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Unraveling mysteries of camels and business opportunities in Gobi desert (camel study reviews)

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Foreword

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Humped camels dispersed from central Asian great Gobi to Horn of Africa. In the world have been counted 20.1 million camels, 7.9 million domesticated camelids such as llamas, alpacas, vicunas guanacos in 2011 by livestock statistic data of FAO. More than 90 % of the humped camel represents the Dromedary camels which is one of useful sources of food, transportation and entertainment for millions of populations in northern of Africa, Near East and Saudi Arabians.

In fact, the camel is not a ruminant, although it has ruminates, but is even-toed *Tylopode*. Latest scientist discoveries had shown the camels have quite differences from ruminants and they hold unique adaptation features in harsh desert condition.

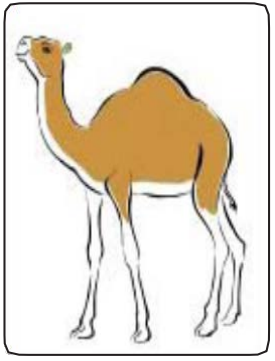
Valuable camel product's demand have been boosted via new unraveling mysteries of camels such as camel nano-bodies, health promoting properties of camel milk but there are faced big challenges how to get camel products from hot desert to people or market and the camels haven't genetic potential to rapidly increasing their productivity within short period.

We created easy-scientific book named "Unraveling mysteries of camels and business opportunities in Gobi desert" that contents newly scientific insights of the camels. This publication dedicated to common readers, businesses and camel hobbies. The desert camel is rising from years to years and their products helping to human health.

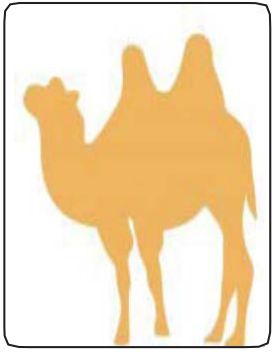
Editor

1. The camel origin-When, Where? Many people believed the myth that camels originated from a rabbit because a camel has grooved upper lip like of rabbits. The camelides belong to order *Artiodactyla*, sub-order (*Tylopoda*), family *Camelidae* which has two tribes *Camelini* origin of Old World camels (dromedary and Bactrian camels) and *Lamini* origin of New World camels (alpaca, guanaco, llama, vicuna). The humped camels Dromedary and Bactrian camels evolved from genus of *Camelus*[44]. The *Tylopoda* and *Ruminantia* groups divided in early revelatory history die to camels have so many differences from ruminant animals. Many researchers indicated that the origin of camels can be traced to the Protylopus were rabbit-sized with four-toed feet and low-crowned teeth animal that occupied the North American continent during the Eocene period or 45-50 million years ago.

Pic. 1 New World Camelids which habitat in South America in there in front of picture is small brown is vicuna, middle one is alpaca, behind of alpaca standing heighier one is llama and the guanaco stands on the stone place.

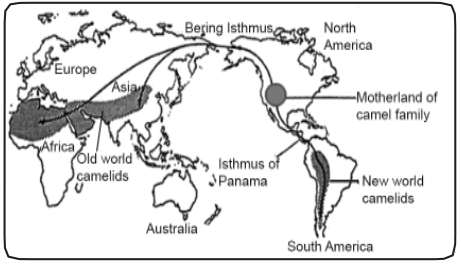


Pic.2 Old World Camelids consist of one humped or dromedary on the right side, two humped or bactrian camel on the left side. Dromedary habitats in eastern Asia, Near East and northern part of Africa and Bactrian camel habitats in Central Asian Gobi Desert.



In 1848, US scientist Joseph Leidy was explored the *Poebrotherium* which is one of ancestor of camels inhabited the open-woodland areas

of North Dakota about 37-24 million years ago. They were lightly built and were goat-sized, about 3 feet long. Their head, with a distinctive narrow snout, and long neck looked similar to a modern-day llama. From 24 to 5 million years ago, camels increased in size with lengthening necks and limbs, also developing and efficient pacing gait for traveling through expanding steppe and grassland habitat of the time. The modern camel's tribes *Camelini* and *Lamini* diverged one another by about 17 million years ago. The *Camelini* had reached Eurasia via the Bering Isthmus about 5-3 million years ago, whereas *Lamini* dispersed to South America via Panam's Isthmus about 3 million years ago[22].



Pic. 3 Drawn picture of origin of a camel family. Motherland of camelid is North America. Camelus dispersed to Eurasia through Bering Isthmus but Lamini tribe dispersed to South America via Isthmus of Panama.

Paracamelus, the likely ancestor of Camelus, is known from the fossil records of Asia, Europe and Africa about 7,5-6,5 million years ago. In there are some of hypothesis that Camelus originated from African continent related these fossil evidents. But most of fossil records were found from North America. In the Yukon of Canada, rare fossil remains of a giant camels such as proximal phalanx, ankle elements, partial long bones and teeth collected from Plio-Pleistocene (3.5 million years ago) deposits of the Old crow Basin at 67th parallel north which are considered Paracamelus in the North[22]. But a research team led by the Canadian Museum of Nature has identified the first evidence for an extinct giant camel in Canada's High Arctic in 2010[22]. The discovery is based on Ellesmere Island at 97th parallel north or 1200 kilometers away from the Yukon early camel fossil remains place and its represents the most northerly record for early camels. They identified using collagen fingerprinting of the fossil limb bone compared with a database of genus-specific collagen peptide markers from 37 modern mammal species as well as that of a fossil camel found in Yukon. The collagen profile of the High Arctic camel most closely matched those of modern dromedary camels as well as the Yukon giant camel, which is thought to be Paracamelus-ancestor of modern camels. The collagen information, combined the anatomical data they to conclude that the Ellesmere camel and the giant Yukon camel are near relatives and is likely the same lineage as Paracamelus which lived 3,5 million years ago.

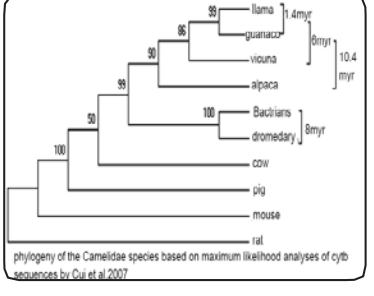
The relative size of the Ellesmere camel tibia is in length about 30 per cent larger than that of modern camels. From the size of the tibia,

the Ellesmere camel was comparable in body size to other giant camels such as the Asian Paracamelus gigas and the Yukon giant camel.

Pic.4 Reconstracted picture of High Arctic Paracamelus fossil record. in the High Arctic at a time when global temperature were 2^0 to 3^0C warmer than today and supported larch forest.

By the palaeo-environmental reconstruction of upper portions of the Ellesmere camel fossil site was determined in the High Arctic at a time when global temperature were 2^0 to 3^0C warmer than today and the area supported a larch dominated forest habitat. Based on the High Arctic camel fossil record the researchers concluded that camels originated in North America and dispersed to Eurasia via Bering Isthmus a land bridge linking Alaska and Siberia. The Paracamelus lineage were living in the North American Arctic for less than 7 million years ago the populations may have dispersed across the Bering Strait in cold winter via Arctic sea ice[22].

Scientists have been reconstructed an evolutionary life tree of the camelidae based on its genome sequences analysis. The complete mitochondrial genome sequence of wild Bactrian camels said that the divergence time for Camelini and Lamini was estimated to be 25 million years. In tribe Camelini, Bactrian camel and dromedary speciation may have begun 8 million years ago, in tribe Lamini, at first appears alpaca 10,4 million years ago, then vicuna speciation have begun 6.4 million years ago and at later time llama and guanaco have diverged 1,4 million years ago. In this study they conclude that the extant wild Bactrian camel and domestic Bactrian camel have separate maternal origins and that the two subspecies diverged some 0.7 million years ago[5,16,24].



phylogeny of the Camelidae species based on maximum likelihood analyses of cytb sequences by Cui et al.2007

Pic.5 Phylogenomic tree of Camelidae on maximum likelihood analysis. The two tribes of Camelidae was diverged as Camelini and Lamini from 25 million years ago but the genus Camelus separeted dromedary and bactrian camels from 10 million years ago. Domestic and wild Bactrian camels diverged into two separate lineage from 0.7-1.2 million years ago.

2. **Did Bactrian camel domesticate from the extant two-humped wild camel?** Recent results of camel's genetic analyses haven't shown the domestic Bactrian camel originated from extant two humped wild camel. Furthermore, comparative mitochondrial DNA analyses conducted in bone samples of *C.bactrians* from late Bronze and early Iron Age sites of Siberia and modern domestic Bactrian camels as well as wild camels. The comparative DNA analyses showed that are inconsistent with an ancestry of the wild Bactrian camel to both the prehistoric and the modern domestic camels whereas the extant wild two humped camel is not the progenitor of the domestic Bactrian camels.

A Dromedary and Bactrian camels were domesticated in Near East for use as a draft and saddle animals, food source as milk, meat and even may be textile source about 2500-3000 years ago. Although many claim there is a consensus within archaeological circles, in reality, scholars debate exactly when the camel was first domesticated in the Near-East for any purpose. In many Bible sources mentioned camels being used as beasts of burden animals in early 3rd millennium and late of 2nd millennium BC. Some researcher notes that not found any evident of domestication camels up to 1000 years of BC.

In 1845, British archaeologists were discovered "The Black Obelisk of Shalmanester III"-black limestone monument in northern Iraq at Kalhu capital of ancient Assyrian. The monument is decorated with domestic Bactrian camels. The obelisk was erected in 825 BC for achievements of King Shalmaneser III (reigned 858-824 BC).This archaeological finding is one of ancient evidences for Bactrian camel domesticated in Near East. Assyrian kings often collected exotic animals as an expression of their power[28].

Pic.6 Domestic bactrian camels on the Black Obelisk of Shalmanesser III King of ancient Assyrian (reigned 825 BC), British Museum.

Near East and Arabian regions were main localities for domestication of animals and crops. May be the Bactrian camels domesticated in this region after then imported to near areas.

Also, in the Syrian cylinder seal dated 1800 BC. depicts two small figures riding on a two-humped camel. Some of researchers noted that the riders may be gods, not human in this cylinder seal described two riders shared a single camel. In this time didn't domesticated camels as

riding animals.

Ancient historical findings and remains also document that over 1000 years before century Bactrian camels were reared in western China; in 840s BC Bactrian camels were used by people in Turkmenistan[44]. Ancient Romans used to call two humped camels as Bactrian camels. Bacteri was a middle Asian country within Macedonia in 4th millennium BC. Hunnu people who lived in the territory of Mongolia used to have feasts by having camel racing. Historic manuscripts reveal that camel caravans used to head China from Hunnu Empire, and also they mention that 700 carriages and 1000 camels were captured[44,45].

Ancient petroglyphs of camels from 2-3 thousand years before century are found in many places in Mongolia, including various drawings of camels such as grazing camels, riding, and leading by people and trotting camels that is shown its was one of motherland of wild and domestic Bactrian camels[45,53].

Pic.7 Ancient Syrian cylinder seal dated 1800 BC depicts two small figures riding on a two humped camel. It could be argued that the riders are gods, not humans because it was customary for two riders to share a single camel.

3. A Camel is ships of the desert. The camels can developed many special biological and physiological abilities to adapt to harsh Gobi desert conditions such as hot like 35-40^{0}C hot in summer days, dry like has less than 80-100 ml annual precipitations as well as average air humidity is 35-40%, chronic shortage of grazing food and water and frequency happened drought, dryness and dusty storms. The camels can store lots of energy in their humps, abdomen and flank in form of fat to survive long food shortage. Moreover, camel's characteristic ability to adapt in harsh desert lifestyle with remarkable traits such as fluctuation its body temperature from 34^{0}C to 41^{0}C throughout the day depending on their dehydration degree, regulations of economy water consumption, tolerating a water losses and capabilities of drinking salt water, huge amount of water can drink in as few minutes. Based on these unique characterizes of camels found name as "Ships of the Desert" that famous in many world's scientific and commercial literatures.

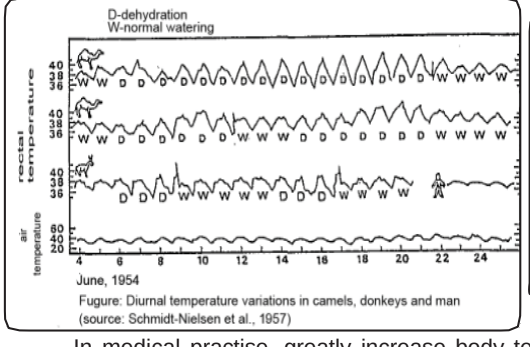
Water saving technologies of camels. Camels are well adapted to dehydration for relatively long period in harsh conditions of the desert where water is scarce. The camel's water resilience included following features as heat store in the body during daytime, desaturation

of exhaled air in their nose, high economy water metabolism, high tolerances to dehydration, water store in their body parts and huge amount water intake in short time period after dehydration.

a) Desert camels with hyperthermia. In 1919, some of camel researchers observed wide range of diurnal body temperature in camels in Algeria and they conclude that the camel was erroneously associated with poor thermo-regulation capacity. About 40 years after Schmidt-Nielson and their team again in Algeria observed an increase in the body temperature of camels during daytime of about two degrees Celsius when watering daily and up to six degrees Celsius when water deprived in the hot summer. Camels realized the huge amounts of fluctuation their body temperature in relation to their heat balance and water economy[25].

The camels can store heat in their body gained from 35-40 degrees hot desert environment and that produced from its metabolism in order to conserving water from expensive evaporation of heat losses due to increase their body temperature up to 41^{0}C during daytime. This heat is then lost passively during the cooling night by conduction, convention and radiation at no cost to its body water as result of this process decreased their body temperature up to 34^{0}C.

Other animals excluded the camels dissipate their additional heat during the hot summer achieved through the water expensive evaporative cooling either from the respiratory tract by panting or through sweating evaporation from skin by sweating. The camel's higher body temperature also tends to decrease heat gain from the warmer environment which reduces the overall heat load on the animal. Moreover, in water deprived camels have increased their body temperature more than normal hydrated camels for example, in normal watering camel can stored 9.5 kilocalorie heat per kg their body weight but in dehydrated camel can be stored 23,6 kilocalorie heat the same body weight. Its meaning the camels are burning inside of their body during hot summer days[11].



Fugure: Diurnal temperature variations in camels, donkeys and man (source: Schmidt-Nielsen et al., 1957)

Pic. 7 The camel can store huge amounts of heat in their body when hot environmental condition. Then the stored body heat lost passively during the cooling night by conduction, convention and radiation due to saved more water.

In medical practise, greatly increase body temperature named a hyperthermia and decreasing body temperature from normal value meaning hypothermia. But the camels have the disorder situations in

their normal desert lifestyle.

b) Camels having "special air condition"-Camel's nose. The nasal cavity of camels is relatively length and consists of long sized lower and upper nasal concha surrounding upper cavity of cuneiform bone. Camel skull has three basic cavities such as maxillary, frontal and cuneiform bone cavities which are performing many essential functions as solidification of skull bone, lightening by their cavity gas contents and cooling brain through nasal cavity[43].

Pic. 8 The nasal cavity of desert camel is one kind of special air-condition. Nasal cavity of camels can desrease the temperature of the exhaled air and removel of water vapor from this air. Also during the inhalation nasal surfaces are cooled air passing over them and absorb the water vapor to inhalated air. Camel nasal surfaces have hygroscopic property

Camels can reduce the water loss due to evaporation from the respiratory tract in two ways, at first by decreasing the temperature of the exhaled air, second by removal of water vapor from this air. The mechanism for cooling of the exhaled air is a simple heat exchanges between the respiratory air and the surfaces of the camel nasal passage ways. On inhalation these surfaces are cooled by the air passing over them, and on exhalation heat from the exhaled air is given off to these cooled surfaces. The surfaces give off water vapor during inhalation and take up water from the respiratory air during exhalation. The hygroscopic properties of the nasal surfaces have been increased when the camel is dehydrated. In the daytime the exhaled air was at near body temperature around 37^{0}C, while in the cooler night the exhaled air was at near environmental air temperature as result of these processes in daytime the exhaled air was fully saturated but at night its humidity might fall to approximately 75%. These combinations of cooling and desaturation of camels can provide a saving of water of 60% relative to exhalation of saturated air at body temperature. In this ways camel's nose can responsible roles of special air condition in hot desert environment. Some investigators may be using the water saving technologies through camel's nose in their new air condition design in future[25].

One of a key factor in survival high heat load is the maintenance of brain temperature. Many animals including camels have a carotoid rete at the base of brain which supports selective cooling of the brain. Other side, nasal and other supplemental cavities of camel's skull can support to cooling of the brain of camels[13].

c) Does a camel have sweat glands? Early, camel researchers mentioned a camel hasn't any sweat glands because can't sweat in or-

der to thermo-regulation. But last year's study showed that a camel has sweat glands in their all skin areas excluded the lips, external nares and perianal region. A light and electron microscope study was made on the sweat glands of the dromedary camel. The secretory tubule was made up of columnar, cuboidal or sometimes flat epithelium in there was no evidence that the glands was of the classical apocrine type[26]. Mongolian camel researcher doctor Luvsan mentioned that in Bactrian camel the hair follicles, sweat and sebaceous glands of skin are not formed during their ontogeny, but total area of camel's hide increases, therefore, number of follicles per unit area of hide decreases[46].For example, in young camel (up to 4 years old) has 0,88-2,1 pieces of sweat and sebaceous glands per one millimeter area of hide but in adult camel has 0,68-1,48 pieces of the glands per one millimeter area of skin. In Bactrian camels have little number of sweat glands per one millimeter of skin area than other domestic animals. Although, the camels well adapted in hot desert environment still needs to dissipate some heat in order to maintain their thermo-regulation. The camels have two ways such as panting and sweating. During the heat of vaporization of one gram water at 33^{0}C or 541 calories and by sweating at 580 calories per a gram water in camels[11]. Camels are sweating to thermo-regulation but they can produce three times less amount of sweat than cattle in same condition. Camel's sweat is alkalinity with high in potassium.

d) Camels have ten times bigger body size than the sheep… Adult Bactrian male camel has a height of 171,5 cm between humps; body length of 146.5 cm; heart girth of 236.2 cm; circumference of cannon bone is 21.3 cm; and a body live weight is 611 kg. But Mongolian gelded ram has height of wither 65 cm; body length of 70 cm and body mass reached to 55-65 kg[55]. Otherwise, the desert camel has 10 times heavy and 5-6 times bigger body size than native sheep.

Pic. 9 Bactrian camels are grazing in Gobi rangeland.

Зураг 10. Sheeps are grazing in Gobi rangeland.

Also, researchers revealed the camel has large body size but their energy and water metabolism rate similar to sheep. Particularly, in camel with 400 kg of body mass have 50 kg/kcal of energy metabolism and 104 ml/kg of water metabolism but in sheep with 40 kg body weight have 55-63 kg/kcal of energy metabolism and 130-210 ml/kg of water metabolism. That means the camels have more abilities to adapt to hot desert condition[11,13]. Furthermore, the capacity of the camel to fluctuate its body temperature diurnally, thus storing heat and conserving water, supplemented benefits of its large body size and low metabolic rate, is further aided by the insulating properties of its fur and skin. In Mongolian camels have dark red, brown and red colors. Out of the total numbers of camels studied, 76.6 per cent were of a dark color[45,46]. Also the camel's skin is an average 4.1-5.5 mm thick and having pearl grey pigment[36,46].

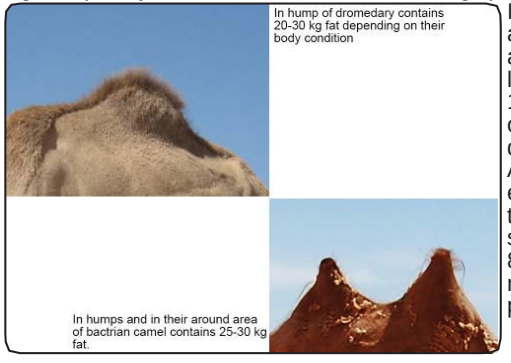
The Bactrian camel has in total 26-36 kg fat in humps, flank and abdomen and the dromedary camel has up to 35 kg fat in hump and flank region. The skin color, thickness of fur and subcutaneous fat of camels acts as a significant barrier against the environmental heat or insulation its. Circadian variations of sweating rate and body surface temperature of dromedary camels study showed existence of minimum ambient temperature 27.5^{0}C observed early in the morning at moment camel's hump skin temperature was 25.6^{0}C but maximum ambient temperature observed at the middle of the day at time hump skin temperature of camels reached 46.3^{0}C[19].

e) Camels tolerance to dehydration or "super dry starvation of camels". Some research paper reported that Mongolian camel use following amount water for watering with a day interval as camel calf and yearling-24-25.1 liter; young camels up to 4 year old-45.5-48.8; female camel and castrate male camel-56.8 liters[46]. Lactated female camel can drink 24-39,8 liter water at every day watering depend on seasonal characters that means female camel used 2.1-3.8 liters of water per kg their intake feed dry matter[59]. In Israeli, desert researchers conducted camel dehydration experiment at two dromedaries. At the ambient temperature varied maximum 35-40^{0}C in early morning to a minimum 26^{0}C with ambient relative humidity was around 25% the selected camels withstood 16 day dehydration without apparent sign of undue stress. During the dehydration of camels not supplied any water (except that five liter of water were given to each on 12 day) but was fed dry hay and small amounts of fresh green dates. Based on this experiment to conclude the camels can tolerate 10-14 days dehydration or without any water for drinking. At the end of the 16 day of dehydration each animal was allowed water free. They consumed 92 and 107 liter respectively (16 and 24% of their normal body masses)[25]. Camels can tolerate water losses of up to 30% of their body masses whereas the maximum for many mammals is approximately 10 to 12%. Rehydration following a period of water is important for animal survival. A camel may drink more than a third of its body weight as it rehydrates. Also reported that a camel intake 200 liter in three minutes, and 110 liter in 10 minutes. In order to rehydration at these levels would lead to over hydration and possible death.

A camel can drink a water equals 10-15% of their body weight and when water deprived they can drink a water about 30% of its body masses related that does the camels store a water in any part of their body? Actually, that is yes. Therefore, camels in hot dry environments are in fact capable of temporarily storing water in their expanded extracellular fluid compartment and in the rumen fluids. The camel's sweat contains high in potassium may be sodium remain in their body that reabsorbed water from metabolic products. Also, after rehydration of camels appears blood erythrocyte is to swell and physiological subcutaneous edema. In addition, water is also stored, in sense, as fluid in the rumen-reticulum which may constitute up to 15% of the live body weight of camels. This stored water may be drawn upon at time of need such as of water deprivation, 12 days in camels and 3 days in sheep that has shown camels were more economic than sheep[13]. Finally, the camel has only 3 parts of stomach such as rumen with glandular sac, reticulum and abomasum.

Furthermore, the camel can dehydrate without compromising blood viscosity, destroyed erythrocyte's shape and changing hemoglobin contents of a blood. Another unique feature of the erythrocytes is their long span when the camel is dehydrated. The life span of the erythrocytes of hydrated camels is 90 to 120 days when camels were chronically dehydrated the life span of erythrocytes was extended to 150 days[13]. Erythrocyte turnover is water and energy expensive process. Therefore, extending the life span of erythrocytes reduces energy and water expenditures.

f) Does the camel store water in humps? The camel habitat Gobi desert area frequency happened drying up and drought and animal food shortage. Desert and semi desert steppe zones, where Mongol camels inhabit more, are ecologically distinct due to less amount of precipitation, scarce pastoral vegetation, limited water resources, average soil and air temperature during warm seasons comparatively high, and high frequency of snow and sand storms during spring time.



In Gobi desert zones, annual precipitation amounts is relatively low ranging 80-110 mm with most of rainfall occurring during June through August. Annual average air temperature is $3,8^0$ degrees, soil temperature is $8,3^0$ degrees. The maximium air temperature is 37-40^0 C.

Number of days with snow and sand storm is counting 35,2 days in average and 55 days maximum a year. In between, during June through August the highest air temperature reaches up to 38^0 C and during January and February the lowest air temperature reached down to -36^0 C. Air moisture in general fluctuates between 40-70 per cent, however, during spring season it goes down to 24 per cent. As a result, Gobi animals affect lack of water at frequency.

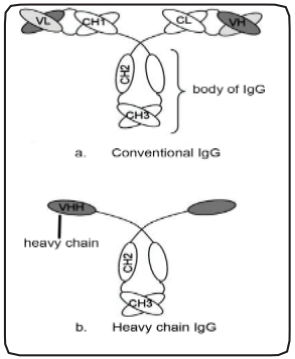
The saltwort-anabasis-needle-grass and saltwort-cheegrass-Siberian nitrebush dominating types semi-desert pastures have yield of maximum 2,84-7,62 one hundred kg/hec in August and its minimum yield of 0,67-1,5 one hundred kg/hec in April. During the summer time, at per kg sample of absolute dried pasture plants contents 0,90-1,04 fodder units, and 96,5-136,4 grams digestible protein but at winter and spring season the pasture plants have 1,25-1,31 times less fodder nutrition and 1,3-2,1 times less digestible protein content than summer seasons[44,59,62].

Why the camel has hump? Why some of them have one and others two humps? The camels can store water in their humps? Are the water resources mobilize when camel dehydration? such as many questions always raise to more known about desert camels. Actually, any animals including camels the fat deposits of in their body used for energy deficits rather than their water deficit. Camels stores its energy reserves in form of fat in different depots in their body of which the humps and abdomen depots therefore, camels can survive in above mentioned food scarce desert conditions for long period. Camel's two humps is adaption change for survive in cold desert conditions during the long evolutionary process like the giraffe has long neck to reach foods on the high trees.

Finally, in hot desert condition camels oxidases the hump fat depots for water needs but during the process more water will be evaporated than the oxidation water formed resulting in a net water deficit and thus, it is actually to the disadvantage of desert camels as far as water balance is concerned[2,18].

4. Unrevealing biological mysteries of the Bactrian camels. Camels have 74 chromosomes that contents genes. The genes consist of thousands of protein which is formed by amino-acids and nucleotides. The camel's genome is the entire genetic material of their organism[2]. The Humans genome sequence project completed before 10 years ago but today camel's genome project almost completed and designed first colonial camel calf in United Arab Emerita. Chinese and Mongolian Bactrian camel genome sequencing and analysis consortium completed the genome sequences of wild and Bactrian camels in 2011. They estimate the camel genome to be 2.38 Gb, containing 20821 protein-coding genes. They published one bigger research paper on the Nature Communication journal at beginning of November, 2011. They concluded that rapidly evolving genes in the camel lineage are significantly enriched in metabolic pathways, and these changes may underlie the insulin resis-

tance typically observed in these animals[17]. It was shown that those rapidly evolving genes are more revealed in carbohydrate, lipid metabolism and signaling pathways regulating the metabolic processes such as insulin and adipocytokine and these pathways may be related to optimize their energy storage and production in the desert habitats.



Pic. 11. Camelids nanobody or single domain chain antibody

a) Only the camelids can produce heavy-chain antibodies that called as nanobodies. An antibody (Ab), also known as an immunoglobulin (Ig), is a large Y-shaped protein produced by B-cells that is used by the immune system to identify and neutralize foreign objects such as bacteria and viruses. The antibody has paratope which recognizes a unique part of the foreign target, called an antigen. The "Y" shaped antigen binding site of the antibody contains light and heavy chains. Since 1975 researchers developed the mouse hybridoma technology that paved the way for emergence of therapeutic monoclonal antibodies. Camelids produce functional antibodies devoid of light chains of which only the single VHHs domain antibody fragment is fully capable of antigen binding. They are well expressed for microorganisms and have a high stability and solubility. These special antibodies are named "Nanobodies".

In 1993, by professor Raymond Hamers from the Vrije University of Brussel (Belgium) was discovered that camelids can produce functional antibodies devoid of light chain. These heavy chain antibodies also lack the CH1 domain, which in a conventional antibody associates with the light chain and lesser degree interacts with the heavy chain. Nanoboies are the smallest available intact antigen binding fragment, only 15 kDa (kilodaliton), with 2.5 nm (nanometer) in diameter and 4 nm in high. Nanobodies are harboring the full antigen binding capacity of the original heavy chain of naturally occurring heavy chain antibodies that have evolved to be fully functional in the absence of the chains. Also nanobodies are small proteins only tenth the size of a conventional antibody so they can penetrate tissues more effectively and recognize uncommon or hidden epitopes than conventional antibodies. Based on these unique properties of nanobodies used for biotechnological and medical applications[15]. Moreover, the nanobodies are highly stable to heat which retain more than 80 per cents of their binding activity after a week of incubation at 37^0C,an melting points of its are in the range 67-78^0C that indicated their terminal resistance. Also nanobodies were shown to be stable against the denaturing effects of chaotropic agents,

in the presence of proteases and to extremes of PH. Therefore, nanobodies able to survive in harsh conditions such as found in the stomach, and remain biological active in the gut, creating opportunities for the oral delivery nanobodies to treat gastrointestinal diseases[15].

The camelids nanobodies unique features should lead to a number of biotechnological and medical applications. Today in several biological laboratories the nanobodies have been used as targeting a research tool and in a variety of diagnostic or therapeutic applications such as targeting device for toxic enzymes or block a specific molecular interaction, bind to a trypanosome coat protein, drugs that treated oncology or inflammatory diseases based on blocking molecular interactions, serodiagnosis of cysticercosis and pork tapeworm. The nanobodies may also be used for several biotechnological applications for example, the targeting and tracing antigens in live cells can be done using fluorescent nanobodies, identified non protein cell components remain invisible and cannot be studied[20]. In 2005, 18 monoclonal antibody products were on the market and more than 100 in clinical trials and engineering or nanobodies products were predicted to account for more 30% of all revenues in the biotechnology market.

b) The camel drinks salt water and intakes a diet loaded with salt but doesn't suffer by hypertension. The wild camel as well as domesticated Bactrian camel can drink salt water and frequently use salty bush for their foods in Gobi desert regions. The domesticated camels not always drink salty water but sometimes, especially in summer they can use salty, rainy pond water in desert salt marsh that is shown domesticated camels can drink the salty water in their water needs.

Pic.12 Bactrian camels are drinking from back water in marsh hollow. This kinds of back water is always be salty via washing around soil mineral contents. The wild camel always drinks salty water for its water daily requerment.

Another interesting issue is the camel urine has higher concentration than ocean water but the concentration of camel urine less than the desert rat urine[1,2]. Some scientists are conducted research on higher concentration of camel urine and the camel kidney is characterized by a long loop of Henle, and well developed medulla of their kidney that helps to reabsorption primary urine water.

Recent year's camel genome investigations are unraveling the

mysteries of super reabsorption of camel urine from the kidneys and their remarkable salt tolerance. In humans the gene CYP2J controls hypertension (increasing blood pressure disease) that ways suppressing it leads to high blood pressure. In Bactrian camels have 11 copies of CYP2J and 2 copies of CYP2E genes, more than in cattle (four and one), horses and humans (one and one). These two genes can help to transform arachidonic acid into 19(S)-HETE which have been demonstrated to be a potent vasodilator of renal preglomerular vessels that stimulate water reabsorption. The camels produce more 19(S)-HETE potentially useful for survival in the desert. In addition, the activity of CYP2J gene is regulated by high-salt diet and its suppression can lead to high blood pressure. Camels are known to be able take in a large amount of salt apparently without developing hypertension because they have 11 copies of CYP2J genes[17].

c) Camel genome holds information about diabetes. According to research reports the basal plasma glucose levels in domestic ruminants (2,5-3,5 mmol/l) are lower than in monogastric animals (3,5-5,0 mmol/l) but not in camels. Basal plasma glucose levels in dromedary camel 6-8 mmol/l, in Bactrian camel 4,9-5,2 mmol/l are significantly higher than monogastrics[6,9,37,41,60]. The physiological experiments had shown that the level of blood glucose in camels may be caused by their strong capacity for insulin resistance. The Bactrian camel genome analysis shows that a large number of rapidly evolving genes in camels are involved in type II diabetes mellitus and the insulin signaling pathways. The two critical genes such as PI3K and AKT involved in this process have undergone rapid divergence in camels, which may change their responsiveness to insulin.

5. Camel milk is magic medicine. Lactation period of Mongolian Bactrian lasts 16-18 months in total milk yield is 330-360 liters in one lactation period that means average daily yield is about half liter. But the dromedary camel has more than 5-8 liters and in there maintaining milking breed of camels. Camel milk plays important roles of food resource for thousands of nomads in hot and cold deserts. Also camel milk is one of main resources against of famine for nomadic people of Somali, Uganda and Ethiopia in Africa[44,45].

The Bactrian camel milk has approximately 15,5% total solids, in which 5,65% fat, 4,23% of protein, 4,4%of lactose and 0,87% of ash. The mineral contents of a kilogram of camel milk consist of calcium 129 mg, phosphorous 94 mg, sodium 96 mg, magnesium 11,5 mg, potassium 144 mg, copper 0,09 mg, zinc 0,39 mg and iron 0,6 mg. One kg of camel milk meets 100% of daily human requirements for calcium and phosphorous, 57,6% for potassium, 40% for iron, copper, zinc and magnesium and 24% for sodium. Camel milk contains 37,4 mg/liter vitamin-C that is three times greater than cow milk. Camel milk is made of 39,1% unsaturated fatty acids[38,44].

Camel milk protein system constituted be two major classes of

proteins: caseins and whey proteins. The caseins account for 80% of the total milk protein content and rest of 20% whey soluble proteins such as immunoglobulin, alpha-lactalbumin, lactoperoxidase, lysozyme, lactoferrin and others[10]. Camel milk has 1,5 times higher amount of these whey proteins than cow milk die to camel milk own unique properties as anti-infectivity and long-life span for coagulation. Camel milk has high good bactericide quality, and therefore, it can be stored in 35-37^{0}C for 10 hours, in 18^{0}C for 18 hours, and in 3-13^{0}C for 90 hours[43]. Furthermore, the camel milk devoid beta-lactoglobulin protein and has different structure beta-casein than that of other animal's milk.

Fermented camel milk has 90-110 T^0 of acidity, 0,3% of alcohol content, 12,4% of total solids, 4,8% fat, 3,63% total proteins and per kg of fermented milk contains 0,12mg carotene and 56mg of vitamin C. Nutrition value of each kg of fermented camel milk equals to 766 calories. Camel milk wet curd has approximately 200 T^0 of acidity and its contains 21,9% of total solids, 13,1% of fat, 7,8% proteins and is total nutrition their total nutrition value equals to 1529,7 calories. The camel milk dried curds made with normal household or laboratory methods have total solids of 93-94%, fat 49-50,1%, ash 6,12-6,1% and 6115-6659 calories of nutrition values in each kg dried products[51].

From each three liter of fermented camel milk could produce one kg wet curd, but from 100 liter camel milk can produce 15 kg dried curds with 6-7% of moisture which contains 38-50% of fat and 30-43% of proteins. Ideal temperature of fat separation from camel milk is 45-55^{0}C, at this condition from each 100 liter of the milk is produced 12-14 kg of sour cream with 35-40% fatness by using milk separator. Suitable temperature regime for camel milk casein coagulation is 40^{0}C and, the camel milk is processing at 60-63^{0}C for 30 minutes will lead to 99,9% of pasteurization and can extend the storage period by 1,5-2 times more[38,52].

Pic. 13 Camel dairy products such as ice-cream, bottled fermented milk, pasteurized pure milk and camel milk yogart in Mongolia.

Bernard Faye of the France based research organization CIRAD "I have studied camels in many countries. From the Rift Valley of Africa to Central Asia you often hear it said that camel milk can cure; diabetes, tuberculosis, stomach ulcers, gastro-enteritis, cancer are all claimed to

be cured" Not surprisingly, the scientists have attempted to verify or disprove the claims. There are two ways to test the curative capacity of camel milk. First is to have a rigorous experimental procedure and, with humans double blind trials. The second is to have more information on the constituents of camel milk, specifically the components which could be responsible for the claimed medical properties.

a) Effect of camel milk in human type I diabetes. Effect of camel milk on type I diabetes checked out in drug –induced experiential dogs, mouse, rats and cats. As result of camel milk treatment in experiential animals showed a significant decline in blood glucose, total proteins and cholesterol concentrations, and perceptible decrease required dose of insulin needs, increase body live weight and the curative effect of the camel milk shown after stopping to drink milk for few months[4,7,12]. However this therapeutic effect was only in raw and pasteurized of camel milk and its was disappearing when use boiled camel milk to treat diabetes[4]. From 2005 Indian researchers conducted clinical trials in patients suffering with type 1 diabetes whose consuming 500 ml camel milk every day, combining usual care including diet, exercise and insulin during a 52 week randomized study. The consumption of camel milk in type 1 diabetes patients had shown significant reduction in the dose of insulin required to maintain long term glycemic parameters, improved quality of life of diabetic patients[3]. Camel milk has high concentration of insulin i.e 52 units/liter, that is similar to human milk. Also we mentioned above camel genome hold information about diabetes.

b) Camel whey proteins can inhibit the hepatitis C virus infectivity. Hepatitis C virus is a global health problem and represents a major of liver disease without the existence of any protective vaccine or effective drugs. Chronically infected patients often develop progressive liver diseases, cirrhosis, hepatic failure and hepatic carcinoma. The dominant camel milk protein is casein which using to produce camel curds by coagulation. The camel whey contains numerous proteins such as immunoglobulin, alpha-lactalbumin, lactoperoxidase, lysozyme, lactoferrin which have anti-infectivity properties. Especially whey lactoferrin plays an important and multifunctional role innate and specific host defense against infection by microorganisms, alone or with other proteins such as lysozyme and immunoglobulin. The camel milk curative features related with these anti-infectivity whey proteins of the milk. Some researchers of Egypt examined antiviral activities of immunoglobulin; lactoferrin and alpha-lactalbumin were purified from camel milk against hepatitis C virus (HCV) using artificial cell lines. Camel milk polyclonal immunoglobulin isolated from camel milk could inhibit the HCV infectivity and demonstrated strong signal against its synthetic peptides. Lactoferrin was able to block the HCV cell-entry and aborted its intracellular multiplication. But the camel alpha-lactalbumin protein not demonstrated any activities against HCV[10].

c) Camel milk can threat children's autism. The etiology of many autistic cases is based on a primary autoimmune disease, affecting an intestinal enzyme responsible for the formation of amino acids from the milk casein. Instead, the breakdown of the caseins, primarily beta-casein and beta-lactoglobulin, is to a powerful opioid named casomorphin which leads to typical cognitive and behavioral symptoms. It is therefore, advisable to restrict milk and milk products that can lead to the formation of casomorphin but camel milk does not contain beta-casein and beta-lactoglobulin, camel milk doesn't lead to autism symptoms. There are many reports from parents of autistic children that camel had helped their children led to improve their immune status, started talking, improved cognitive and communications skills and treated their secondary diseases such as gastroenteritis, *Helicobacter pylori* infection and lactase deficiency. At first time, Dr. Reuven Yagil suggested that children's autism is not brain disease but it is autoimmune disease related intestinal enzyme disorder because recommended camel milk regular drinking[30,31].

Most of the ruminant milk can cause food allergies and recent years food allergies rapidly grown due to increasing urbanization. In fact, the camel is not a ruminant, although it ruminates, but is a *Tylopode*. Camel milk composition is vastly different from that of ruminants. The proteins of camel milk are the decisive components for preventing and curing food allergies because camel milk contains no beta-globulin and different types of beta-casein these two proteins in cow milk are responsible for milk allergy. This unique advantages of camel milk has been increasing opportunities of using camel milk for functional and child's milk food[31].

d) Camel milk value chain- new niche market. Now at world metal exchange market gold has highest values. Resent years the camel milk market demands rapidly growing year by year via investigation of its curative properties. In certain regions such as the Middle East camel milk is a strong boost for sales that leads to intensification of camel dairying. Professor Ulrich Werner of camel research laboratory in Dubai said that "in the United Arab Emirates, there will be dairy camel operations in the future, just like the world has now with dairy cows.

Pic.14 Modern camel milking parlor in a camel farm in Dubai, United Arab Emirates Photo: Ulrich Wernery

Maybe there will even be high tech rotary milking parlors". Main challenges of camel milk market are how to bring camel milk from harsh desert to people, the camel milk producers' mainly nomads nature, poor development rural infrastructure, camels has long gestation period and with low daily milk yield of camels.

Camel milk yield of dromedary and Bactrian camels haven't so much because in order to enhance the camel milk production used extensive ways combining with modern technological advantages such as growing number of she-camels in total camel herds, genetic improvement of camels, received one camel calf each year by using synchronization of heat of she-camels, creating camel milk collecting and heat processing units in rural areas with shareholder camel herding nomads, camel milk and milk product link to niche market such as endocrine clinic, functional and vegetarian food market, child's dietary food and mining markets.

6.Valuable properties of camel meat. Camel meat is one of important source food for Asian and African nomads still. Some people thought that the camel meat has lots of mineral, fats and with low calocricity of nutrition values but last year's investigations shows that the fat contents of camel meat is considerably less than beef, low in cholesterol and high in protein.

a) Cholesterol free camel meat. Increasing population with high income led meat consumption grew year to year. The demand for camel meat appears to be increasing especially in arid regions. Camel meat is healthier as they produce carcasses with less fat as well as having less level of cholesterol in fat than other meat animals. Camel meat has low intramuscular fat content compared with other meat animals because camel fat depots accumulated in their abdomen, flank and humps. The chemical composition and food value of camel meat have shown that it has two qualities which distinguish from beef and mutton as low fat and high moisture contents. Camel meat protein content was similar to beef but nutrition value is a bit lower than beef and mutton[14,58].

Pic.15 Slaugthering of the bactrian camel to make dried meat for summer food of nomads. Gobi herders usually slaugther camel for food at winter season.

Mongol Bactrian camel meat yield is 220-250 kg depending on body conditions which equals 48-52% of their live weight. If total weight of Bactrian camel carcass is considered as 100%, meat is 54%-56%; fat is 17%-19,8%; bone is 19,8%-24,07%; fascia and hard tendon are 3,2%-4,9%; waste during de-boning is 1,3%-1,45%. Mongol Bactrian camel meat contains in average 66,1-74,3% of water, 25,7-33,9% of total solids, 5,34-13,9% of fat, 18,95-19,95% of proteins and 0,91-0,96% of ash. One kg of meat caloricity is 1622,4-2071,3 calories. The camel meat has 15 types of amino acids, including cysteine, leucine+histidine, arginine, asparagines, serine+glycine, glutamic acid, threonine, alanine, proline, valine, phenylalanine, and leucine+isoleucine[45,58]. Camel meat use for food, sausage production, dried meat and burger meat. Also the camel meat especially camel dried meat helps in African nomads whose suffering long lasting drought, and chronic famine in this way FAO supported camel dried meat project for these target area.

b) Camel dried meat or "borts" named by Mongolian nomads. In Mongolia camel meat is also dried, especially during winter and spring. During winter, if humidity is around 39-76%, with plenty of air and wind, meat gradually looses its water and moisture and keeps its nitrogen content. Meat dried in such way turns brown yellow and has good flavor. Bactrian camel dried meat has 7,07% moisture; 20,04% fat; 69,2% protein; 3,75% ash; total nutrition value is 2753 calories. Spring dried meat protein contains 18,1% myoalbumine, 68,1% globuline, 13,6% myogen. The camel dried meat has 13 types of amino acids[58]. **Camel jerky**. In many countries have been produce jerky by camel meat named camel jerky. 100 gram camel jerky reached $17-20 in online food grocery.in Mongolia has huge opportunities of produce camel jerky using Bactrian camel meat and, linked to Great Gobi tourism market and domestic mining market.

7. Luxury men' coats made by Mongolian camel wool. One of most important productivity of Bactrian camel is wool production. The Bactrian camel can produce fibers with fine soft down to survive at Central Asian cold desert condition. Bactrian camels are molting 1-1,5 months of summer from May to July during this time in the camel skin remains long hairs that are framework of a camel wool. Camel fine wool grows from July to December by an average of 2,12cm a month.

Average wool yield of Bactrian camels are 2,6-8,3 kg depending on age and gender. In the whole camel wool occupied 21,6-35,5% of coarse wool and 70% of fine wool. Bactrian camel coarse and fine wool contains relatively different amounts of fine down with 14,4-23,6 microns or cashmere. For example, the coarse wool contains 66,5-84,7% and fine wool contains 86,0-94,4% of fine soft downs[48]. Young and female camel hairs have fine soft down that is similar quality to goat cashmere. According to grading of animal fiber are fibers with 14-20 micron as cashmere, 21-23 with microns as cashgora and fibers with more 23 mi-

crons as mohair. Mongolian goat fibers included in fine cashmere grade, now one kg raw cashmere sold at $40-45 in domestic market. But same amount camel wool market price was only $3-4 in domestic fiber market. This bigger price difference related to less development of the camel wool process capacities.

Pic.16. Camel wool products made by Mongolian nomads.

Pic.17 Camel wool handmade yarn

In online shops of high design clothing found images of pure camel wool luxury men coat made by Italian producers may you thought that is made by Arabian camel wool but it is not true, these luxury men's coat made by Mongolian Bactrian camel wool. Because, secrets of the luxury products to being in integrated with central Asian camel's cashmere, Italian camel silk producing technologies using mountain's pure water combining Spain's thorny plant's head and Italian style superior design of clothes.

8.Camel caravans through the Silk roads. The Silk Road is a historical network of interlinking trade routes across the Afro-Eurasian landmass that connected East, South, and Western Asia with the Mediterranean and European world, as well as parts of North and East Africa. The Silk Road gets its name from the lucrative Chinese silk trade but though silk was certainly the major trade item from China, many other goods were traded, and various technologies, religions and philosophies, as well as also traveled along the Silk Routes.

These roads were largely traveled by one method: camel caravan. Camel caravans were groups of people and camels who traveled in convoys over long distances. Camels were well-suited to the task, which adapted hot and cold deserts. Mongolian Bactrian camel has a capacity to lift 160-240 kg on its back, 300-400 kg on carriage, and they can travel with this amounts of luggage 30-35 km per day that means with 4-5 km/hour in speed[32].

Camel racing competitions are very popular in Arabian Countries because there enhance racing camel breeds. In dromedary camel has in average 40 km/hour speed but Bactrian camel racing speed has

27,2km/hour[39]. Camels with thin body builds, short body, long legs and light bone tend to be faster.

Pic. 18 The Bactrian camel loaded on the back by Mongol nomad

Pic.19 The dromedary camel loaded on the back by African nomad

9.Reproduction in Bactrian camels. Male Bactrian camels reach sexual maturity at 5-6 years of age, females at 3-4 years. A heat of she camels starts from January ends at beginning of April each year. Estrus of most of female camels (up to 75%) happened in last decade January and during the February every year. Calving of them occurs between March and May of next year depending on their conception time, most camels' calves in March each year. 74, 3% of all female camels are become pregnancy in February and 82, 5% of them delivery camel calf in March of next year. Mongolian she camel has one heat period, its takes 3-16 days.

Pic. 20 Camel bull with heat one of sign is frothing at the mouth.

Pic. 21 Mating of dromedary camels.

The ovulation of the she camel always become after mating with bull camels. The ovulation of female camel to be complete within 72 hours after mating[42,45,56].

Complex features of estrus in she camels are as follows: decrease appetite, sits down via long time, excitement, bleating, swollen their vulva with mucous discharge, tries to smell urine and external genitalia of male and raises the tail, show some homosexual tendencies and also comes to camel bull. Bactrian female camel with conception shows cocking of the tail 3-7 days after mating, frequent urination and stopped on wide legs when approached by a male camel or handled by herders. When happened an abortion, in Bactrian camel disappeared the cocking of the tail sign, discharged lochia from external genital organs, decrease their milk yield and emerge new estrus of them[42].

Rutting period of Bactrian bull can divided three sections such as pre-rutting, rutting and finish of rutting. Pre-rutting period of bull camel hold 30-45 days from mid of November to mid of February every year. During this period, the camel bull shows the following breeding behaviors: restrain their feed, decreased their belly size and body condition score, frequent urination, produce grunting sound with grinding of teeth and hit on weathers by his head. But in this period the camel bull doesn't mate with female camel. The rutting period of the bull camel fully managed female herds and mating with she camels[55,56]. Bactrian bull rutting period stars from January ends beginning of April. During the rutting period Bactrian male camel shows following features as with brisk movement, emits a black pigment from his poll glands, grinding on weather by poll of his head, expel castrated male camel and young uncastrated camels from his herds, frothing at the mouth, standing with its legs widely apart and swishing with its tail to its foreskin to be to spray urine, sprays urine, produce gurgling sound with grinding of his teeth.

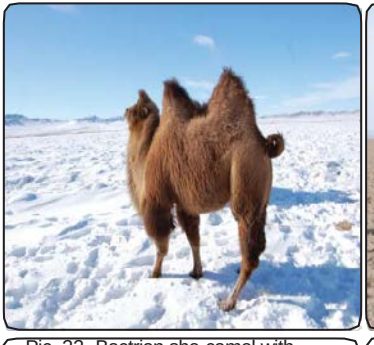
A bull camel can copulate with she camels 1-2 times (91.1% of all bull camels) per day maximum 5 times per day depending on their body conditions, age and estrus of she camels. The bull camel can use for breeding purpose from 5 years to 14 years old but Bactrian bull camel can mate up to 18 years old. A penis of the bull camel is slender and with rotary movement. Duration time of act of mating in Mongol bull camel was 4 minutes 31 seconds but dromedary camel takes 5 minute 24 seconds. Average amounts of semen in Mongol Bactrian bull camel was 5,83 ml; in dromedary bull-5,34 ml; in the bull camel of wild camel-7,17 ml[33,34,35,54,57].

a) Parturition and twinning in camel. The duration of gestation of Bactrian camel is 399-405 days. Female camels always have a single young camel calf, twins were not observed. 74, 3% of all female camels are become pregnancy in February and 82, 5% of them delivery a calf camel in March of next year in Mongolia[45].

She-camel pregnancy establishment occurs almost exclusively in the left horn and twin pregnancy is very rare. Even when embryos

are transferred to the right horn migration occurs and the subsequent pregnancy is found on the left side. If multiple embryos are transferred together a twin pregnancy may establish but will only last for around 25 days as one pregnancy becomes dominant[27].

The first indication of coming delivery calf in Bactrian camel is usually the enlargement of the udder from 23-27 days before parturition and filled with milk 1-3 days; swelling of a vulva 4-10 days; erythema of vaginal mucous membrane 3-5 days; opening of cervix of uterus 20,5-34,6 hours and released of pelvic ligaments 4-5 days before calving of she-camels. In Bactrian female camel occurs restlessness and go away from her herds to 2-10 kilometers distance from herds. Process of this pre-birth sign happened following ways as at first she is walking, not pick up any grasses and takes it 1,5-2,5 kilometers from their herds after then go at trot up to 0,5-1 kilometers and stop and urination repeats the actions she camels go out to 2-10 kilometers from their herds. Parturition in camels holds three stages processes such as opening the cervix of ureter or labor pain, out of the fetus and separation of afterbirth. In the Bactrian camel continues the labor pains about 10 more hours[50].



Pic. 22 Bactrian she-camel with conception shows sign of cocking of the tail after 7 days mating.

Pic. 23. New born camel calf with its mother on rangeland. In behind of mother lies their afterbirth

Parturition of Bactrian camel continue for 23-45 minutes, offspring weight of Bactrian camel is 35-40 kg at birth that equals 10% of adult camel live weight. Bactrian camel calf stands on its own within 2,5-3,5 hours after birth. Bactrian female camels haven't instinct of lick her offspring only she can smell it[61].

b) Five years birthday of cloning camel. Cloning by somatic cell nuclear transfer a special significance in the genetic improvement of camels and can be used to produce elite males, racing champions, animals with the highest potential for milk production or the prized beauty camels. In Dubai camel research was produced the world's first cloned

camel, named Injaz who was born on April 8th 2009, has been produced from the embryo reconstructed with cumulus cell obtained from a slaughtered animal. They mentioned that the potential applications of somatic cell nuclear transfer in camels are currently, however, constrained by low pregnancy rates from the transferred reconstructed embryos[29].

9. A camel in desert rangeland. In Gobi desert region, camel's grazing time decreases by 2-4 hours during winter and spring, thus intake feed from range during this time is 35,4-43,7% less than summer and autumn seasons and, furthermore as nutrition value of pasture plants is decreased by 28,6-44,6%. Therefore, it is required to provide supplementary fodder during this time of year[59]. Mongol Bactrian camel travels 7,8-24,7 km for grazing depending on Gobi pasture yields. Average grazing radius of Bactrian camel is 2-6 km. Mongol camel consumes maximum of 22 species of pasture plants during summer, and in minimum 6 species of plants in winter, 17,7% of which is fog grasses. During grazing time the camels 9-13 times pick up the pastoral plants and then 7-11 chewing them and swallow it. With increased pasture yields, time spent for chewing and swallowing per time is decreased. During a day grazing period Mongol Bactrian camel picks up pasture grass 18,2 thousand times, chews it 14,3 thousand times and swallows 1738 times daily. Adult castrated male camel consumes depending on seasons, pasture yields from 7,2 to 39,9 kg feed masses from pasture. The camel digests 51-70% of dry matter of daily consumed feed masses which fluctuates from season to season[40].

Pic. 24 Bactrian camels are grazing in saxaul-saltwort types of rangeland.

Pic. 25. Dromedary camels on the water point in hot desert.

Mongol Bactrian camel reared by around pasture spends 9,8-16,5 hours for grazing which in total corresponds to 40,8-68,7% of a day, and the rest of time is spent in their camp. Active grazing time of camels composes 30,4-48,5% of total daily time. Mongol Bactrian camel travels in average 7,8-24,7 km distance daily which of 15,0km in autumn, 7,8km

in winter, 24,7km in spring and 16,5km in summer. Average grazing radius is 1,7-2,5km in autumn, 2,3-4,0km in winter, 3,8-6,2km in spring and 4,5-6,0km in summer. While grazing, camel picks grass and plants 9-13 times and chews 7-11 times and then swallows. The rumination period of adult castrated Bactrian male camel equals to 22,2-26,9% of a day, which consists of 5-8 rumination phases, with duration of 46-59 minutes each. For the total duration of rumination, there are 437-526 chewing parts. Each part includes 26-59 chewing movements with duration of 28,5-36,6sec, and for the total duration of rumination, chewing movement is made 11,8-15,2 thousand times[40].

Mongol Bactrian camel intake a day 27,6 kg green grass which contains 176.3 gram crude protein and, 240.7 gram minerals per one kg dry matter in summer and autumn but they can intake only 13,8 kg hay that contains 127.5 gram crude protein and 135.8 gram minerals every day during winter and spring seasons. Moreover, the camel drinks 34.3-42.3 liters of water with 0.7-2.3% of mineral content each day during warm seasons and 22.3-28.4 liters with same amount mineral content of water each day during cold seasons[49].

Bactrian camel receives 1.87-6.76 kg of minerals through their feed and water, out of which, 32.3-58.3% is absorbed in its body. Camel gets its daily required amount of minerals from pasture grass and plants by 72.4-82.6%, from water by 3.6-7.0% and the remaining amount from salt, minerals enriched fodder and saltpeter. For Bactrian camel daily mineral requirement equals 3.14 gram per their body mass[49].

Bactrian camel has following behavioral features such as overall quiet manner, spread grazing at desert range, like to lie and turn over on ash or marshy soil, easy to handling and hard working for riding and backbone transport. The camels are grazing alone though rangelands not subgroups, they pick up above parts of pastoral plants during the walking. In summer session the camels go out to wind direction and use ground waters such as salty small ponds and backwaters in Gobi region.

Also, the camels have many adaptive features for desert rangeland with scarce food sources such as camel eyes can see the edible plant from distance, long and flexible movement neck which is suitable to pick up plants during the walking, a prehensile and split upper lip which is used for selectively plant parts and lower lip is large and pendulous and inner membrane of cheek is covered with conical papillae which point backwards.

Mongol Bactrian camel pick up the pasture plant up to 2,5 cm above ground surface and during the grazing the camels always moving to pick up plant. During the grazing Bactrian camel occupied dimensions with 64-99 cm width. Bactrian camel's one walking length is 27,4-59,2 cm, their front leg's pad has 125,2-307,8 and, hind leg's pad has 94,7-243,9 $см^2$ therefore, body pressure on per cm pad unit equals 521,6-609,0 grams that means camels less harmful to Gobi desert rangeland[47].

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