmental factors according to field records of the veterinary clinic.

2. Internal parasites

Camels can be infected with different roundworms in the gut. The parasites in the gut cause weight loss, weakness. There are some parasite that has ability to cause diarrhea and death especially in the young animal. Lungworms one of the causes of breathing problems in the camel herd and infected animals develop a short, sharp cough. Camels can also be infected with flukes, which infect the liver especial the camel that come from the northern part of the Iraq. The occurrence of these parasites were reported from different areas in Basra governorate according to Basra Veterinary Hospital records. However, intensity of the herd, the immunity of the animals, weather, other diseases, sex and age are considered as predisposing factors that play important roles in the occurrence of parasitic infestation.

3. Mange

According to Basra Veterinary Hospital records, mange is one of the important parasitic disease that was highly contagious and infects camels of all ages. Mange was also frequently observed in as a sudden infection in herds suffering from shortage of food and health care as well as intensive breeding.

4. Diarrhoea

Diarrhea was reported as one of the main causes of mortality in small camels. The method of breeding and management play an important role in the emergence and development of diarrhea in the camel calves. It is essential for the young camel to take sufficient quantity of colostrum to

protect them against some diseases. The she camel produces colostrum for 4 to 5 days after birth. Many camel owners do not allow the young camel to freely suckle because they believe this causes the young to suffer from belly pain and diarrhea. Moreover, some owners were prevented the young camel from taking any colostrum and many dead animals were reported (Alani, 1997).

5. Other diseases

The other individual cases of camel diseases in Basra was included: intestinal poisoning, food poisoning, pneumonia, diseases of the reproductive system and Surra, which is a very common disease of camels. The disease is caused by very small parasites, called trypanosomes, which live in the blood of the animal. According to Basra Veterinary Hospital record, the total number of cases treated with tetramizol against internal parasites were 5118 camels. In October 2015, there were a lot of camel breeders who visited the veterinary clinic in Zubair, to register their animals and to acquire the veterinary health card for the purpose of obtaining fodder. Moreover, the total number of camels which were registered up to 1727.

Local camel's names

In Basra/ Iraq, local people used different names to call of the camel these are as follow:

Al nakah: the female camels that have Births
Al baaer: male adulthood
Al hajiah: adult female is more than 5 years
Al fahal: adult male
Al hoar: aged from one month - Year
Alfao: which is more than a year old
Al mafrood: two years of age, where the animal is weaned this age and singled out for mother
Allchi or allchih: animal aged 4 years who stays with his mother and moves with her movement
Althalol: are camels that are quiet and obedient.

Feeding camels

Food and Agriculture Organization data is indicated that about 60% of the total food needs for livestock produced by natural pastures. However, camels are depended entirely on natural pastures in compare to other animals such as sheep and goats (FAO, 2007). Camel husbandry requires skill and experienced team. Camels as animal does not accept people strangers and anyone, does not handle it easily because its ability to distinguish its owner from the others. The good relationship between a camel and its owner is a prerequisite in the assets of the camel breeding. The owner of the camel doesn't preferred to sleep well at night if his

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camels are hungry. The owners of the camels believe to sleep hungry and his camels bellies is filled in food.

Camels food needs are low in compare to other animals due to the higher food conversion rate of the camels, although the poor feeding land areas for the grazing. The camels usually grazing in the early morning and before and after sunset. The camels choose the plant species according to the environment. The pastoral animals exist in most cases in the arid and semi-arid areas which totally dependent on rainfall (Wardeh, 1989). Tendah grass, Al hamdh, nasy, arfag and ramath are the most common herbs that grow in the province of Basra. Thus, the pastures remain the main source of fodder for camels except for the newly born camels which provide with other concentrate food and in most cases with dry bread. The young camels are not allowed to graze with their dams, therefore they keep them with the male (Al fahal) or Althalol.

Camel milk and meat

The range of the amount of milk produced by female camel in Basra is up to 5 kg in the morning and 5 kg in the evening. The milk is limited for young camel feed and personal consumption. The owner of camels believed that spring milk is sweet while summer milk is more salty due to the quality of the grass in summer. As well as they drink milk without heating but in a direct way (directly after milking) (Technical Report, 2015). On the other hand, the camel is an important source for the production of meat, which is considered the best meat, especially young camels, and below the account of slaughtered camels recorded in the abattoir of Basra (Technical Report, (2015) (Table 2).

Table. 2. Shows the total numbers of the camels slaughtered at the abattoir of Basra.

Year	Slaughtered camels
2010	9
2011	24
2012	1
2013	1
2014	0
2015	0

Mating and childbirth

Mating usually begins in the camels at the five years old. At this age, the estrus cycle appears in the she camel at winter and during November, December and January. During the sexual activity, the he camel becomes very fierce and increased his aggressive tendency against other males. During the period of mating, all camel's owners take caution when they are dealing with a male camel. In general, the ratio of the he camel to the she camel is 2 to 100 in each herd. The duration of pregnancy in camels is 11 months and usually the female gives birth for single calf. The she camel remains a full year without mating after her delivery, in order to maintain

their health and also for the purpose of providing milk for her calf. These natural phenomena is help in reduce the proportion of death in newly born camels. Milking process of the she camel is innate behaviour and only occurs when the small animals becomes in contact with their dam. The she camel should remain with her calf a full week until this calf become able to stand (Technical Report, 2010-2015).

The problems of camel breeding

1. The number of camels is slowly decline in Basra due to lack of forage sources, which is the main source of camels feed. The camel's owner is in continuous movement between the different southern governorates in the case of abundance of rain and the growth of pasture. Most camel herd move between Dhi Qar, Samawah and Diwaniya especially in summer, when the rain is absence and lead to scarcity of pasture. This continuous movement of the animals raise the problem regarding the counting the actual numbers of the camels. Application of microchips is the ideal solve of this problem.
2. There are a lots of vast areas in the governorate of Basra which is the natural grazing area for the camel, are located within the oil exploration and production areas. This factor make these areas not suitable for the camels and thus directly affects the breeding process of the camels. Moreover, most owners move their camels more than hundreds of kilometres, to protect them from pollutions.
3. There are scarce in the education of the camel's owners. They are rarely visits the veterinary clinic and seeking treatment for their camels. These factors increase the possibility of the spreading of diseases, especially internal and external parasites because of the poorness of the veterinary care provided for the diseased camels. The education program are required to implement in order to help the owners and increased their knowledge regarding the disease of the camels and to help them to deny the previous idea that the camels are resistance to all diseases.
4. There are many environmental pollutions in Basra governorate. The spreading of the remnants of war such as mines is of the most important problems in vast areas of the Basra, and that lead to a significant mortality in herds. Moreover, there are doubts about the effect of some radioactive material from some of the buried war remnants of previous wars.
5. The spreading of the corona virus disease, is one of the important problem that face owners of the camels in Basra. The outbreaks of this disease have been reported in the Iraqi neighbouring countries, and the Iraqi open borders might lead to spread of the disease inside Iraq. The attention should be given to this disease to avoid its spreading into Iraq. More regional and international cooperation are needed to prevent transmission of the disease because it is one of the trans boundary diseases.
6. The continuous increased in the meat and milk products is a good incentive factor to increase the breeding of camels in Iraq. Basra

governorate has particularity in this issue because it has Al Zubair extensive desert. Al Zubair desert has favourable environment for breeding of camels and lead to strength the economy of the Basra.

7. Iraqi veterinary state should develop a national policy regarding breeding of the camels in Iraq. This policy will support and coordinate the camel breeding and help in the control the distribution of the diseases. In addition, national camel's laboratory is required to establish in order to improve the methods of diagnosis of the diseases.

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Original article

Some normal haematological values of Arabian camels reared in western desert of Al-Najaf governorate/ Iraq

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Abstract

This study was designed to study some normal hematological values of Arabian camels reared in western desert of Al-Najaf governorate/ Iraq. Blood samples was collected with anticoagulant tube from 78 free breeding Arabian camels in western desert of Al-Najaf governorate/ Iraq at January 2015. Complete blood count CBC were done for each sample and data were reported. The results showed low mean value of red blood cells (RBCs) in calves and lactating females and high hemoglobin level in adult males. Moreover, the lymphocytes: neutrophils ratio (L: N) was close to 1:0.6 and all blood indices were increased with age. In conclusion, this study revealed the normal hematological values of free breeding Arabian camels in western desert of Al-Najaf.

Key word: Arabian camel, Iraq, dromedary, CBC, lactating she camels.

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Introduction

Dromedary camels is an important part of economic resource in arid and semi-arid areas due to their adaptation on harsh arid environment (Abbas and Tilley, 1990). In Iraq, the number of camels are about 58,000 (Tara, 2011). Most communities that live in desert, is depending on camels to perform their daily activities. Camels are used for packing and riding as well as all bedouin consumes the camel milk and meat. Moreover, camel skin leather is used for different purposes. Blood examination helps in assessment of animal general health (Dessouky, 1992). Many authors provide data references about hematological values of dromedary in several camels reared countries (Holler

and Hassan, 1966; Majeed *et al*., 1980; Nyangrao *et al.*, 1997). The present study was designed to study the effect of sex, age and lactation on blood values of Iraqi dromedary that reared in Al-Najaf desert /Iraq.

Materials and methods

The study was carried out at January 2015 in Haydia village about 35 km western /Al-Najaf city. Eighty-seven camels of different age and sex were examined. All examined animals were under veterinary care with annual deworming and prophylactic treatment program against Surra disease. The animals were kept in semi closed barns at night and free grazing at day. The blood samples were collected from the jugular vein by 18 Gauge disposable syringe and placed in plastic tubes containing EDTA. All samples were sent to laboratory for further hematological examination. The red blood cells, packed cells volume, hemoglobin and total leukocytes count were assessed manually according to Coles, (1986). Blood indices (mean corpuscular volume MCV, mean corpuscular hemoglobin MCH and mean corpuscular hemoglobin concentration MCHC) were calculated according to the formulas of Wintrobe *et al.*, (1976). The differential leukocytes count DLC were made by staining of dried blood smear with Leishman's stain and the Total leukocyte count (TLC) expressed in percentage. All obtained data were analyzed by Statistical Analysis System (SAS).

Results

Erythrocyte indices were presented in (Table.1). The RBC count were significantly lower in calves and lactating she camels, while the highest hemoglobin value was recorded in adult males. Meanwhile, the result of this study revealed that all blood indices were increased with age. The lowest total and the highest leukocyte count were appeared in calves aged less than one year and above one year respectively. While, the adults were revealed same parameters in both sex. The ratio between lymphocytes: neutrophils in all examined animals is close to 1:0.6.

Discussion

The present study provides data about hematological values in camels in Al-Najaf governorate. The results of this study is compatible with previous studies (Hussein *et al.*, 1992; Amin and Abdelatif, 2007; Busadha and Osman, 2000). However, the results of this study is disagreed in some aspects from others due to variation in geographical zone, nutrition level, genetic factors and sampling method (Rezakhani *et al*., 1997). The results showed that the means of RBCs and hemoglobin were significantly higher ($P \leq 0.05$) in adults compared to means in calves and this fact supporting other previous findings (Hussein *et al.*, 1992; Al-Ani *et al.*, 1992). The means of blood indices is in agreement to other studies (Busadha and Osman, 2000; Babeker *et al.*, 2013). The MCHC was higher in adults and the relative increase of

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MCHC in comparison with human may reveal the oxygen carrying capacity as benefit of unique camel physiology. The means of WBC obtained in the present study were in normal ranges reported by other researcher (Sarwar and Majeed, 1997; Busadha and Osman, 2000).

Table. 1: Shows the mean of erythrocyte indices of examined camels

Indices	Unit	Male (No.11)	Dry female (No.28)	Lactating Female (No.18)	Less 1year calves (No. 6)	Above 1 year calves (No.15)
Rbc	g/dl	9.02a	9.03a	7.94b	6.93 b	b7.72
Hb	10^6/µl	11.29a	9.92 b	9.99b	8.55b	8.95b
PCV	%	27.1a	26.78a	25.9a	23.58b	26.25a
McCV	pg	30.57a	30.14a	32.83b	34.12 ab	34.29 ab
MCH	pg	12.67a	10.75b	12.73 a	12.45a	11.56 a
MCHC	%	65.43a	37.68 b	53.10 ab	36.39b	33.85b

Table. 2: Shows the means of leukocyte indices of examined animals

Indices	Unit	Male (No.11)	Dry female (No.28)	Lactating Female (No.18)	Less 1year calves (No. 6)	Above 1 year calves (No.15)
Wbc count	10^3 / µl	13.36a	13.58a	11.74	8.22	19.25
Lymphocytes	%	57.95a	58.39a	55.49a	65.62b	58.31a
Monocytes	%	2.05a	2.08a	2.13a	2.67a	1.93a
Neutrophils	%	39.2a	38.98a	40.88a	30.92b	38.16a
L:N ratio		1:0.68a	1:0.6a	1:0.71a	1:0.46	1:0.65
Eosinophil	%	0.7a	0.54a	1.2a	0.8a	1.4a
Basophils	%	0.1	0. 0	0.3	0	0.2

+

Significantly increase ($P \leq 0.01$) is reported in adult animals than in calves aged less than one year and these findings is in agreement with (Rezakhani *et al*., 1997), who reported that the TLC increased continuously with advancement of age. As other ruminant the lymphocytes: neutrophils ratio recorded in present study was about 1:0.6 and this ratio is compatible to findings of Al-Ani *et al.*, (1992). Al-Ani et al., (1992) is recorded 1:1 lymphocytes: neutrophils ratio. There are no significant difference in the percentage of monocytes, eosinophil and basophils among different ages this finding was in agreement with Babeker *et al*., (2013).

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Mirror of Research in Veterinary Sciences and Animals (MRVSA)

Original article

In vitro Evaluation of Antimicrobial Activities of Camel's milk Filtrate product against some Pathogenic Bacteria and Yeasts

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Abstract

This study was designed to examine the antimicrobial activity of camel's milk filtrate products on the pathogenic bacteria and yeasts in vitro. The milk samples were collected from a 4-5 years she camels (*Camelus dromedaries)* raised in local farm (sample 1) and from Western Desert of Samawa (sample 2). The chemical properties of the milk samples were analysed. The results of the chemical analysis of these samples (sample 1 & 2 respectively), revealed that these samples composed of fat (3.98%, 3.98%), protein (3.64%, 3.12%), lactose (4.62%, 4.84%) and ash (0.68%, 0.80) respectively. The pH of both milk samples was ranging between 6.34 and 6.82. The percentages of acidity as lactic acid were estimated between 0.15% and 0.17% for sample 1 and 2 respectively. *Escherichia coli O157:H7*, *Pseudomonas aeruginosa*, *Enterococcus faecalis*, *Staphylococcus aureus*, *Klebsiella spp*, *Salmonella typhimiurum*, *Clostridium spp.* and *Candida albicans* were used as pathogenic microorganisms to evaluate the antimicrobial activity of camel's milk filtrate products. Camel's milk filtrate products were revealed different inhibition zone on all pathogenic bacteria and yeasts. The diameters of inhibition zones of sample (1) for both X and 2X concentration were 14,12,11,9,11,11,13,12 and 18,20,16,11,15,14,19,17 mm respectively, and for sample (2) also for X and 2X concentration were 17,15,16,12,11,14,17,16, and 21,20,21,18,19,21,21,20 mm respectively, against *Escherichia coli O157:H7*, *Pseudomonas aeruginosa*, *Enterococcus faecalis* , *Staphylococcus aureus*, *Klebsiella spp*, *Salmonella typhimiurum* , *Clostridium spp.* and *Candida albicans* respectively. Antimicrobial activity of 2X concentration for desert camel's milk filtrate products was more effective and compared with some antibiotics groups of beta-lactam and amino glycosides. The results showed that the 2X concentration of camel's milk filtrate product was more effective and revealed large inhibition zones. In conclusion, the results of this study showed that Camel's milk Filtrate product has antimicrobial activity against different pathogenic microorganisms. Moreover, the milk sample collected from the desert camel was more effective than the milk sample collected from camel raised in local farm. In addition, 2X concentration of filtrate products was better than X concentration of both samples, as well as from different other antibacterial.

Key words: antimicrobial activity**,** *Escherichia coli***,** camel's milk filtrate products**.**

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Introduction

Recently, there are significant increases in the prevalence of resistance to antibiotics in common pathogens of humans and animals worldwide. The increasing morbidity, mortality, and cost of health care are the consequences of the appearance and spread of antibiotic resistance. The major cause for the appearance and spread of antimicrobial resistance has been increasing antimicrobial use that enable the pathogenic microorganisms to modify themselves against the antibiotics. Most Bacteria have developed mechanisms of resistance to all classes of antibiotics available for systemic use in humans and animals. These mechanisms can be divided, by function, into three general groups: (1) inactivation of the antimicrobial, (2) alteration of the site of antibiotic activity, and (3) isolation of the target site from the antibiotic (Neu, 1992; Dixit and Gandhi, 2010; WHO, 2014).
The beta-lactam is a broad category of antibiotics which working on inhibition of cell wall by inhibiting of peptidoglycan synthesis. After resistance period, the bacteria often has ability on synthesis of β-lactamase enzyme. This enzyme is able to breaking antibiotic and analyses the lactam ring by breaking the bond between carbon and nitrogen, which suspended the antibiotic and converts it into inactive form (Elander, 2003). The aminoglycosides antibiotics have a direct effect on microbial cell proteins synthesis (Jeffrey Buyten, *et al*, 2005). So resistance to these antibiotics arise by modified enzymes of aminoglycosides which encodes by transfer plasmids (Galimand *et al*, 2003). All these factors enhance researcher to find alternatives and safe antimicrobial agents from natural sources such as plant or animal products. Review of literature revealed a scarce information regarding the use of milk's camel as antibacterial agent. So, this study was designed to extract camel's milk filtrate products and to investigate its activity as antibacterial agents on the pathogenic bacteria and yeasts in vitro. Moreover, antimicrobial activity of camel's milk filtrate products was compared with antibiotics from beta-lactam and aminoglycosides categories.

Materials and Methods

Milk Samples

Milk Samples were collected from 4-5 years old she camels that raised in the local farm and also from Western Desert of Samawah in AL- Muthanna governorate. The animals were healthy and free from subclinical mastitis according to the results of California mastitis test (Coles, 1986). The case history of these animals were also collected to be sure that these animals didn't take antibiotics for a period not less than one month from samples collection. The samples were kept in sterile plastic bottles and transport directly to the laboratory using cooling box. The

screening test was done to avoid the impurities. The pasteurization treatment at 72Cºfor 5 second were also conducted.

Chemical analysis of milk samples

Camel's milk samples were analyzed by using LAL act scan instrument according to the instructions of Bulgarian Milkotronic company , camel's milk was skimmed using cream Separator (Bulgaria) with speed of 3000 rpm for 30 minutes at the laboratory temperature (Connor, 1995).

Camel's milk filtrate product

Skim milk was centrifuged (ultra-high centrifugation) using a refrigerated high speed centrifuge (Huttich, Germany) at 14000 rpm for 20 minutes. Later on, the upper part was pulled carefully and gently. This solution was concentrated and called as the filtrate product of milk. The first product (X) was filtrate. The X product was heat at 60 Cº until reaching to its half size (50% of its original size) and called (2X) product.

Pathogenic microorganisms

Eight different species of pathogenic bacteria and yeast, were used in this study and kindly provided from the laboratories of bio – technological and food science department / college of Agriculture / Baghdad University. Gram negative bacteria were: *Escherichia coli O157:H7*, *Pseudomonas aeruginosa*, *Salmonella typhimiurum*, *Klebsiella spp*, *Enterococcus faecalis*, while Gram positive bacteria were: *Clostridium spp*, *Staphylococcus aureus*, as well as *Candida albicans* yeast.

All these microorganism are pathogenic for human and animals and also considered as important food pathogens that cause damage for some food (Abu Elnaga *et al.*, 2014).

Culture of pathogenic microorganisms isolates

All selected microorganisms were cultured according to method described previously by Atlas *et al*., (1995). The bacteria were cultured on Muller Hinton medium (Oxide), while the yeast was cultured on Sabouraud medium (Oxide). All cultured bacteria were kept at 37 Cº for three hours for bacteria. The yeast culture was incubated at 30 Cº for 24 hours. Growth turbidity was compared with turbidity of the standard McFarland solution by reading optical density using a spectrophotometer on wavelength 450 nm. The dilutions of bacterial cultures density were adjusted to the McFarland with cells number 1.5 x 10^8 cfu/ml. However, yeast dilutions were adjusted to 4x108 cfu/ml at light intensity 0.98 nm.

Antimicrobial activity of camel's milk filtrate products (X and 2X)

Well diffusion method was used to study antimicrobial activity of camel's milk filtrate and according to method described by Cleidson *et al.*, (2007). The bacterial and yeast suspension were adjusted to (1.5x 10^8 and 4x10^8 respectively) cfu/ml and

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spread on the surface of nutrient agar and Sabouraud agar respectively. Six milliliters (mm) in diameter wells were done on the surface of the agar by cork piercing. A 50 microliter of camel's milk filtrate products (X and 2X) were placed individually in each wells, while one well were filled with distal water and acted as (control). All plates were incubated at 37 Cº (yeast at 30 Cº) for 16-20 hours. The diameter of the inhibition zone was measured. Two plates were done for each product.

Comparison of camel's milk filtrate with some antibiotics

Desert camel's milk filtrate (2X) Activity were compare with some antibiotics: Beta - lactam group (Amoxicillin AX) and Aminoglycosides group (Tetracycline T, Gentamycin GN, Vancomycin VN). These antibiotics were used at 50mg / 100 ml concentration and added to the wells using the Well diffusion method (Cleidson *et al.*, 2007) that mentioned above.

Results and discussion

The chemical analysis of the camel's milk collected from sample 1 and 2 revealed the following components: fat (3.98%, 3.98%), protein (3.64%, 3.12%), lactose (4.62%, 4.84%) and ash (0.68%, 0.80) respectively. The geographical location, nutrition conditions and different breeding conditions (desert or local farm camel) , seasons of the year , age , milking stage and number of the births are affected on the stability of camel's milk components (Khaskheli *et al*., 2005). The pH was ranging between 6.34 and 6.82, and the percentages of acidity as lactic acid were estimated between 0.15% to 0.17% in sample 1 & 2 respectively.

Antimicrobial activity of local farms camel's milk filtrate product

The diameters of inhibition zones for bacteria and yeast, which were exposed for camel's milk filtrate products from milk samples 1 were (14, 12,11, 9, 11, 11, 13, 12) mm at (X) concentration for *Escherichia coli O157:H7*, *Pseudomonas aeruginosa, Staphylococcus aureus, Enterococcus faecalis, Klebsiella spp, Salmonella typhimiurum, Clostridium spp, and Candida albicans* yeast respectively . Moreover, the diameters of the inhibition zones at (2X) concentration were (18, 20, 16, 11, 15, 14, 19, 17) mm for *Escherichia coli O157:H7*, Pseudomonas *aeruginosa, Staphylococcus aureus, Enterococcus faecalis, Klebsiella spp, Salmonella typhimiurum, Clostridium spp, and Candida albicans* yeast respectively (Figure. 1).

Antimicrobial activity of Desert camel's milk filtrate product

The diameters of inhibition zones for bacteria and yeast, which were exposed for camel's milk filtrate products from milk samples 2, were (17, 15, 16, 12, 11, 14, 17, 16) mm at (X) concentration for *Escherichia coli O157:H7*, *Pseudomonas aeruginosa, Staphylococcus aureus, Enterococcus faecalis, Klebsiella spp, Salmonella typhimiurum, Clostridium spp, and Candida albicans* yeast respectively .

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Moreover, the diameters of the inhibition zones at (2X) concentration were (21, 20, 21, 18, 19, 21, 21, 20) mm for *Escherichia coli O157:H7*, *Pseudomonas aeruginosa, Staphylococcus aureus, Enterococcus faecalis, Klebsiella spp, Salmonella typhimiurum, Clostridium spp, and Candida albicans* yeast respectively (Figure 2).

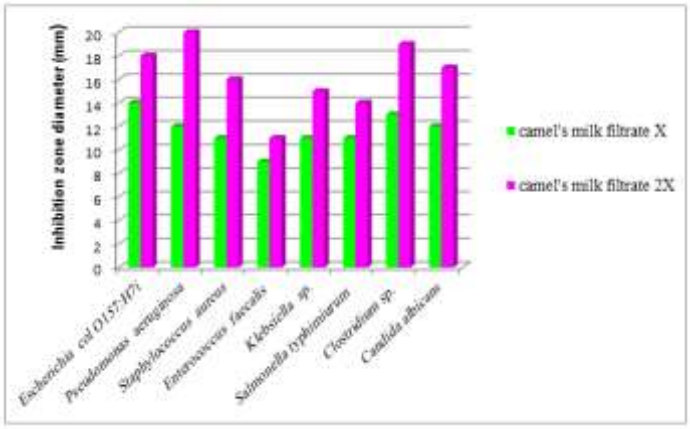

Figure.1: Shows the antimicrobial activity against different pathogenic microbes for camel's milk filtrate product of the local farms she camel.

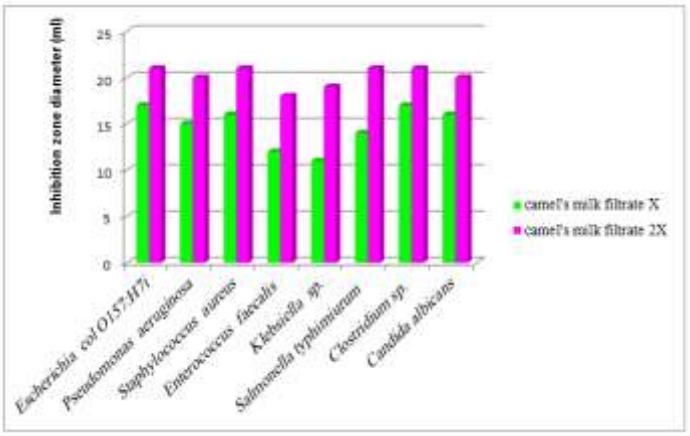

Figure .2: Shows the antimicrobial activity against different pathogenic microbes for camel's milk filtrate product of the desert she camel.

The results of this study revealed the efficiency of camel's milk filtrates products that extracted from collected milk from both local (sample 1) and desert (sample 2) she camel. The filtrate products revealed clear inhibition zones of the growth of both gram positive and negative tested pathogenic bacteria and yeasts. This results are compatible with previous studies (Agrawal *et al*., 2003), who proved that camel's milk have inhibition effects against gram negative and positive bacteria because it possess of high concentration of inhibitory substances such as peptide like insulin. This substances appeared to have a considerable role in the inhibition of microorganisms such as *Escherichia coli, Listeria monocytogenes, Staphylococcus aureus* and *Salmonella typhimurium*. Moreover, other inhibition factors such as Lysozyme, Hydrogen peroxide, lactoferrin, lactoperoxidase and immune proteins contribute also in inhibition action (Benkerroum *et al.*, 2004). Kappler, (1998)

approved that camel's milk is rich with peptide (PGRP) peptidoglycan recognition protein, which is a highly effective against pathogenic bacteria because its ability to conjugate to the bacterial cell wall. Previous study approved that the antibacterial activities of camel's milk was more than the activities of other single immune proteins and peptides due to the synergistic effect of proteins and peptides that present naturally in the milk. Moreover, milk Lactoferricins, Casocidin-I and Isracidin have also antibacterial activities because they are conjugated and release the liposaccharide molecules that located in outer cell membrane of the gram negative bacteria, and this mechanism is similar to lactoferrin molecules (Clare & Swaisgood, 2000). Desert camel's milk filtrate product revealed high inhibition effects in compare with camel's milk filtrate product that extracted from local farm raised camel. This difference occurred due to the nature and quality of the desert pasture. Previous study approved the effectiveness of desert plants (pasture) that contain amino acids, non-protein nitrogenous materials, proteins and inorganic elements, in addition, to the effect of the high salinity of the desert plants (Shehabi *et al*., 2004).

Results of the comparative study of antimicrobial activity of desert camel's milk filtrate product (2X) with some antibiotics

Results of this comparative study presented in tables (1). This study revealed that the pathogenic microorganisms have clear resistance for some antibiotic, in spite of the high concentration that has been used. However, the desert camel's milk filtrate product (2X) revealed clear variable inhibition zones on the tested microorganisms. The results of the sensitivity test revealed the resistance of the following bacteria for different antibiotics: *Escherichia coli O157:H7* (Amoxicillin (AX) and Vancomycin (VN)), *Pseudomonas aeruginosa* (Gentamycin (GN) and Vancomycin (VN)) , *Staphylococcus aureus* (Amoxicillin (AX)) , *Enterococcus faecalis* (Gentamycin (GN) and Vancomycin (VN)), *Klebsiella spp.* (Gentamycin (GN)) , *Salmonella typhimiurum and Clostridium spp.* (Tetracycline (T)), while *Candida albicans* showed resistance to Amoxicillin ,Vancomycin, Gentamycin and Tetracycline.

Table.1: Shows antimicrobial activity of the camel's milk filtrate product (desert she camel) (2X) in compare to antibiotics.

Pathogenic isolates	Inhibition zone diameter mm				
	Desert Camel's Milk Filtrate 2X	Antibiotics			
		VN	T	GN	AX
Escherichia coli O157:H7	21	-	11	16	-
Pseudomonas aeruginosa	20	-	19	-	12
Staphylococcus aureus	21	18	14	15	-
Enterococcus faecalis	18	-	16	-	10
Klebsiella sp.	19	15	14	-	12
Salmonella typhimiurum	21	-	14	12	14
Clostridium sp.	21	18	-	14	16
Candida albicans	17	-	-	-	-

*each number represent rate of two repeated
*- no inhibition

The development of bacterial resistant are one of the important problems that face the health sector since long time ago. Resistance of bacteria to antimicrobials drugs emerges through one of the following ways: natural resistance in certain types of bacteria; genetic mutation; or by one species acquiring resistance from another (General Background, 2015). Resistance can develop spontaneously due to accidental mutations; or more commonly following gradual build up over time, and because of mistreatment of antibiotics or antimicrobials (About Antimicrobial Resistance, 2015). Resistant microbes are increasingly difficult to treat, requiring alternative medications or higher doses—which may be more costly or more toxic. Pathogenic bacteria resistant to multiple antimicrobials are called multidrug resistant (MDR); or sometimes superbugs (Antibiotic Resistance Questions & Answers, 2013). Antimicrobial resistance is on the rise with millions of deaths every year (World Health Organization, 2014). A few infections are now completely untreatable due to resistance (Tricia *et al.*, 2006). So, looking for alternative antimicrobial derivatives is the ideal choice for treatment of resistance microorganisms. The results of this study is approved the use of camel's milk filtrate product as alternative derivatives to inhibit the growth of pathogenic microorganism in vitro.

In conclusion, the results of this study showed that camel's milk filtrate product has antimicrobial activity against different pathogenic microorganisms. Moreover, the milk sample collected from the desert camel were more effective than the milk sample collected from the camel that raised in local farm. In addition, 2X concentration of filtrate products were better than X concentration for both samples.

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Original article

The effect of camel's milk on some blood and liver parameters in formaldehyde induced arthritis in rats

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Abstract

This study was designed to evaluate the effects of camel's milk on some blood and liver parameters of formaldehyde induced arthritis rats. Forty-two adult male rats were used in two experiments. The preliminary study was done to induce arthritis and to evaluate the changing in blood and liver enzyme parameters. Twelve adult male rats were divide into two groups. All animals in group 1(G1/ control) and group (G2) were injected at the Plantar fascia of the left foot with 0.1 ml physiological saline and 0.1 ml formaldehyde twice (1st and 3rd day of the experiment) respectively. The experiment study was done to evaluate the anti-arthritic nature of camel's milk against the formaldehyde induced arthritis in rats and its effect on some blood and liver parameters. This experiment included 30 adult male rats and divided into five groups (G3, G4, G5, G6, and G7) each with 6 rats and received different treatment according to the design of the experiment that explained in the methods. The results of this study revealed significant elevation ($p< 0.05$) in the Leukocyte Count (WBC) especially in the neutrophil and monocyte and in the level of (AST, ALT, and ALP). There were also significant decrease ($p< 0.05$) in the percentage of lymphocytes and monocyte in formaldehyde induced arthritis rats, when compare with the control group. The treated groups G6 in the second experiment revealed significant decrease ($p< 0.05$) in the in the WBC especially in the neutrophil and monocyte and in the level of (AST, ALT, ALP). Moreover, there was significant elevation ($P< 0.05$) in the percentage of lymphocyte. In conclusion, the results of this study revealed anti-arthritic activity of camel's milk against the formaldehyde induced arthritis in rats.

Key word: Camel milk, Arthritis, Blood parameters, Liver enzymes.

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Introduction

Although camels live in drought areas, it can produce an adequate amount of milk. The camel's milk has an importance for the young camel, and also for man, who drinks this milk. Data concerning the composition of milk vary greatly. The inherited capabilities of the animals are the important factors that attribute to the variation in the milk composition. In addition, the stage of lactation, age, and the number of calving also play a role. The feed and water quantity and quality play also special significance to the quality of the produced milk. Milk plays a vital role in man maturation, since it represents an essential source for different kinds of food, milk has been suggested as a nutrition system, in order to treat different kinds of diseases (*Kergoat et al., 1992*). Camel milk considered as rich source for vitamin and different kinds of metals. It characterizes by it low level of cholesterol and high concentration of insulin (Agrawal *et al.,* 2002). It has a medical activity against germs and viruses (El-ouardy *et al.,* 2011) and consists of high concentration of lactoferrin (Yagil *et al.,* 1994). In addition, it has the ability to inhibit the growth of *Salmonella, Brucella, Mycobacterium tuberculosis* and *Escherichia coli.* The milk of the camel has different distinctive features that make most people in the Arab world to use it for treat different kinds of diseases such as modulation of the immune system, babies suffering from malnutrition, liver disease especially the Jaundice, diabetes (Farah, 1993). The effectiveness of camel's milk against diseases like Brucellosis, Tuberculosis and Breast cancer and some kinds of immune diseases comes from that, this milk contains antimicrobials agents that destroys different kinds of germs. It is also used for treating some kind of spleen diseases, Asthma, Anemia and others (EL- Sayed *et al.,* 1992).

Inflammation is the response of the mammals living tissues against different kinds of injuries. In fact, it is the reaction of the defence part of the body in order to eliminate or stopping the causes of the disease. Arthritis is a group of diseases that affected the joints, tissues, synovial fluid and cartilage. Arthritis is also considered as kind of chronic disease, which spread all over the world. This disease consists of more than one hundred kind (Osteoarthritis, rheumatoid arthritis, septic Arthritis, gout, Juvenile Idiopathic Arthritis, Ankylosing Spondylitis and psoriatic arthritis). These kinds of disease have symptoms prevalent such as sclerosis around the joint, swelling in one or more than one of the joints, pains, redness, and fever in the joint and not able to move naturally (Hafstrom *et al.,* 2001).

There is a very strong connection between blood and many rheumatoid diseases. Arthritis is one of important diseases that has a very strong effect on some blood parameters. Leukocyte is considered as one of the main component of the immune system of the blood. Previous research reported that total leukocyte count is increased considerably in arthritis patients, the presence of (WBC) in great number is a sign of infection or inflammatory diseases (Jaijesh *et al.,* 2008; Norberg *et al.,* 2005). Review of literature revealed scarce information regarding the anti-arthritic effect of camel's milk. So, this study was designed to evaluate the activity of camel's milk on the total

and differential leukocyte count and also the level of liver enzymes (ALT, AST, ALP) in the formaldehyde induced arthritis rats.

Materials & Methods

Animals

Forty-two, 10- 12 weeks old male rats (*Rattus norvegicus*), about (200-275) gm in weight were used in this study. Rats were kept under suitable environmental conditions and feed with standard laboratory animal food. This research study was approved by the research and animal ethical committees/ Biology Department / College of Science / University of Thi-Qar

Camel milk

The first Camel's milk samples were collected from a herd of camels in Al-Salman region about 160 km south of Samawa City/ Muthanna governorate. Hand milking was used to collect milk samples from the camels early morning. All samples were collected from healthy camels and neither suffer from mastitis nor received any kind of antibiotics. The samples were collected in sterile screw bottles and kept in cool box until transport to the laboratory.

Induction of arthritis

Arthritis in rats has been induced by using formaldehyde (HCHO), the induction has been done by injection 0.1 ml of 2% formaldehyde in the plantar of the left foot of the animals during the first and the third day of the experiment (Tirkey and Tiwari, 2012). This kind of induction of arthritis is a kind of chronic inflammation and its changes considerd as the same changes that take place in rheumatic arthritis that happens in human beings **(**Okoli *et al.*, **2008;** Greenwald, 1991**)**.

Experimental design

The current study consists of two experiments:

Preliminary study

Twenty-four rats were divided into two groups each with 12 animals and treated as follow:
1- (G1): Animals were injected twice with 0.1 ml of normal saline at the plantar fascia of the left foot at the first and third day of the experiment. This group was acted as affected control group.
2- (G2): Animals were injected twice with 0.1 ml of 2% formaldehyde solution at the plantar fascia of the left foot, at the first and third day of the experiment. This group was not treated and considered as non-treated control group. The preliminary study was done to investigate the blood and liver parameters.

Blood samples with and without anticoagulant were collected from both groups after ten days and send to the laboratory for further investigation.

Experimental study

Thirty animals were used in this experiment. The animals were divided into 5 groups each with 6 animals and treated as follow:

1- (G3/ negative control group): Animals were injected twice with 0.1 ml f normal saline in the plantar fascia of the left foot, at the first and third day of the experiment and were left to the end of the experiment

2- (G4/ positive control group): Animals were drench orally 1 ml/ day milk of camel for fourteen days starting from the eleventh day until the twenty fourth day of the experiment.

3- (G5/ affected control group): Animals were injected twice with 0.1 ml of 2% formaldehyde solution in the plantar fascia of the left foot, at the first and third day of the experiment and left to the end of the experiment.

4- (G6):- Animals were injected twice with 0.1 ml of 2% formaldehyde solution in the plantar fascia of the left foot, at the first and third day of the experiment. Animals were drench orally 1 ml/ day milk of camel for fourteen days starting from the eleventh day until the twenty fourth day of the experiment.

5- (G7): Animals were injected twice with 0.1 ml of 2% formaldehyde solution in the plantar fascia of the left foot, at the first and third day of the experiment. Animals were drench orally 1 ml/ day milk of camel for seven days starting from the eleventh day by day until the twenty fourth day of the experiment.

Collection of blood samples

Blood samples were collected directly from the heart from all experimental animals (G3, G4, G5, G6, G7) after the twenty fourth day of the experiment. Samples were kept with anticoagulant and without anticoagulant tubes for the following test:

1- Total and differential leukocyte counts using Hematological analyzer according to (Brown, 1976).

3- Serum samples were separated from blood samples without anticoagulant by centrifugation. Serum samples were used to estimate ALT, AST and ALP enzyme using colorimetric method according (Reitmanand Frankel, 1957).

Statistical Analysis

SPSS version 14 was used to analyze the collecting data. The one-way analysis of variance (ANOVA) was used to determine significant differences between experimental groups to calculate the L.S.D. in the level of probability ($P<0.05$).

Results

The results of the preliminary study revealed significantly increase ($p<0.05$) in the total leukocyte (WBC) and the percentages of the neutrophils, monocytes

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in (G2) in comparison with (G1) (Table.1). The results also showed that there were significantly decreased ($p<0.05$) in the percentages of the lymphocytes in (G2) in comparison with to the control.

The results of the experimental study revealed significant decreased ($p<0.05$) in the total leukocyte and the percentages of neutrophil and monocyte in (G6), however, non-significant decreased was observed in (G7) in compare to (G5) (Table.2). Moreover, there was a significant increase ($p < 0.05$) in the percentages of lymphocyte in G4, G6 and G7, in addition to the significant decrease in the percentages of neutrophil and monocyte in G4, G6, G7 in compare to G5 (Table.2). The results of this study revealed significant elevation ($P<0.05$) in the level of AST, ALT, ALP enzyme in G2 animals in compare to G1 animals (Table.3).

The results of estimation of the AST, ALT, ALP enzyme showed significant decrease ($P<0.05$) in G6 animals in compare with G5. However, non-significance difference was appeared in the level AST and ALP in the in G7 in compare with G5. Moreover, significantly difference were observed in AST, ALT, ALP in G6 in compare to G3 and G4. A decrease in the level of ALT in G7 as compare with G5 was also observed (Table.4).

Table (1) shows the effect of arthritis on the total number and the differential Count of white blood cells for the laboratory male rats.

Groups	White blood cells / Mean ± standard error			
	WBCX10^3/uL	NEU %	MON%	LYM%
G1	7.33 ±3.74 b	10.5 ±0.8 b	2.19 ±0.4 b	86.11 ±5.41 b
G2	16.03 ±8.62 a	28.22 ±1.96 a	3.0 ± 0.2 a	67.38 ±9.74 a
LSD	8.55	1.7	0.398	10.14

*Different letters refer that there is incorporeal differences among groups ($P<0.05$).

Table. 2: shows the effect of camel milk on the total and differential leukocyte count in the experimental animals.

Groups	White blood cells / average ± standard error			
	WBCX10^3/µL	NEU %	MON %	LYM%
G3	7.42 ± 0.69 b	11.6 ± 0.97 b	1.34 ± 0.28 b	85.36 ± 5.46 a
G4	10.66 ±2.49 b	18.9 ± 0.58 b	2.64 ± 0.4 b	76.56 ± 6.56 a
G5	19.68 ±3.90 a	24.0 ± 0.55 a	4.3 ± 0.6 a	69.98 ± 2.01 b
G6	14.43 ±3.29 b	15.8 ± 0.3 b	2.9 ± 0.38b	79.71 ± 5.19a
G7	19.11 ±4.60a	12.1 ± 0.2b	1.4 ± 0.86b	85.0 ± 4.11a
LSD	4.011	0.68	1.05	5.847

*Different letters refer that there are significant differences between groups.
*Similar letters refer to similarity in significant differences.

Table. 3: Shows the effect of induced arthritis on the level of liver enzyme (AST, ALT, ALP) in the experimental animals.

Group	Liver enzymes / average ± standard error		
	AST (U/L)	ALT (U/L)	ALP (U/L)
G1	127.66 ±5.85 b	134.83 ±18.07 b	70.66 ±3.66 b
G2	171.16 ±13.40 a	168.5 ±8.31 a	332.16 ±176.81a
LSD	13.32	18.09	160.9

*Different letters refer that there is significant differences between groups ($P<0.05$).

Table .4: Shows the effect of camel milk on liver enzyme (AST, ALT, ALP) in the arthritis induced experimental animals.

Groups	Liver enzymes / average ± standard error		
	AST (U/L)	ALT (U/L)	ALP (U/L)
G3	136.83± 6.94 b	132.33± 8.33 b	79.66± 5.0 b
G4	143.83± 39.09 b	130.83± 21.25b	88.33± 7.52 b
G5	189.33± 3.32 a	157.66± 3.23 a	579.0±53.58 a
G6	157.5± 26.39 b	131.16± 23.41 b	126.16±64.91 b
G7	186.33± 15.37 a	138.33± 3.98 b	572.0±119.3 a
LSD	26.7	17.61	77.8

*Different letters refer that there is incorporeal differences among groups.
*Similar letters refer to similarity in incorporeal differences.

Discussion

It is well known that the immunoglobulins (Igs) are large long and short-chained domains, having difficulties reaching and penetrating antigens. Researcher found that camel immunoglobulins have no short chains and small and they are active against antigens. The camel's immunoglobulins pass into the milk and so are available for fighting autoimmune diseases (Yagil, 2004).
The effect of drenching camel milk in reducing the effect of experimental induce arthritis on the total and differential leukocyte count and also on the levels of liver enzyme in rats were investigate in this study.
There were significant increase in total leukocytes count in G2 animals. Leukocytes are the cells of the immune system that are involved in protecting the body against both infectious disease and foreign invaders. The elevation was occurred due to the involvement of WBC in the arthritis that induced experimental in these animals. (Hassan and Jassim, 2011; VanderBorght *et al.*, 2001).
The results of this study revealed that there were increased in the percentages of neutrophil and decreased in the lymphocytes. This results is compatible with previous studies that reported the changes in the percentages of differential leukocytes count with neutrophilia, lymphopenia in the in vivo induced arthritis. They reported that these changes occurred due to mobilised of the leukocytes from the blood to the inflammatory lesion, and exudate leucocytes show a markedly increased phagocytosis and metabolic activity (Kumar et *al.*, 2004; Siegal, 1980).

Formaldehyde was used in this study to induced arthritis. The results of this study approved the animal models of arthritis using formaldehyde, which can be used in the preclinical studies in the evaluation of anti-arthritic drugs such as milk of the camel. These animals' models were used in this study to investigate the anti-arthritic effects of camel milk. Animals injected with formaldehyde showed severe arthritis accompanied with lymphocytopenia and neutrophilia, which occurred due to increase in the cytokines and chemokines activities that attract the inflammatory cell to invade the affected areas (Karouzakis *et al.,* 2006; Kassab *et al.,* 1992).

The results of this study revealed a decrease in the total leukocyte count in all experimental animals that received camel milk. The decrease of the total leukocyte count might be occurred due to the effect of the milk camels components (camel's immunoglobulins) that pass into the milk and so are available for combating diseases (Agrawal *et al.,* 2005;. Carmen, 2002).

The lymphocytosis was observed in the experimental animals treated by camel milk. This result is compatible with studies that reported previously (Karakilcik et al., 2005; Fetrow and Avila, 2000). These studies approved that milk of the camel has high level of vitamins C& E. These vitamins work as antioxidant factors to prevent the harmful effects of the free radicals products such as peroxides that destroy the cell membrane. In addition, it work to protect the lymphatic cells genetic material (DNA) from the oxidization activities (Karakilcik *et al.,* 2005; Fetrow and Avila, 2000; Shlig, 2009; Coles, 1986).

There was also significant increase in leukocytes count in G7 animals, which might be occurred due to the reduction in concentration of camel's immunoglobulins, because these animals were treated day between days (each two days).

The effects of camel milk on the level of liver enzymes (ALP, ALT, AST) in the experimental animals revealed the clinical signs of induced arthritis and treated with camel milk. There were a significant increase in the levels of liver enzymes in the formaldehyde induced arthritis animals due to chemical irritation that led to decreases the level of cellular Gluathione (GSH). It is well known that glutathione is the body's own master antioxidant the preventing damage to important cellular components caused by reactive oxygen species such as free radicals, peroxides, lipid peroxides and heavy metals (Al-Fartosi *et al.,* 2011; Stempel and Miller, 1977).

The elevation in the ALP enzyme in the untreated animal with arthritis was observed in this study. This result is agreement with previous studies that reported the relation between the performance of liver cells and arthritis. The elevation in ALP activity enzyme might be occurred in case of bones, liver, kidney diseases, in addition, there are 11 ALP analogues (Al-Fartosi *et al.,* 2011; Kaplan *et al.,* 2003; Gaw *et al.,* 1999). The results of this study revealed a decrease in liver enzymes in experimental animals that suffered from in induced arthritis but treated with camel milk. This reduction might be resulted from the effect of camel milk that content a high concentration of minerals such as magnesium contained in the camel milk. Magnesium has also acted like GSH enzyme. It protect the cells from the reactive oxygen species such as free radicals, peroxides, lipid peroxides and heavy metals and its being

necessary to produce Glauthione (Al-Fartosi *et al.,* 2011; Barbagallo *et al.*,1999).

In conclusion, this study revealed the anti-arthritic ability of camel milk to reduce the inflammatory reaction in experimentally animals that suffered from arthritis induced by formaldehyde.

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Original article

Recurrent outbreaks of Camel pox in *Camelus dromedarius* in Dhi- Qar governorate /Iraq

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Abstract

Outbreaks of pox-like exanthemas lesions were observed in camels in Dhi- Qar governorate in southern of Iraq, between May-June 2001, July 2007 and May - June 2013 in Batha desert areas, Alfager region and Alnaser region respectively. This study intended to report the case history, epidemics and the diagnostic clinical symptoms that appeared on the infected camels. A forty-two suspected infected camels revealed various clinical signs of camel pox. These clinical signs included high temperature, increased in the respiratory rate, loss of appetite or complete refusal of food, ataxia, and presence of pox like lesions in different stages on the skin especially in the lint-free areas. These lesions were observed in the young animals. It was also observed that the duration of camel pox cases emergence among the herd was between 3 and 12 days.

Key words: Batha, Camel pox, Dhi- Qar governorate, pox like lesions

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Introduction

Camel pox is an economically important contagious skin disease of camelids and causes clinical disease in camel populations worldwide (Yousif and Al-Naeem, 2011). It is caused by camelpox virus (CMLV) and characterized by mild local skin infection and less common severe systemic infections (Bhanuprakash *et al*., 2010). A Camel pox virus (CMLV), is a member of the Orthopoxvirus genus in the Poxviridae (Afonso *et al*., 2002; Al-Ani, 2003, Peffer *et al*., 1998; Omar, 1986). Between 1893 and 1902, camel pox was first reported in Russia (Wernery and Kaaden, 2002), Rajaputana and Punjab parts of India (Leese, 1909). Later on, several strains of poxviruses were isolated from camels from different parts of the world. It was isolated in Iran, Egypt, Yemen, Kenya, the Soviet Union and Iraq (Ramyar & Hessami, 1972; Baxby,

1972, 1975; Marennikova *et al.,* 1974; Tantawi *et al.,* 1974; Davies, Mungat & Shaw, 1975; Al-Falluji *et al.,* 1979).

Recently, CMLV is regarded as unique naturally infect old world camelids, including *Camelus dromedarius* (dromedary camel) and *Camelus bactrianus* (Bactrian camel) (Wernery and Kaaden, 2002). The course and the outcome of camelpox may vary depending on age, sex and the circulating CMLV strains, which may differ in virulence (Al Zi'abi *et al.,* 2007; Gitao, 1997; Jezek *et al.,* 1983; Kriz, 1982). The disease usually manifests in a localized form in adult camels, but under certain circumstances, generalized or fatal internal forms may be seen. The incubation period of the disease is ranged between 9–13 days, followed by fever, enlarged lymph nodes, skin lesions and prostration. Camelpox shows typical skin lesions and pass through all the stages of pock lesions progression, i.e., macules, papules, pustules, vesicles and scabs. Eruptions of the lesions are mainly localized on the head, nostrils and eyelids, as well as on the mucous membranes of the lips and the nose and also in the oral cavity. Later on, lesions may be extend to the limbs, mammary glands or scrotum. It takes 4–6 weeks for the lesions to heal. In converse, the generalized forms show lesions that may spread over the body, particularly on the head and the limbs, and swellings on the neck and abdomen. In such cases, pock lesions may be found in the respiratory and digestive tracts, and the outcome of the disease is more likely fatal (Pfeffer *et al.,* 1998). It is also observed that young camels under the age of four years and pregnant females appear more susceptible to camel pox. It is also reported that abortion rates can reach 87%, as observed in Syria (Al Zi'abi *et al.,* 2007), although this high percentage might be explained by the absence of immunity as CMLV circulation had never been reported in this country before.

Camel pox is transmitted by direct contacts with sick animals through skin abrasions or via aerosols (Wernery and Kaaden, 2002). Scab materials, saliva and secretions of affected camels may shed virus in the environment, such as in water which becomes then the source of infection (Khalafalla and Ali, 2007). The virus can survive on the dry skin scabs for a period of 4-5 months, but it susceptible to heat, direct sun light, acids, alkali and potassium permanganate.

The camel pox is well known diseases since ancient times .Some researchers pointed out to the possibility of transmission of infection to humans, so it is one of the zoonotic diseases among the camels and humans as it can infect the human in contact with infected camels. The virus has gained attention from researchers due to its recent emergence with close genetic relatedness to variola virus, the causative agent of smallpox, and carrying genes responsible for host immune evasion mechanisms (Bhanuprakash *et al.,* 2010; Bera *et al.,* 2011). In a report on an epidemic of the disease in the north of Kenya found that the disease moved to humans by drinking of contaminated milk from infected she camels with camel pox, which appeared in the form of sores in the mouth and lip (Al-ani & Al-salihy 1988).

In Iraq, Al-Falluji *et al.,* (1979) isolated camel pox virus from camel pox-like lesions. The outbreak occurred in 1977 in an area near the Iraqi-Iranian border. The virus was identified serologically as a virus of the Orthopoxvirus group. The biological properties of the isolate indicated that it was probably identical with strains of camel pox virus isolated from Iran, Egypt, Kenya and the

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U.S.S.R. The recurrent incidence of camel pox occurred in Iraq, however, review of literature revealed scarce reports. Consequence, this article intended to document the case history, epidemics and the diagnostic clinical symptoms of camel pox outbreaks in different areas in Dhi- Qar governorate / Iraq.

Methods and Materials

This study was conducted on the diseased camels in the Dhi Qar province in Batha region, Alfager region and Alnaser area at May-June 2001, July 2007 and May- June 2013 respectively. The disease was observed on 42 camels that suffer from a skin disease (15, 22 5 animals in 2001, 2007 and 2013 respectively). The infected animals were examined clinically. All clinical parameters (temperature, pulse, respiration) were recorded. Skin lesions were examined carefully and the locations of the lesions were also reported.

Results

Clinical examination of the infected herds during epidemics in 2001, 2007 and 2013 showed that not all camels in the herd were showed the clinical signs of camel pox. The infected animals revealed following symptoms: high temperature (39.6 - 40 ^{0}C), increase in heart rate (60-80 / min) and respiratory rate, lack of appetite or stop eating and ataxia (the infected animals were unable to stand). All sick animals revealed typical skin lesions (papules or vesicles, blisters diameter 0.5-1.5 cm, sores and scars). These lesions were observed in all areas of the body especially skin free of lint. Nodules spread to include the front of the head especially the nostrils and upper lip area and the lower lips which appeared as sagging lips (Figure.1) The lesions spread in some cases and appeared as hemorrhagic nodules in the upper and lower lips, gums, tongue and oral cavity. The lesions were ulcerated and left a red and bleeding areas. The infection of oral cavity occurred and leading to difficulty in swallowing and restriction the animals from eating. Some animals showed distribution of the nodules on the eyelids, udder and legs (Figure. 2). Many lesions were appeared on the joints, causing severe pain and effect on the movement of the animal. In some cases the lesion coalesced together and leaving large ulcerated and hemorrhagic painful swelling areas (Figure. 3). Most of the infected cases appeared to heal after a period ranging from 5-13 days.

Figure.1. shows the coalesced lesions on the upper lip and tongue
Figure.2. Shows the spread of nodules on the back legs.

Figure. 3. Shows the spread and integration of painful and hemorrhagic nodules on the back legs.

Discussion

Diagnosis of camel pox can be established through clinical signs and lesions that appeared on the skin and mucous membrane (Al-Ani 2004). Typical skin lesions and general systematic signs of camel pox were reported in camels in this study. These typical skin lesions (pox like lesions) and general systematic signs that reported in the camel (*Camelus dromedarius*) in Dhi Qar governorate are compatible with previous observations reported by other researcher (Wilson, 1998). Wilson, (1998) was diagnosed the camel pox in 10 cases in Sudan, in addition to isolation and characterization of this camel pox virus from the infected animals. The clinical signs reported in this study are also agreed with cases that reported in one hump camels in the United Arab Emirates (Pfeffer *et al.*, 1996; Al-Ani & al-salihy 1988; Radostitis *et al*., 2007). In conclusion, this study reported camel pox outbreaks in the Iraqi camel type Judy in Dhi Qar governorate / southern Iraq. The author recommend virus isolation and used the rapid molecular diagnostic test for accurate diagnosis of this important disease.

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Mirror of Research in Veterinary Sciences and Animals (MRVSA)

Review article

Camels and adaptation to water lack

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Abstract

The camel is truly multi-purpose animal. For hundreds of years the camel had been exploited by man in Asia and Africa in arid and semiarid areas - often being the only supplier of food and transport for people. Camel is beast of burden and provider of milk, meat, and hides. The camel has shown to be better adapted to extreme conditions in most aspects than other domestic ruminants.The camel has an exceptional tolerance to dehydration of the body. It has a low evaporation, a low output of urine, and a low loss of water with feces, so it can go a very long time without water. In severe dehydration the plasma volume of camel is only slightly reduced. The camel is able to drink in 10 minutes about one third of its body weight water. After that the camel shows no signs of water intoxication. The camel does not drink more than necessary to obtain a normal water of the body. The camel is truly multi-purpose animal. For hundreds of years the camel *had* been exploited by man in Asia and Africa in arid and semiarid areas - often being the only supplier of food and transport for people. Camel is beast of burden and provider of milk, meat, and hides. The camel has shown to be better adapted to extreme conditions in most aspects than other domestic ruminants.

Key words: adaptation, water lack, Camel, extreme conditions

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Introduction

For hundreds of years the camel had been exploited by man in Asia and Africa in arid and semiarid areas - often being the only supplier of food and transport for people. It is truly multi-purpose animal and called beast of burden. Camel provides milk, meat, and hides. Other than most domestic ruminants, camel has shown its abilities to adapt to extreme conditions. The camel has a unique tolerance to dehydration with low evaporation, a low output of urine, and a low loss of water with feces, so it can go a very long time without water. In severe dehydration the plasma volume of camel is only slightly reduced. This review article intends to focus on camels and its adaptation to water lack.

Taxonomy

Dromedary camels (*Camelus dromedarius*) and the domestic Bactrian camel (*Camelus bactrianus*) were named in 1758 by Swedish zoologist Carl Linnaeus, who only knew of the domestic variety. Wild Bactrian camels (*Camelus ferus*) were discovered in 1878 by Nikolai Prejevalsky, Russian geographer who explored Mongolia and Tibet. For many years, the wild Bactrian was thought to be a subspecies of the domestic Bactrian. However, in recent years, DNA analysis confirmed that *C. ferus* was a separate species, the San Diego Zoo says on its website. The main difference between the two species is that the wild Bactrian has three more chromosome pairs than the domestic Bactrian.

- Kingdom: Animalia
- Phylum: Chordata
- Class: Mammalia
- Order: Artiodactyla
- Family: Bovidae
- Genus and species: *Camelus dromedarius*, *Camelus bactrianus*.

There are two species of camels belonging to the camelidae. The two- humped or Bactrian camel (*Camelus bactrianus*) is found in Asia and thrives particularly in cold and arid regions (San Diego Zoo Global, 2009).

The one-humped or dromedary camel (*Camelus dromedarius*) also called the Arabian camel. The one–humped Dromedary occurs in India, Pakistan, the Middle East and Africa. Other forms migrated south and became the llamas, alpacas, guanacos and viçunas of South America. Fossils show that the early evolution of the Camelidae took place in North America. The earliest found ancestor (Protylopus) from the Upper Eocene period was no bigger than a hare (http://australiancamelindustry.com.au). Australia is now the only country in which there are wild camels (Yagil, 1985).

Some Prominent Physiological Features

Gestation in camel lasts some 360 – 380 days. The single young weighs about 40 kg at birth and is suckled for more than a year. Oestrus can recur as early as 1 month after parturition, but the interval between births is normally 18 – 24 months. Sexual maturity is reached in about 4 years. Camels have a life span of 20 – 25 years (http://australiancamelindustry.com.au). Camels can run at 25 mph (40 kph) for long periods. If their owner is in a hurry, they can kick their speed up to 40 mph (67 kph). (Alina Bradford, 2014). They have a third, clear eyelid that protects their eyes from blowing sand. Two rows of long lashes also protect their eyes (Wilson, 1984). Camels are known for spitting on people. In fact, the animals are throwing up the contents of their stomach along with spit. This is a defense tactic when the animals feel threatened (Alina Bradford, 2014). The hump of the camel is absent in the new–born, but can be as heavy as 200 kg in a 700 kg animal. It is made up of fat, blood vessels and fibrous tissue. During drought, the hump is a source of energy and a camel can last as long as 6 months if water is available. Because of a slower metabolism, the camel uses fat at only half the rate of cattle (http://australiancamelindustry.com.au). The nostrils of camels have sphincter muscles which keep the nares closed except when breath

is drawn (they open for about 1 second, ten times a minute) (http://australiancamelindustry.com.au).

Thermoregulation

Temperature and heat are not the same thing. Heat is form of energy, so it is measured in units of joules (or calories). If a given amount of heat is added (removed) to an object, its temperature goes up (down) by an amount that depends on its specific heat capacity. High heat capacity: absorbs heat with little change in temperature. While the Low heat capacity: absorbs heat with greater change in temperature. Moreover, the body heat = heat produced + heat gained - heat lost. The heat produced by metabolic reactions. Examples - 58% of energy released by electron transport chain is trapped in ATP, so 42% released as heat. 75% of energy released from ATP in muscle goes to mechanical work of contraction, so 25% is released as heat (Thermoregulation: Dealing with Heat and Cold). The dromedary camels have very special anatomical and physiological characteristics, which enable the animals to live, and to work under extreme conditions of heat and aridness - even during periods of drought when cattle, sheep and goats barely survive (Dorman, 1984). Camels, like most other animals, need to maintain a constant brain temperature. However, this is very difficult considering they live in an extreme hot environment. To assist this, camels have a "rete mirabile", it is a complex of arteries and veins lying very close to each other which utilizes countercurrent blood flow to cool the blood flowing to the brain. Doing so helps camels maintain a stable brain temperature, essential for survival (Ana Maria, 2011). A special feature of the Camelidae is the oval shape of their red blood-cells -unique among mammals that help continue blood flow during times when water is scarce. (Wilson, 1984). Camels usually maintain a body temperature of 41 Celsius during the day, and almost 34 Celsius over the night (Yagil, 1985).

In the aftermath of the devastating droughts, which hit Africa during the 1970s and 1980s an interest has awakened in this beast of burden and provider of milk, meat, and hides. They have shown to be better adapted to extreme conditions in most aspects than other domestic ruminants husbanded in the harsh environments of arid and semiarid Africa and Asia (Bornstein and Younan, 2013). Camels have learned to face the sun when lying down, causing less of the body to be exposed. In this way, the body catches less sun and doesn't heat up as fast (Schmidt-Nielsen, 1956). The Arabian camel stands over 2 meters at the shoulders and an adult camel weighs about 400-700 kg (Wilson, 1984). The long legs and the large humps, containing adipose tissue, gives to the camel a large skin surface in relation to the body mass, which is another advantageous feature in regards to heat regulation (Kataria *et al.,* 2001 A). The height above the ground (long legged) it is used to hold their body far from the hot sand and allows the desert winds free access to the body thus in some circumstances cooling it effectively (Kataria *et al.,* 2001 A).

Water conservation

Camels are the only mammals that can withstand a loss of 25% of body weight due to sweating, while others do not survive after 3-4% (Yagil, 1985). During the winter and cool season (6-7 months) in the Sahara the camels can go without water. They do not even drink when offered water.

In winter they need not drink at all (Kataria *et al.,* 2001 B). During the dry season when pastures have dried up. Camels are taken to water every 6-10 days. In extreme situation they can go without water for over a month (Evans and Powys, 1984). When the mean temperature reach 30-35°C in the Sahara and in the Sahel, camels can go 10-15 days without water but when the temperature exceeds 40°C, shorter periods between watering is necessary(Kataria *et al.,* 2001 B). Mechanisms of temperature regulation are closely related to osmoregulation and water balance, respiration, pH balance, body size, and ecology (habitat use) (Kataria *et al.,* 2001 A). Instead of dissipating most of its heat through loss of water during the hot part of the day by sweating, the camel, when dehydrated can store some of the heat allowing its body temperature to rise as high as 40.7°C. During the evening and cooler part of the night the temperature of the body can fall to a little above 34C° (Wilson, 1984). This difference in temperature (34.5-40.7°C) of 6.2° of a camel weighing 500 kg is equivalent to approximately 2 500 kcal, which by dissipation via evaporation would require nearly five litres of water (sweat), which is thus saved (Evans and Powys, 1984). At high ambient temperatures the respiratory rate increases slightly in the camel from 6-11 to 8-18 breaths per minute. This raise in respiration rate does not significantly increase evaporation or loss of water (compare the panting in the dog) (Yagil, 1985).

The sweat evaporates directly from the skin surface in the dromedary camel rather than from the tip of the hairs as it does on heavily furred animals. Latent heat of vaporization is therefore drawn directly from the skin. Evaporation that takes place directly on the skin saves more energy and cools the skin more effectively than if the evaporations took place at the tip of the hairs (Kataria *et al.,* 2001 A). That the daily urine volume excreted by dehydrated camels was one thousandth of the animal's body weight. Dehydrated sheep living in the same environment excreted one two-hundredth of its body weight. If an adult man (80 kg) would excrete urine as the dehydrated camel does, it would mean a daily volume of 0.08 liters (Yagil, 1985). A wide variation of data on the volume of urine excreted by camels are found. In Kenyan camels urine volumes declined from 0.8 litres a day when water was given ad libitum to 0.2 litres per day when the camels where dehydrated (Yagil, 1985). As camels become dehydrated when deprived of water, protein is secreted into the plasma. Blood volume is maintained while water is drawn from the gut and cells. This process allows them to continue in circumstances where men, horses, cattle and sheep would suffer circulatory failure and die (Siebert & Macfarlane, 1975).

Salt (NaCl) is a very important part of the camel's diet. Traditional grazing management by most camel breeders involve regular supplementation of salt, usually by taking the camels to saline pastures, saline wells or salty earth, at least twice a year. It is believed that they will lose condition, abort, give less milk and will be prone to diseases like skin necrosis and arthritis if not given enough salt (Kataria *et al.,* 2007). The animal can also produce urine with extremely low concentration of urea, when fed a diet low in proteins. Thus the

camel can conserve urea for protein synthesis when food is low in protein or when growing or pregnant (Kataria *et al.*, 2001 A).

Another adaptive mechanism of this extraordinary animal includes its metabolic activity, which is sensitive to temperature fluctuation. Like all other mammals, exposed to high ambient temperatures, the metabolic rate increases with increasing body temperature. However, in camels dehydration leads to a reduction in the metabolic rate. There is inhibition of thyroxin production during periods of dehydration which decreases pulmonary water loss and reduced metabolism (Nielsen, 1979; Yagil, 1985). None of the adaptive mechanisms to cope with the environmental stresses are unique to the Arabian camel, but the efficiency of its adaptation is superior (Nielsen, 1979). At high ambient temperatures the camels adapt to the scarcity of water by reducing their fecal, urinary and evaporative water losses (Kataria *et al.*, 2001 A).

During dehydration, the kidneys reduce water losses both by decreasing the glomerular filtration rate and by increasing the tubular reabsorption of water. Also their ability of regulating their body temperature from 34.5-40.7°C conserves a lot of water, when most needed (Kataria *et al.*, 2001 A).

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The feral camel (*Camelus dromedaries)*
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Mirror of Research in Veterinary Sciences and Animals (MRVSA)

Original article

Detection of bovine viral diarrhea-mucosal disease (BVD-MD) virus in Dromedary camel in Iraq using ELISA/ A preliminary study

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Abstract

Bovine Viral Diarrhea- Mucosal Disease (BVD- MD) virus causes a high economic losses. BVD-MD infects a wide range of domestic animals (cattle, buffaloes, sheep and goat). The causative agent, bovine viral diarrhea virus (BVDV) is a member of the Pestivirus genus of the family Flaviviridae that composed of two genotypes (BVDV-1, BVDV-2) and each genotype has 2 biotypes: non-cytopathic (NCP) and cytopathic (CP). Only NCP strains of BVDV produce Persistently Infected (PI) animals. Eighty- eight blood samples were collected from dromedary camels in different areas surrounding Baghdad (Al-Shula, Abu- grab and Al-Fudhailiyih) as well as from Karbala, Najaf and Babylon governorates. All serum samples were examined using a BVDV specific indirect enzyme – linked –immunosorbent assay (ELISA) specific to BVD-MD virus antibody. Totally, 12/ 88 (13.63%) serum samples revealed positive reaction for (BVD-MD) virus antibodies. Moreover, 5 / 22 (5.68%), 2 /22(2.27%), 4/22 (4.54%) and 1/22 (1.13%) revealed positive reaction from Baghdad, Karbala, Najaf and Babylon respectively. No significant differences were seen between male and female. In conclusion, this preliminary study approved presences of positive camels for BVD-MD virus. The author recommend to another future study that included large numbers of camels and from different areas in Iraq, as well as observe the congenital anomalies and abortion in newly camels.

Key words: ELISA, BVD-MD virus, Camel, Abu- grab

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Introduction

Bovine viral diarrhea virus (BVDV) is a member of the genus Pestivirus in family Flaviviridae (Franki *et al.*, 1991; Pringle, 1999). Each of the two

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genotypes has two biotypes, non-cytopathic (NCP) and cytopathic (CP) (Peterhans *et al*., 2010).

The (NCP) genotype is series than (CP) genotype. (Amstel and Kennedy, 2010). The BVDV, border disease virus (BDV) of sheep and classical swine fever virus (CSFV) are antigenically related, (Nettleton *et al.,* 1998). Bovine viral diarrhea (BVD) is a worldwide distribution infectious disease of cattle (Nettleton, 1995). BVDV infections involve mainly respiratory, enteric and reproductive organs accompanied with increased risk of retained placenta and clinical mastitis, (Niskanin *et al.,* 1995). BVDV caused intrauterine death, stillbirth, and weak calf syndrome with congenital deformities, neonatal respiratory disorders and acute hemorrhagic gastroenteritis in adult dromedaries. Acute infection induced immunosupression that potentiate secondary bacterial and viral disease of the respiratory and enteric tract of persistently infected (PI) animals. The (PI) animal remain lifelong shedding large quantities of virus in secretion and excretions (carriers) (Alenius *et al.,* 1996). BVDV is a significant economic disease of ruminant, which is endemic in the majority of countries throughout the world. Review of literature, revealed scarce information regarding BVD in camel in Iraq. So this a preliminary study was designed to detect the infected camels with BVDV-MD in Iraq serologically

Material and methods

Eighty eight Blood samples were collected from dromedary camels from slaughter houses around Baghdad city (Abu-grab, Al-Shula, Al-Fudaiylia) as well as Karbala, Najaf and Babylon governorates. Blood samples were collected in tubes without anticoagulant and kept in cold box and transfer to the laboratory for further processing. Serum samples were separated from each samples and stored at (-20 ^{0}C) until used.

Serological test

Elisa Kits (antibody ELISA kits) were purchased from Belgium BIO-X diagnostics. The ELISA procedures were done according the instructions of the manufacture.

Results and discussion

ELISA antibody test were done for (88) serum samples. Totally, 12 (13.63%). out of 88 samples revealed positive results for BVDV antibodies (Table. 1).
Moreover, 5 / 22 (5.68%), 2 /22(2.27%), 4/22 (4.54%) and 1/22 (1.13%) revealed positive reaction from Baghdad, Karbala, Najaf and Babylon respectively (Table.1). Meanwhile, Baghdad governorate revealed the high number of positive camels and 5 out of the 22 samples revealed positive reaction. The positive samples were 1/7, 3/8 and 1/7 from Al-Shula, Abu-grab and Al- Fudhailiyih respectively (Table. 2).

Table.1: Shows the number and percentage of positive samples in different governorate

Name of governorate	No. Sample	Positive	Percentage of infection
Baghdad	22	5	5.68%
Karbala	22	2	2.27%
Najaf	22	4	4.54%
Babylon	22	1	1.13.%
Total	88	12	13.63 %

Table.2: Shows the number and percentage of positive samples in different area surrounding Baghdad governorate

No. of examined samples	Name of area	No. of animals	Positive	Percentage
22	Al-Shula	7	1	4.54%
	Abu-grab	8	3	13.63%
	Al-Fudhailiyih	7	1	4,54%
Total		22	5	22.72 %

According to the sex, the samples were collected from 30 and 58 male and female respectively. Moreover, there were 4 (13.3%) and 8 (13.7%) positive samples from male and female respectively (Table.3). Statistical analysis revealed non-significant difference between male and female.

Table .3: Shows the number of positive samples in male and female with percentage

No. of examined animals	Sex	No.	Positive	Percentage
88	Male	30	4	13.3%
	Female	58	8	13.7%

BVD virus was detected in cattle in Iraq (Al Rodhan 2005). It was also approved in buffaloes ((Al-Rubayie and Hasso, 2012) using ELISA antigen and antibody. The results revealed presence of antibody against BVDV. This result is in agreement with (Doyle and Heuschele, 1983). The percentage of infection in Baghdad was (22.72 %). This result is compatible previous studies in Dromedary (18%) in Saudi Arabia (Al-Afaleq *et al*. 2006).
However, the results of this study is disagreed with Taha, (2007) in UAE dromedary that approved the sero-prevalence (negative) (Taha, 2007). The results of the current study revealed high percentage of positive animals in compare with previous studies. This might occurred due to mixed breeding management between animals in Baghdad especially the animals that act as a source of BVDV infection in camelids. The author believe that the infection

occurred via the oronasal mucos, which occurs most probably after inhalation of viral particles which are present in body fluids of infected animals (Byers *et al*., 2011). In conclusion this study approved that the antibody of (BVD–MD) virus was detected by specific (BVDV) antibody ELISA kits in dromedary camel. This result indicates the presence of the disease in Iraq in dromedary. The author recommends to do another future study that included large numbers of camels from different areas in Iraq. Polymerase chain reaction (PCR) is recommended with Antigen-enzyme-linked immunosorbent assay, and also skin biopsy with immunehistochemistry, (IHC) – antigen detection. Virus isolation and typing, sequencing are necessary also, in addition to observe the congenital anomalies and abortion in newly borne camels.

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Mirror of Research in Veterinary Sciences and Animals (MRVSA)

Abstract /Original article

Plastinated anatomical features of the distal camel thoracic limb (*Camelus dromedarius*)

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Abstract

The limbs of the camel are an important role commensurate with animal movement in the desert environment, Plastination is the process of impregnating tissues with polymer. The article describes the useful method for teaching of gross anatomy at Basra University, college of veterinary medicine. We Substitution the harmful formalin fixed dissected specimens with dissected and sliced plastinated specimens, the locally made polymers used for this purpose, fifteen distal camel thoracic limbs fixed with 10 % formalin, The fixed specimens were dehydrated in acetone to dispose of water and adipose tissue. The dehydrated specimens were submerged in a local made polymers and impregnated by decreasing the vacuum one atmosphere at -15°C. The anatomical structures can be seen in all sections, with their relations both before fixation and after plastination.

Advantages of this model include reduction of the use of live animals. Initial use of anatomically real models may reduce student anxiety,

Result explains that the plastination are, free from harmful toxic fixatives and odour and Remain for long periods. And can be handled over and over without degradation. And form an adequate procedure for the preservation and preparation of the thoracic limb soft tissue, and suitable for teaching anatomy.

Key words: Anatomy, Camelus *dromedaries,* limbs, plastination.

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Mirror of Research in Veterinary Sciences and Animals (MRVSA)

Abstract /Original article

Dermatophytosis (Ringworm) in camels: A case Report and short literature

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Abstract

Dermatophytes are among the most frequent causes of superficial skin infections in man and animals, collectively known as Dermatophytosis (ringworm). It is caused by fungi in the genera Microsporum, *Trichophyton and Epidermophyton*. Ecologically, dermatophytes may be anthropophilic (mostly associated with humans), zoophilic (associated with animals) and geophilic (found in the soil). However, Species included in the three groups are associated with clinical disease in man and animals. It is well known that camels are susceptible to infection with a variety of dermatophytes.

In this article; we present a case report on dermatophytosis in a three years old dromedary camel. Case history, clinical signs response to treatment and laboratory confirmation of infection are included; with a short review of literatures concerning reports on dermatophytosis in camels all around the world.

Keywords: Dermatophytosis, dromedary, *Epidermophyton*, Ringworm *Trichophyton.*

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Abstract /Original article

تحضير مركز بروتيني من مخلفات الإبل باستخدام بعض الأعشاب النباتية

Preparation of Protein concentrate from camel Remnants internal organs using some plant herbs

الدكتورة اميرة كاظم ناصر; الدكتور سمير اسطيفان حنا ; الدكتورة غيداء علي مكي
كلية الزراعة/جامعة البصرة/قسم الثروة الحيوانية

الخلاصـــة

استهدفت الدراسة الحالية استعمال بعض الاحشاء الداخلية لذبائح الابل شملت الكبد والطحال والرئتين في تحضير مركزات بروتينية باستخدام بعض الاعشاب النباتية والتي شملت ريزومات الزنجبيل ونبات الشنان ومقارنتها مع المركزات المحضرة باستخدام انزيم الببسين والقاعدة والماء المقطر.

درست الصفات الكيميائية والوظيفية للمركزات المحضرة واحتسبت كمية الحاصل.

اظهرت نتائج الدراسة ان اعلى كمية حاصل تم الحصول عليها من المركز النباتي المحضر باستخدام الاعشاب اذ بلغ المتوسط 9.52% وارتفاع نسبة البروتين مع انخفاض نسبة الدهن معنويا الى 4.10. %

كما اوضحت النتائج تفوق المركز البروتيني المحضر باستخدام الاعشاب في قدرته على امتصاص الماء وربط الدهن مقارنة بالمركزات الاخرى بالاضافة الى تفوقه في نسبة الذوبان والتي بلغت 88.9% كما امتاز مستحلب المركز البروتيني المحضر باستخدام الاعشاب بانه اكثر ثباتية بالاضافة الى احتفاظه بكمية اكبر من الماء المرتبط. وتفوق المركز بقابليته على تكوين الرغوة وثباتيتها اس هيدروجيني 6.2.

استطاع المركز على تكوين الهلام عند تركيز 7% في حين لم تمكن المركزات الاخرى من تكوين الهلام حتى تركيز 10% بالاضافة الى تفوق هذا المركز في درجة لزوجته عند تركيز 1 و 2. %

Key words: Protein, camel, herbs, internal organs, Remnants

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Abstract /Original article

A camel the Technology of the Desert

ألابل تقنية الصحراء

الدكتور عبدالكريم عبدالزهرة ابراهيم
مديرية البيطرة \ المستشفى البيطري في المثنى

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Abstract
This article review intends to briefly describe how Quran stress on the camels in different verses. Different names of camel have also described. The conditions and the different adaptation mechanisms have explained which help the camel to be the unique animal that can be resistant to the severe weather in the desert and can be consider as the technology of the desert.

Key words: adaptation, camel, Technology of the Desert, Quran

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Mirror of Research in Veterinary Sciences and Animals (MRVSA)

Review article (Arabic language)

التكيـــف الفسلجي والبيئي للإبل

Physiological and environmental adaptation of camels

كمال السعد

فرع الطب الباطني والوقائي

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الابل في القران الكريم

إن الله سبحانهُ وتعالى يأمرنا في القرآن الكريم أن نتدبر خلق الإبل ورفع السماء ونصب الجبال وتسطيح الأرض في آيات متتابعات من سورة الغاشية .

بِسْمِ اللهِ الرَّحْمنِ الرَّحِيمِ

{أَفَلَا يَنظُرُونَ إِلَى الْإِبِلِ كَيْفَ خُلِقَتْ }

{وَإِلَى الْجِبَالِ كَيْفَ نُصِبَتْ }

{وَإِلَى الْأَرْضِ كَيْفَ سُطِحَتْ } الغاشية (17- 20)

وقد جاء عن الرسول الكريم محمد صلى الله عليه وسلم قولهُ :
والخيل معقود في نواصيها الخير إلى يوم القيامة)) ((الإبل عز لأهلها، الغنم بركة لأهلها

ورد الحديث عن الإبل في القرآن :ومن ذلك من إعجاز القرآن الكريم أنه يتكلم عن الشيء الواحد بألفاظ مختلفة : منها الكريم في عدة مواضع ، وبألفاظ مختلفة

:وقد ورد لفظ الإبل في موضعين هما : الإبل 1-

قال الله سبحانهُ تعالى (وَمِنَ الإبِلِ اثْنَيْن) :

(الأنعام: 144)
(أَفَلَا يَنْظُرُونَ إِلَى الإبِلِ كَيْفَ خُلِقَتْ) :وقوله سبحانهُ تعالى
(الغاشية 17)

الناقة

. هي أنثى الجمل
، مرتان في سورة ورد في سبعة مواضع ، ولفظ الناقة : وهي تدل على المفرد وجمعها نوق قال أهل اللغة
•– الشعراء- القمر- الشمس – الإسراء السور الآتية: هود الأعراف، ومرة واحدة في كلٍ

وَآتَيْنَا ثَمُودَ النَّاقَةَ (وكلها تشير إلى ناقة النبي صالح عليه السلام، كما في قوله سبحانهُ تعالى :
(الإسراء:59))مُبْصِرَةً
(هَذِهِ نَاقَةُ اللهِ)(هود:64) وقوله سبحانهُ تعالى

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- *البُدْن*

. بدنها لفظ (البدنة) يقع على الواحدة من الإبل و البقر ، سميت بذلك لعظم
" وَالبُدْنَ جَعَلْنَاهَا لَكُمْ مِنْ شَعَائِرِ اللَّهِ لَكُمْ فِيهَا خَيْرٌ فَاذْكُرُوا اسْمَ اللَّهِ عَلَيْهَا صَوَافَّ : "قال الله سبحانهُ تعالى (الحج36)

يسمى جملاً إذا بلغ أربع سنوات: *الجمل*
إِنَّ الَّذِينَ كَذَّبُوا بِآيَاتِنَا وَاسْتَكْبَرُوا عَنْهَا لَا تُفَتَّحُ لَهُمْ أَبْوَابُ " ورد اسم الجمل مرة واحدة في قوله سبحانهُ تعالى (الأعراف:40)"السَّمَاءِ وَلَا يَدْخُلُونَ الْجَنَّةَ حَتَّى يَلِجَ الْجَمَلُ فِي سَمِّ الْخِيَاطِ وَكَذَلِكَ نَجْزِي الْمُجْرِمِينَ

قال الله سبحانهُ تعالى:" فَشَارِبُونَ شُرْبَ الْهِيمِ"(الواقعة:55) : - الِهيم

وَلِمَنْ جَاءَ بِهِ حِمْلُ بَعِيرٍ " : *البعير* يشمل الجمل والناقة. وقد جاء ذكره فقط في سورة يوسف ، قوله سبحانهُ تعالى وَأَنَا بِهِ زَعِيمٌ " (يوسف : 72)

: . قال الله سبحانهُ تعالى و تشمل : الإبل, البقر, والغنم : - *الأنعام*
: وقال الله سبحانهُ تعالى.. (النحل:5)"وَالأَنْعَامَ خَلَقَهَا لَكُمْ فِيهَا دِفْءٌ وَمَنَافِعُ وَمِنْهَا تَأْكُلُونَ "
(النحل : 7)"وَتَحْمِلُ أَثْقَالَكُمْ إِلَى بَلَدٍ لَمْ تَكُونُوا بَالِغِيهِ إِلَّا بِشِقِّ الأَنْفُسِ إِنَّ رَبَّكُمْ لَرَءُوفٌ رَحِيمٌ "

تقديم

تتنوع البيئات على سطح الأرض ما بين الحارة والباردة، وهذا التنوع أدى إلى تنوع الكائنات الحية وسبل تكيفها وتأقلمها مع الظروف المحيطة بها، كما أن كل المخلوقات تمتلك الإمكانيات التي تساعدها على العيش في البيئة التي خلقت فيها، ومن أمثلة تلك البيئات الصحراء، وهي عبارة عن مناطق رملية شديدة الحرارة وجافة جدا، وتفتقر إلى أي من مقومات الحياة تقريبًا، حيث أن المياه تكاد تكون معدومة إلا من بعض الواحات، وقليلٍ من الأمطار التي تسقط عليها، فتنمو فيها النباتات الشوكية الصحراوية، وبالرغم من الظروف الصعبة في الصحراء، إلا أن هناك حيوانات استطاعت أن تتغلب على كل تلك المعيقات، وتكيّفت مع الأجواء الحارة وقلة المياه، ويعدّ الجمل من أكبر حيوانات الصحراء، وأكثرها تحملًا لهذه الظروف، فهو قادر على تحمّل الجوع والعطش لمدة طويلة، والسير بشكل متواصل دون أن يشعر بالتعب، ولهذا السبب أطلق عليه اسم سفينة الصحراء، ويرجع ذلك إلي بنيته الجسدية العجيبة التي وهبها له الخالق سبحانه وتعالى، فهو يمتلك سناما ضخما ، ويمتلك الجمل أنفًا غريبًا تختلف عن باقي الحيوانات، ويستطيع الجمل ملء معدته بكميات كبيرة من الماء، ، كما أنّه يتميز عن بقية الحيوانات فهو لا يفرز العرق، بل يقوم برفع درجة حرارة جسمه إلى 41 درجة مئوية لتتناسب مع درجة حرارة الصحراء، وبذلك لا يضطر جسمه إلى التعرق، ويختزن جسم الجمل الحرارة نهارًا ويتخلص منها ليلا. وللجمل شفة علوية مشقوقة، يتمكن بها من التقاط النباتات الشوكية، كما أن له أسنانًا قواطع تمكنّه من مضغ الأشواك، ونلاحظ أن أذن الجمل صغيرة جدا، وتحتوي على شعيرات متناهية في الصغر حتى تمنع دخول رمال و غبار الصحراء إليها، ولا يتوقف سبل تكيف الجمل مع بيئة الصحراء عند هذا الحد، فعيونه مزودة بصفين من الأهداب الطويلة؛ ؛ بل إنّ الجمل يتميز عن بقية الكائنات الحية بأرجله الطويلة حتى تبعده عن حرارة رمال الصحراء، وهي مزودة بخف إسفنجي لين، يمكنه من السير على رمال الصحراء الملتهبة دون أن يشعر بالألم أو أن تبطئ من سرعت

موقع الإبل في التصنيف العلمي للمملكة الحيوانية

Animalia- المملكة : الحيوانية

Vertebrata- الشعبة : الفقريات

Mammalia- الصف : الثدييات (اللبائن)

Ungulata- الرتبة : الحيوانات الحافرية

Artiodactyla- تحت الرتبة : ذوات الظلف

Pecora- القسم : المجترات الحقيقية

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Camelidae- العائلة : الجملية (الإبليات)

Lama L.glama , L.pacose , L.ganaco- الجنس : اللاما

Vicugna V. vicuna ولها نوع واحد- الجنس : فيكوكنا

Camelus- الجنس : الجمال

Dromedarius *النوع* : الجمال ذات السنام الواحد

Bacterianus النوع : الجمال ذات السنامين

إحصائيــات

يبلغ عدد الإبل في العالم حالياً حوالي 20 مليون رأس منها 14 مليون في المنطقة العربية (أي 70 % من إبل العالم) . تحتل أفريقيا المركز الأول وتضم 75 % و تليها آسيا 25 % .

من الدول الغير عربية التي توجد في أراضيها أعداد متميزة من الإبل : الهند , باكاستان , منغوليا , أثيوبيا وكينيا.

من الدول العربية المشهورة بتربية الإبل تاتي الصومال في المرتبة الأولى (54 %) تليها السودان (26 %) ثم موريتانيا (7,3 %) ثم ليبيا وتونس والسعودية ومصر والجزائر والإمارات.

تربي (2%) }، تتوزع الابل في العراق { بادية الجزيرة (51%) و البادية الجنوبية (47%) والبادية الشمالية الإبل قبائل وعشائر ترتحل وراء الكلأ

.إن تعداد الإبل في العراق يبلغ (250) إلف رأس ، تنتشر في العراق سلالتان من الابل هما الخوار و الجودي

إبل الخوار

تنتشر الخوار في الباديتين الشمالية ، والجزيرة بين سوريا و العراق . تتميز بحجمها المتوسط ، ورأسها الصغير ، وقوائمها الدقيقة و الطويلة ، وذنبها الرفيع و الوانها الفاتحة و انتاجها المرتفع من الحليب .

إبل الجودي

تنتشر الجودي في البادية الجنوبية بين العراق والسعودية (نجد) وتتميز بضخامة جسمها ، وكبر عظامها وتستخدم لأغراض الحمل والتنقل اساساً.

تتعدد أسماء الإبل من ذكور و أناث بحسب أعمارها

لذكر وأنثى الإبل عند ولادتها تسمى حوار وذلك لأن أمه تحير عنده ولا تسير إلا وهو معها ولمدة ستة أشهر والحوار يستطيع الوقوف خلال ساعتين من ولادته و يستطيع السير على مهل مع أمه.

الذكر

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1 - القعود : الذكر الذي بدأ يكتمل .

2 - الجمل : الذكر الذي اكتمل نموه .

3- الهرش : الذكر الذي بلغ سن الشيخوخة

الانثى

1 – البكرة : التي بدأت تكتمل استعداداً للركوب واللقاح.

2 – الناقة : التي بلغت متوسط العمر .

3 – الفاطر : التي كبرت وتوقفت عن اللقاح وبدأ يتفطر جسدها وتكثر فيه التجاعيد .

تسمى الابل في العراق حسب الوانها بالاسماء التالية :

- **المغاتير** : ذات الالوان الفاتحة
- **المجاهيم** : ذات الالوان الداكنة
- **الوضحة** : ذات الالوان الصفراء
- **المالحة** : ذات الالوان الصهباء
- **الحجلة** : ذات الالوان الحمراء
- **الشعلة** : ذات الالوان البيضاء والسوداء المتداخلة

كما تسمى الابل في العراق حسب استخدامها بالأسماء التالية:

- **الذلول** : الابل المستخدمة للركوب
- **الزمل** : الابل المستخدمة في حمل الاثقال
- **الفاطر** : الابل المعدة للذبح

زينة الإبل:

الرحل : الرحل هو السرج الذي يوضع على الناقة ليجلس عليه الراكب

الوضين : يثبت الرحل على الناقة باستخدام حبل أو رباط مما كان متاحاً من المواد، كالصوف أو الشعر وينسج نسجاً.

" **الخطام** :هو المقود الذي يقاد به البعير وتعريفه "ما وضع في أنف البعير ليقاد به

الغبيط : الغبيط هو الهودج الذي يجعل على ظهر البعير فوق الرحل، ويقصد منه أن تجلس فيه المرأة وهي في ستر، وقد يسمى هذا الغبيط بالظعائن والظعن وهذا مشهور في الشعر

الرجازة:الرجازة: وهي شعر أو صوف يعلق على الهودج في خيوط بها

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الخواص التشريحية والفسلجية في الإبل

الإبل بخواص تشريحية وفسلجية فريدة لأداء وظائفها الحيوية تساعدها على التأقلم والمعيشة في ظروف تتميز البيئة الصحراوية القاسية والأراضي القاحلة وتكون ذات مقاومة عالية للأمراض، تعد الإبل رمز الخير والعطاء حيث قيل عنها(**إذا حلبت أروت، وإذا نحرت أشبعت، وإذا حملت أثقلت، وإذا مشت أبعدت**)، ولهذا تسمى سفينة الصحراء. فقد أودعها الله سبحانه وتعالى أسرار الحياة ليميزها عن فرديتها التامة في كثير من الأمور التي لازال البعض منها غير واضحة التفسير .

بعض الصفات الخاصة بالإبل

- يبطن الفم غشاء مخاطي كثيف تساعد الإبل في الإستفادة من الأشواك في غذائها، الشفه العليا مشقوقة طولياً وتكون الشفتين لينه وسريعة الحركة ويكسوها شعر كثيف يساعد على منع دخول الأتربة والرمال .
- الغدد اللعابية في الثدييات ثلاثة أزواج بينما يوجد زوج رابع في الإبل يسمى الغدد الضرسية، تقوم بحماية غشاء الفم وترطيب الغذاء وتذوقه، وتوفير العناصر المغذية لميكروبات القناة الهضمية ومنع النفاخ .
- تفرز غالبا نوعين من اللعاب : الأول سميك القوام يحتوي على بروتين سكري والمخاط، والثاني قليل الكثافة يحتوي على الأنزيمات وقليل من المخاط. وتقدر كمية اللعاب المفرز يوميا بحوالي 21- 80 لترا، يساهم في الدورة المائية للجسم.

المعدة المركبة في الإبل تتكون من ثلاثة أجزاء وهي:

الكرش والشبكية والمعدة الحقيقية وتكون الوريقية أثرية بينما في المجترات الأخرى تتكون المعدة من 4 أجزاء من ضمنها الوريقية . يحتوي تجويف الكرش على ما يدعى بالجيوب المائية وتقدر سعة هذه الجيوب بـــ 5-7 لتر تقريباً .

على شكل شقين ضيقين محاطين بالشعر وحافتهما لحمية التكوين مما يسمح له أن يغلقهما حماية **منخرا الإبل** للرئتين من الرمال الدقيقة التي تحملها الرياح.

.تقوم بترطيب هواء الشهيق قبل دخوله إلى الجهاز Rostrumيمتاز التجويف الانفي بوجود عدد من الفجوات في الأنف تعمل على تبريد هواء الزفير الخارج من الرئتين مشبعا ببخار Turbinates التنفسي ، كما توجد لوالب . مما يؤدى تكثف بعض من بخار الماء ويعاد امتصاصه والاستفادة منه مرة أخرى بتبريد الدم الذاهب إلى الماء الدماغ للحفاظ عليه من التأثير الضار لحرارة البيئة الخارجية.

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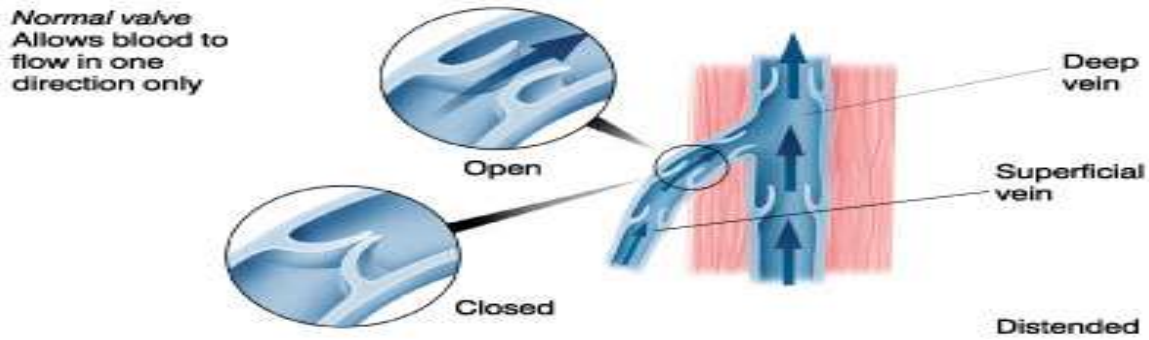
عيون الإبل تتميز عن بقية الحيوانات بأن الرموش ذات طابقين متداخلين في بعضهما وبهذا تستطيع حماية العين من دخول الرمال . كما ان جفون عين الجمل تكون شبة شفافة مما تمكنه القدرة على الرؤيه وعيونه شبة مغلقة عند السير أثناء هبوب العواصف الرملية.

عند تعرض الإبل في بعض الأحيان للجفاف أو العواصف الرملية يستمر إفرازها للدموع بكمية كبيرة مما يحافظ على الأنسجة الطلائية للقرنية والغشاء المخاطي المبطن للعين من الجفاف

الإبل ذوات أعناق و قوائم مرتفعة تمكنها من تناول طعامها من نبات الأرض وأيضاً من قضم أوراق الأشجار المرتفعة ، كما أنه في حاجة الى خفض رأسه لشرب الماء . هذا التغير المتكرر لوضع الرأس بين الارتفاع عن سطح الأرض بما يقرب من مترين ونصف ثم الانخفاض إلى مستوى سطح الأرض يؤدي إلى التغير الفجائي في ضغط دم .

يوجد في الأوردة الكبيرة صمامات تقوم بتنظيم ضغط دم الدماغ بدقة متناهية فعند خفض الجمل رأسه للشرب أو الرعي تمنع هذه الصمامات ارتفاع ضغط دم الدماغ . كذلك عندما يرفع الجمل رأسه تمنع هذه الصمامات انخفاض ضغط دم الدماغ.



الرقبة الطويلة في الإبل تساهم في موازنة الحيوان عند النهوض وتعمل عمل الرافعة الآلية حيث إن الإبل هو الحيوان الوحيد الذي تحمل عليه الأحمال وهو جالس إلى أن ينهض بحمله بسهولة. القوائم تتميز بأوتار عضلية قوية تنتهي بالخف، ويغطي الخف **من الاسفل** قطعة جلدية قوية تتحمل الضغط اثناء سيرها على الرمال مهما كانت ناعمة لها دور فاعل لمقدرة الجمل على النهوض وهو محمل بالأثقال .

القوائم طويلة للإبل تتحرك بأسلوب متناغم ، كل طرفين من جانب واحد مع بعضها إلى الأمام ثم تنتقل الحركة للطرفين من الجانب الآخر مع بعض أيضاً مما يشبه التجديف بالمركب ويعتقد أن تسمية سفينة الصحراء أتت من هذه الظاهرة الغريبة التي ينفرد بها الإبل

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كما ان توزيع الوبر يساعد على عكس اشعة الشمس، ويسمح بتبخر ، **الجلد مكسو بالوبر** كعازل حراري للجسم العرق على سطح الجلد مع بقاء الوبر جافا وهذا يعتبر افضل طريقة تبريد للجسم . ويلاحظ ان رقة الطبقة الدهنية تحت الجلد تسمح بإشعاع حرارة الجسم دون الحاجة الى افراز العرق وفقد كمية من الماء .

توجد مناطق متقرنة في الجلد تسمى الوسائد الجلدية وهي عبارة عن نسيج قرني خالية من الشعر بسمك يصل ملم ، تتواجد في مناطق تلامس جلد الإبل مع الارض عند البروك (الركبة، الصدر، العرقوب والكاحل) الى 7 ووسادة الصدر تعتبر اكبر هذه الوسائد، لمنع إحتكاك الجسم مع الرمال الساخنة صيفاً.

السنام : عبارة عن نسيج ليفي دهني يرتفع بمقدار 35 سم فوق الحارك ، شكله بيضاوي او هرمي .

خلايا الدم الحمراء في الإبل لها القدرة على البقاء سليمة في المحاليل الملحية دون أن تنكمش أو تنفجر وذات قدرة على امتصاص الماء والانتفاخ بمعدلات عالية ثم إنها أكثر عدداً وذات قدرة أكبر مما في الإنسان أو الحيوانات الأخرى على نقل الأوكسجين لخلايا الجسم لاحتوائها على تركيز عال من الهيموكلوبين .

الصفيحات الدموية لها القدرة الفائقة على إيقاف النزف الذي يمثل أخطر الأسباب في فقد السوائل من دم الإبل حيث يزيد عددها على ضعفي ما موجود في دم الإنسان ، إضافة إلى إحتواء دم الإبل على مركبات تمنع تخثرالدم يبلغ نشاطه ثمانية أضعاف نشاطه في الإنسان) Factor VII Anti hemophilic factor(عامل التخثرالثامن

التناسل فى الإبل

مدة الحمل فى .)يبدأ تناسلها مع بداية فصل الشتاء ويستمر حتى نهاية الربيع(الإبل حيوانات موسمية التناسل . الناقة حوالى 380 يوم والفترة بين ولادتين فى المتوسط 24 شهر

• يكتمل النضج الجنسي في عمر 3 سنوات ولكنها لا تلقح إلا بعد إكتمال النمو الجسمي في عمر 4 – 5 سنوات لتعطي أول ولادة لها في عمر 6 سنوات.

. تمتد الحياة الإنتاجية فى الإبل إلى مدة تزيد على 25 عام . تعطي الناقة خلال حياتها الإنتاجية حوالى 12 ولدة

. • طول دورة الشبق فى الناقة حوالي 24 يوم وتظهر عليها علامات الشياع لمدة 4 إلى 6 أيام

• الإباضة مستحثة (كما في القطط). ويحدث الحمل في القرن الأيسر من الرحم دائماً .

أكثر وضوحاً في Dulla) ويسمى اللهاة بـ(Palatine divertculumفي موسم التلقيح يكون الرتج الحنكي وهو عبارة عن تمدد خاص للحنك الرخو عند منطقة الاتصال مع البلعوم الذكور

عند فترة الهياج الجنسي تخرج للخارج على أحد جانبي الفم، حمراء بارزة تنتفخ على شكل كيس كبير مملوء دلالة على تهيج بالهواء مثل البالون وبشكل متقطع ويخرج معه صوت هدير قوي مع خروج رغوة بيضاء مزبدة .الجمل جنسياً

يوجد زوج من (غدة الرائحة) الغدة الزرقاء خلف الجمجمة عند اتصال الرأس بالرقبة وغالباً ما تكون واضحة فى الذكور ويكون إفرازها داكن اللون وذو رائحة نفاذة وخصوصاً خلال موسم التناسل .

قدرة الإبل على تحمل الجوع والعطش الشديد

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تتمتع الإبل بصفات فريدة لا نظير لها في الحيوانات الأخرى تمكنها من التكيف مع ظروف العطش أو الجفاف، تبقى الإبل في الأجواء الحارة عدة أسابيع بدون ماء وقلة الغذاء حيث تفقد 30 % من سوائل الجسم أو حوالي 40 % من وزنها الحي ورغم ذلك تبقى حية دون ان تتأثر وظائفه الحيوية.

. أما الإنسان والحيوانات الأخرى فإن فقد 10 % من سوائل الجسم فإن ذلك غالباً ما يؤدي إلى الموت أو الهلاك

135 لتر) من الماء أي أنه يمكن أن يعوض النقص -يستطيع الجمل ان يشرب بعد عطش في المرة الواحدة (100 في السوائل خلال دقائق معدودة دون آثار جانبية. كما وجد أن هناك علاقة عكسية بين العطش وسرعة شرب الجمل للماء، فكلما زاد العطش قلت سرعة شربه للماء والعكس بالعكس

هناك عدة ميزات وصفات الإبل منها الفسيولوجية والسلوكية و التشريحية تساهم في الدورة المائية في الجسم وتحمل العطش الشديد في الأجواء الحارة عند الجفاف و إرتفاع الحرارة وقلة المياه ولعدة أسابيع وهي :

1- يبقى فم الإبل رطباً وتستطيع الأكل وبلع الطعام مهما إشتد بها العطش ويعود ذلك إلى سببين وهما:

* إستمرار عملية الإجترار وهذا يساعد على بقاء الفم رطباً.

* وجود مادة اليوريا في لعاب الإبل ومن صفات اليوريا الإحتفاظ بالماء.

2- الإبل لا يلهث أبداً ولا يتنفس من فمه وهو بذلك يتجنب تبخر الماء من الفم.

3- الإبل لا تفرز إلا مقداراً ضئيلاً من العرق عند الضرورة القصوى بفضل قدرة الجسم على التكيف مع المعيشة في ظروف الصحراء من خلال تنظيم درجة حرارة ثابتة . أن يجعل مدى تفاوت حرارة الجسم 7 درجات مئوية دون ضرر، تتغير فيها درجة الحرارة بين الليل والنهار(34 مْ-41 مْ) .

يساهم الوبر في حماية الجسم من الحرارة حيث يعتبر عازلاً حرارياً ثم إن له ميزة فإنه لا يتبلل عند التعرق أي العرق لا يتبخر من سطح الوبر وإنما من سطح الجلد وهذا يجعل لعملية التعرق ميزة تبريد قوية في الإبل.

4- السنام يستهلك في الإبل إذا طال الجوع والعطش، ولتوليد الطاقة و الماء الأيضي المتحرر من تحلل دهون السنام ، كما يمكن للإبل خفض عمليات الأيض وبالتالي ينتج عن ذلك تقليل إستهلاك الأوكسجين أي قلة إنتاج الحرارة الداخلية وهذا معناه الإقتصاد في إستهلاك الماء للفعاليات الحيوية .

5- تستطيع الإبل العطشانة أن تشرب الماء المالح (ماء البحر أو ماء مستنقع شديد الملوحة أو المرارة) بفضل إستعداد الكلية لإخراج تلك الأملاح مهما كان تركيزها في بول شديد التركيز.

1:4 وبذلك Renal cortex القشرة الكلوية إلى الطبقةRenal medulla تكون نسبة سمك الطبقة الب الكلوية . إن الكلية تفرز البول بحيث يكون يكون تركيب الكلية في الإبل مهيأة لتكوين بول مركز من النوع مفرط التوتر عالي التركيز ويكون حوالي ضعف تركيز الأملاح في ماء البحار وهذه الصفة الإعجازية تمكن الجمل من تناول . النباتات المالحة وكذلك شرب المياه شديدة الملوحة

أن طريقة التبول في الإبل مختلفة عن بقية الحيوانات حيث يضع الحيوان جسمه في اتجاه الريح ويتبول لكي يستقبل رذاذ البول لسيقانه الخلفية، وذلك للاستفادة من الماء الخارج مع البول بترطيب جسمه لتقليل فقد ماء الجسم .

8- تستطيع الإبل أن تحبس في دمها كميات كبيرة من اليوريا لكونها صائدة للماء فإنها تساعد في الحفاظ على حجم بلازما الدم وأيضاً للاستفادة منها في تصنيع البروتين الميكروبي في الكرش بواسطة الأحياء الدقيقة .

9- تستطيع الإبل من حبس سكر الكلوكوز في الدم بنسبة عالية بسبب العطش الشديد لإن طرحه في البول يتطلب فقدان ماء بدرجة كبيرة .

10- هناك إمتصاص واسع للماء في القولون وهذا يساهم في تقليل فقدان الماء مع الفضلات حيث تكون الفضلات شبه جافة.

11- تستطيع الكريات الحمراء أن تقاوم نقص الماء الشديد في الدم وفي نفس الوقت تقاوم عدم التمزق عندما تنتفخ بعد شرب الماء بكميات كبيرة وبسرعة فائقة .

أحتوى القرآن الكريم والسنة النبوية المطهرة على كنوز في مجال الطب الوقائي والعلاجي تحت مسمى الإعجاز العلمي في القرآن والسنة .

: قال رسول الله محمد صلى الله عليه وسلم :

(إن في ألبان الإبل شفاء للذربة بطونهم).

يتميز بصفات خاصة إضافة لكونه مادة غذائية ممتازة ويفضلونه طازجا في معظم **حليب الإبل Camel Milk** الأحيان، ناصع البياض ولهُ رغوة (ثمالة) ويتوقف في مكوناته و طعمه على نوع وكمية الغذاء للإبل و مرحلة الإدرار وعمر الناقة . حيث ثبت أنه غذاء ودواء لأنه يحتوي على مواد مثبطه لنشاط البكتريا ويحتوي على نسبة كبيرة من الأجسام المناعية المقاومة للأمراض خاصة للأطفال حديثي الولادة .

الاستخدامات الطبية لألبان الإبل

تتميز الإبل ذات السنام الواحد عن غيرها من الثدييات بإنها تملك في دمائها وأنسجة الجسم أجسام مضادة تتركب وسميت بالأجسام المضادة الصغيرة Vمن سلاسل قصيرة من الأحماض الأمينية وشكلها على صورة حرف) هي أحد مميّزات الجهاز المناعي في الإبل ولا توجد هذه الأجسام المضادة إلا Nanobodies (الأجسام النانوية في الإبل العربية

تمتاز هذه الأجسام النانوية بأنها أكثر ثباتاً في مقاومة درجة الحرارة وتغير الأس الهيدروجيني وتحتفظ بفاعليتها أثناء مرورها بالمعدة والأمعاء بعكس الأجسام المضادة العادية التي تتلف بالتغيرات الحرارية والأنزيمية للجهاز الهضمي

تركزت الأبحاث العلمية على هذه الأجسام المضادة منذ حوالي 2001 م في علاج الأورام على حيوانات التجارب وعن الإنسان وقد نجحت بعض الشركات المهتمة بأبحاث التكنولوجيا الحيوية الخاصة وهذا أوجد آفاقاً لصناعة أدوية تحتوي أجساماً نانوية لعلاج الأمراض المزمنة والالتهابات البكتيرية والفيروسية

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إن التجارب الحديثة في الوقت الحاضر في علاج مرض الإستسقاء وداء السكري ومرض الكبد الوبائي من النوع B ، C وكما لوحظ قابلية حليب الإبل في التقليل من نسبة الكولسترول في الجسم وبذلك يمنع حدوث تصلب الشرايين، ثبت أيضا فعالية تلك الأجسام المضادة في القضاء على الأورام السرطانية حيث تلتصق بجدار الخلية السرطانية وتدمرها بكفاءة عالية لإمراض السرطان المبكرة التي عولجت بحليب الإبل.

اللحم

وهو الأقل ضرراً على القلب نظراً لضآلة نسبة التخسيس الغذائي لحم الجمل ينصح بتناوله لراغبي الريجيم أو الدهون فيه مقارنة مع اللحوم الحمراء الأخرى. إن لحم الجمل يتميز بأن أليافه خشنة وعريضة ومرتبطة ببعضها بعضا بنسيج ضام كثيف لا يوجد فيها دهن مختلط بالعضلات. وينصح بتناول لحم الجمل لمن يطبقون الريجيم فيه وجود حامض اللينوليك الغذائي للتخسيس، ويرغبون في تقليل مستوى الكوليسترول في الدم، نظراً لوجود الأحماض الدهنية غير المشبعة في لحم الجمل تقلل أيضا من احتمالات الإصابة بأمراض القلب المختلفة