

Types and breeds of the Chinese Bactrian camel (*Camelus bactrianus*)

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Key words

Camelus bactrianus - Bactrian camel - Breed - Body conformation - Geographical distribution - Productivity - China.

Summary

The Bactrian camel (*Camelus bactrianus*) is an important livestock species in China. Its various specialized types and breeds are nevertheless not well enough known. The Bactrian camels are multipurpose animal primarily used as fiber producer, for transport or draft, providing milk and meat as a tertiary product without disrupting the fragile ecosystem. The current classifications are largely based on geographical locations. The paper introduces some important information on the distinctive camel types and breeds in China, their ecological environments, population, distribution, conformation, body measurements and productivity. To improve camel productivity and develop conservation strategies, an urgent need for a finer characterization of breeds, types and populations with special respect to morphology, current production levels and genetic differentiation should be emphasized.

■ INTRODUCTION

All domestic animal species differentiated into types and/or breeds soon after their domestication due to the selection for specific economic traits. This resulted in morphological and functional changes, particularly size, shape and color, which also varied according to ecological conditions and genetic factors. These changes have often been used to establish reasonably precise dates and places of initial domestication and record the history of utilization of animals by human beings.

However, the camel has gone through very few changes since it was first domesticated. Even in modern times there have been very little directed selections into what can truly be considered breeds. Very few attempts have been made to understand the organized breeding of camels for specific purposes, e.g. for meat or milk production, or to create pure breeds the way it was done for cattle, sheep, goats and horses.

Bactrian camels (*Camelus bactrianus*) are nowadays primarily classified according to their habitats and conformations and secondarily only according to functions attributed to camels. It is too early to conclude whether these differences are due to ecological factors or are breed related. There are some existing breeds or types of Bactrian camels in China. They are described in this review according to their native names or habitat areas, rather than upon strict biological and physiological differences (figure 1). Moreover, they do not relate to the local knowledge and classification system used by camel breeders themselves.

■ ALAHSAN BACTRIAN CAMEL

The Alahshan Bactrian camel is one of the earliest Chinese camel breeds and is widely distributed over most of Chinese camel habitat areas. Its population was estimated at 307,432 corresponding to 51.24% of the national camel population (2).

The breed is concentrated in the Alahshan Union and the neighboring desert areas located between latitudes 37-43° N and longitudes 97-108° E with a surface area of 400,000 km². The altitude is about 1400 m. The grassland in the area is that of typical deserts or semi-deserts; the soil pH is 8.3-9.1. The climate is typically continental: arid, windy with small rainfall. Annual precipitation is around 100 mm (40-200 mm) with evaporation as high as 2000 mm (22).

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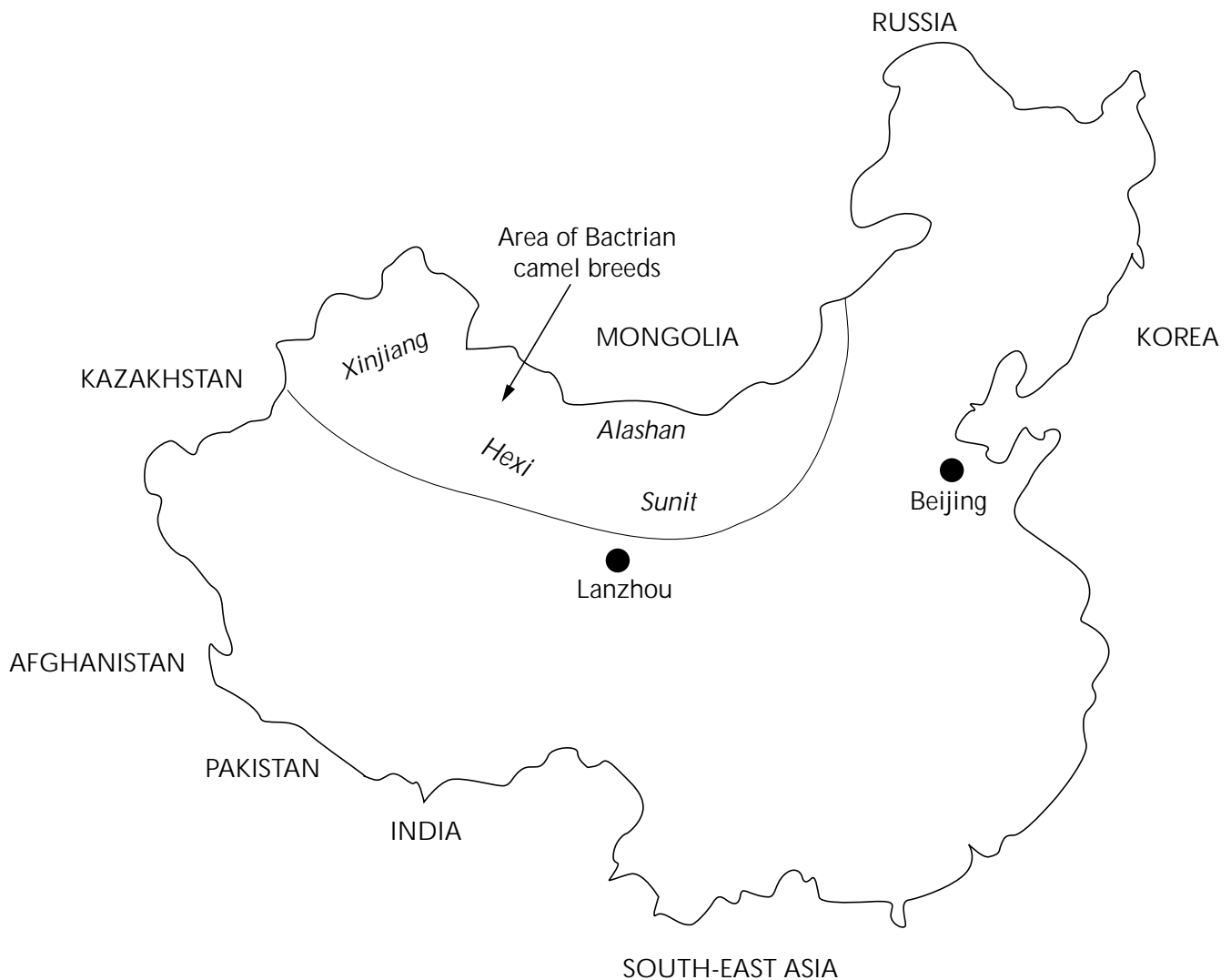


Figure 1 : Distribution of different Bactrian camel breeds in China.

General conformation

The conformation of the Alahshan Bactrian camel is well described with a short and broad head, big alert eyes, small ears, a fine and long neck, deep and broad chest, short back, long lumber, straight and strong forelegs with large feet, hindlegs with well-developed muscles and obvious joints. The neck is 90-100 cm long and Z-shaped. There are two humps 30-40 cm high. The tail is 40 cm long. The breed can be subdivided into two types according to its geographical location and basic conformation, the Gobi and Desert types. The Gobi type population is 130,000 and can be further divided into South and North subtypes. The Gobi type has a heavy muscular body, a short and strong head, protruding nose bridge, strong neck, broader and deeper chest, big and elevated humps with the front hump forward. The wool color is brown-red. Most camels of the South subtype are distributed in the West Gobi, Mazong mountainous areas and Badanjilin desert with a population of about 50,000. This subtype is characterized by a pink-yellow or brown coat. The North subtype is distributed mostly on the border between China and Mongolia. The population is about 75,000. This subtype is characterized by a brown-red or brown coat. The Desert type population is estimated at about 50,000 to 60,000. Its habitat covers the area on the

territories between China and Mongolia and the deserts of Badanjilin, Tenggeli and Wulanbuhe. The conformation of this type is characterized by a light body, fine and long wool with a high percentage of yellow color, big and alert eyes, a big and round abdomen and outside rear legs.

Body weight

The body weight of the Alahshan breed averages 454 kg for the female (n = 119), 680 kg for the castrates (n = 61). There are little differences in body measurements between sexes (table I) (16).

Productivity

Wool production is the most important trait of the Alahshan breed. Maximum production for males could be 12 kg or even more and for females about 6 kg. There is little difference between the Desert (average 4.2 kg, n = 1361) and Gobi types (4.5 kg, n = 2613) (16). However, there are some differences in the thickness of the wool between subtypes (table II) (7, 10, 12, 15).

Work capacity for the Alahshan breed is pretty good. The fastest speeds were 25 min 4.2 sec and 10 min 44 sec for distances of 10 and 5 km, respectively (17).

Table I
Body measurements of the Alahshan Bactrian camel

Sex	Num.	Height (cm)	Length (cm)	Heart girth (cm)	CC ^a (cm)	Length index	Heart girth index ^b	Trunk index ^c	CC index ^d
Male	185	172.3	147.3	218.2	20.6	85.5	126.6	148.1	11.9
Female	1356	168.8	143.5	213.0	18.8	85.0	126.2	148.4	11.1
Castrate	668	174.9	148.4	218.8	20.9	84.8	125.1	147.4	11.9

^a Cannon circumference

^b Heart girth (cm) / height (cm) x 100%

^c Trunk length (cm) / height (cm) x 100%

^d Cannon circumference (cm) / height (cm) x 100%

Table II
Wool thickness of the Alahshan breed subtypes (cm)

Subtypes	Sex	Num.	Neck		Shoulder		Front side		Hindside		Croup		Average	
			Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE		
N Gobi	Male	5	5.90	0.80	5.50	0.50	5.50	0.61	5.40	0.42	4.00	1.12	5.26	1.16
	Female	26	5.04	0.75	5.23	0.59	5.52	0.71	5.08	0.87	3.65	0.61	4.90	0.95
	Castrate	11	5.50	0.63	5.77	0.85	5.68	0.93	5.45	0.91	4.05	0.65	5.29	0.99
Mean			5.48	1.07	5.50	0.65	5.57	0.75	5.31	0.73	3.90	0.79	5.15	1.03
S Gobi	Male	9	5.72	0.67	5.72	0.44	5.89	0.85	5.65	0.65	3.50	0.56	5.21	1.14
	Female	46	5.59	0.82	5.79	0.66	6.10	0.89	5.60	0.60	3.67	0.62	5.30	0.16
	Castrate	5	5.30	0.84	5.90	0.65	5.90	0.72	5.55	0.55	4.60	0.55	5.45	0.06
Mean			5.54	0.78	5.80	0.58	5.96	0.82	5.60	0.60	3.92	0.58	5.32	0.45

SE = standard error

The Alahshan breed can transport 150-250 kg loads at a speed of 25-30 km per day. The maximum draft power for a castrate is 428 kg. When used as plough animals, a pair of camels could plough 330-450 m² of land in one day (16).

Dressing for castrates is estimated at 50-55%. The carcass weight is around 200-250 kg and fat 20-40 kg. The composition of camel meat is shown in table III (16).

Residual daily milk yield for the Alahshan breed averages 1.5-2.0 kg after suckling. The lactation period lasts 14-19 months.

Growth and development

The newborn calves weigh 35 kg, i.e. 5-7% of the mature body weight. Male calves weigh slightly more than females. The early growth rate depends a lot on management and the dam nutritional status. The subsequent growth also depends very much on management, the environment and general climatic and vegetation conditions. The mature weight is not reached until 5 to 6 years of age. The growth and development patterns of the neonates are characterized by rapid growth from the third to fifth months, followed by a slow growth and an even slower growth before weaning. The weight increases gradually up to eight months after birth, but there is no significant growth at nine months mainly because of the grass shortage and cold weather during this period of the year (20).

■ XINGJIANG BACTRIAN CAMEL

This breed is named after its habitat or locality and is distributed almost all over the Xingjiang region. This region is located in the center of the Asian continent and is divided by the Tian mountain into northern and southern parts. Xingjiang played an important role in camel transport on the ancient Silk Road. Nowadays, the Xingjiang Bactrian camel is considered to consist in two different types due to its vast distribution, geographical and climate variations, i.e. Northern Xingjiang and Southern Xingjiang types. The population for these two types is 160,000 (65% of the total population of Xingjiang camels) and around 80,000 for each of them (1, 4, 8, 9, 11, 20).

The Northern type is characterized by strong body conformation, a light and small head, short legs, apart and well-developed humps, a deep and broad chest, thick and dense wool coat. The wool color is light yellow in more than half of them (50.5%), brown (30.5%), dark red (15%) and milk-white (4%). The mean body weight is 582 kg for males and 479 kg for females. Males and castrates are slightly bigger than females (table IV). The average wool yield is higher for males (8.3 ± 1.59 kg) than for females (4.68 ± 1.1 kg) and net pure wool reaches 75% (16).

Table III

Meat compositions of the Alahshan breed

	Moisture (%)	Dry matter (%)				
		Absorbed water	Protein	Fat	Ash	Liver sugar
Mean	57.25	4.67	80.96	5.21	4.44	4.80
SE	4.63	0.67	2.73	3.40	0.23	1.60
CV	8.01	13.63	3.38	65.30	5.23	33.39

SE = standard error

CV = coefficient of variation

Table IV

Body measurements of the Northern Xingjiang Bactrian camel

Sex	Num.	Height (cm)	Length (cm)	HG ^a (cm)	CC ^b (cm)	Length index ^c	HG index ^d	Trunk index ^e
Male	157	172.6	150.7	217.3	21.3	87.0	125.9	144.8
Female	514	167.8	147.3	207.6	18.6	87.8	137.7	140.9
Castrate	58	178.2	158.2	231.8	22.3	88.8	130.1	146.5
Average	729	172.87	152.07	218.9	20.73	87.86	131.23	144.06

^a Heart girth^b Cannon circumference^c Length (cm) / height (cm) x 100%^d Heart girth (cm) / height (cm) x 100%^e Trunk length (cm) / height (cm) x 100%

The Southern type is characterized by a high body, long legs, a small head, straight nose, long neck, narrower trunk, light body and small humps. The wool color is buff in more than half of the population (55.9%), brown-red (24.2%), dark brown (13.0%) and cream (6.9%). Wool yields are 6.57 ± 1.12 kg for males and 4.83 ± 0.83 kg for females. The carcass weight is 200-250 kg for castrates, the fat from both humps is 20-30 kg. Body measurements and growth pattern for this type are shown in table V and figure 2 (16, 23).

■ SUNIT BACTRIAN CAMEL

The Sunit Bactrian camel is distributed in the desert area of inner Mongolia, mostly in the Sunit Left Banner, Sunit Right Banner and Wulanchabu Union between latitudes 41-45° N and longitudes 110-116° E, with a surface area of about 150,000 km² and an altitude of 1000-1500 m.

The climate is arid, windy with little rainfall, long sunshine hours and huge variations in day/night temperatures. The aridity gradually increases from southeast to northwest. The average annual rainfall is 140-220 mm, of which 70% occur in July-September. Cumulative snowfall is about 10 cm within a snow time period of 68-83 days. The annual evaporation is about 2200-2500 mm. The humidity is 0.15-0.3 and the annual relative humidity is 55-55%. The temperature in this area is lower than in other parts of the region (16).

General conformation

This breed is characterized by good conformation, strong bones, well-developed muscles, thick and dense wool, a large body, long

trunk, deep and broad chest, big humps and heavy appearance. The coat color in this breed is brown-red (37.24%), buff (35.63%), brown (18.48%) and cream (8.65%). The Sunit Bactrian camel population in Xiling Gaole Union and Wulanchabu Union is about 65,000 (13, 14).

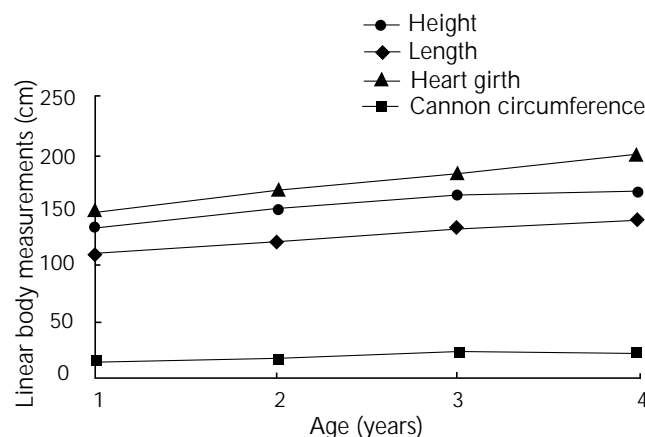


Figure 2 : Growth pattern of four linear body measurements in the Southern Xingjiang Bactrian camel.

Body measurements

Females of this breed are slightly smaller and lighter than males and castrates (table VI) (14) and Sunit Bactrian camels are bigger than other Bactrian breeds (table VII).

Productivity

The annual wool yields are different due to different shaving methods. The average yield is 4.5 kg if the wool is collected during its natural molting time, and 5.85 kg if it is collected with scissors (14).

The transport capacity for this breed is 150-200 kg and 250-300 kg for long and short distance transportation, respectively. Its running speed is 32 min 15 sec over a 12.5 km distance (14).

The carcass weight for this breed is 250-350 kg, with a maximum at 480 kg. The fat weighs at most 101 kg. Dressing is 55 to 61.44%. The mean meat production of the Sunit breed is higher than that of the Alahshan Bactrian breed (table VIII).

Residual daily milk yield is 1-1.5 kg after suckling. The lactation lasts 12-14 months. The milk contains 5.5% milk fat (14).

Table V

Body measurements of the Southern Xingjiang Bactrian camel

Sex	Num.	Height (cm)	Length (cm)	HG ^a (cm)	CC ^b (cm)	Length index ^c	HG index ^d	Trunk index ^e
Male	40	183.1	152.4	215.9	21.0	84.1	117.9	141.7
Female	64	173.8	147.5	209.6	19.1	84.9	120.6	142.1
Castrate	19	180.0	155.2	220.1	20.7	86.2	122.3	141.51
Average	123	178.97	151.7	215.2	20.27	85.07	120.2	41.77

^a Heart girth^b Cannon circumference^c Length (cm) / height (cm) x 100%^d Heart girth (cm) / height (cm) x 100%^e Trunk length (cm) / height (cm) x 100%**Table VI**

Body weight and measurements of the Sunit Bactrian camel

Sex	Num.	Weight (kg)	Height (cm)	Length (cm)	HG ^a (cm)	CC ^b (cm)	Length index ^c	HG index ^d	Trunk index ^e	CC index ^f
Male	84	738	174.9	155.7	239.7	24	89.0	137.0	150.0	13.7
Female	251	646	172.8	153.3	232.8	20.3	88.7	134.7	151.0	11.7
Castrate	223	702	180.4	159.4	247.3	22.6	88.4	137.1	155.0	12.5

^a Heart girth^b Cannon circumference^c Length (cm) / height (cm) x 100%^d Heart girth (cm) / height (cm) x 100%^e Trunk length (cm) / height (cm) x 100%^f Cannon circumference (cm) / height (cm) x 100%**Table VII**

Comparison of body measurements between Sunit and other Bactrian camels

Breeds	Num.	Height (cm)	Length (cm)	HG ^a (cm)	CC ^b (cm)	Length index ^c	HG index ^d	Trunk index ^e	CC index ^f
Sunit	251	172.8	153.3	232.8	20.3	88.7	134.7	151	11.7
Alahshan	531	168.9	142.9	201	18	84.7	119	140	10.6
Xingjiang	48	166	144.9	211	18.6	87.3	127.1	145.5	11.2
Hasake	732	170.4	150.3	216.4	19.7	88.2	126.9	143.9	11.6
Mongolian	242	166.3	146.3	207.1	18.2	88.1	124.5	141.4	10.9

^a Heart girth^b Cannon circumference^c Length (cm) / height (cm) x 100%^d Heart girth (cm) / height (cm) x 100%^e Trunk length (cm) / height (cm) x 100%^f Cannon circumference (cm) / height (cm) x 100%

Table VIII

Comparison of meat production between Sunit and Alahshan Bactrian camels

Breeds	Num.	Carcass		Net meat and fat		Fat		Average live weight kg	Bone:meat ratio	Fat:meat ratio
		kg	%	kg	%	kg	%			
Sunit	4	428	61.4	340.5	48.99	68.6	9.9	695.5	1:4	1:3.9
Alahshan	11	249.1	56.7	177.5	40.4	16.9	3.68	439.4	1:2.6	1:9.5

Growth and development

Newborn calves weigh 37 kg, and their daily weight gain is 550-700 g up to 45 days after birth. Body measurements of males and females up to 5 years of age are shown in figures 3 and 4, respectively. The breed fertility is relatively low (42.8% with a maximum at 57.2%).

■ HEXI BACTRIAN CAMEL

The Hexi Bactrian camel is distributed mostly in the Hexi corridor of Gansu province. The geographical location of the Hexi corridor is at latitudes 37°19' to 42° N and longitudes 92°13' to 103°54' E.

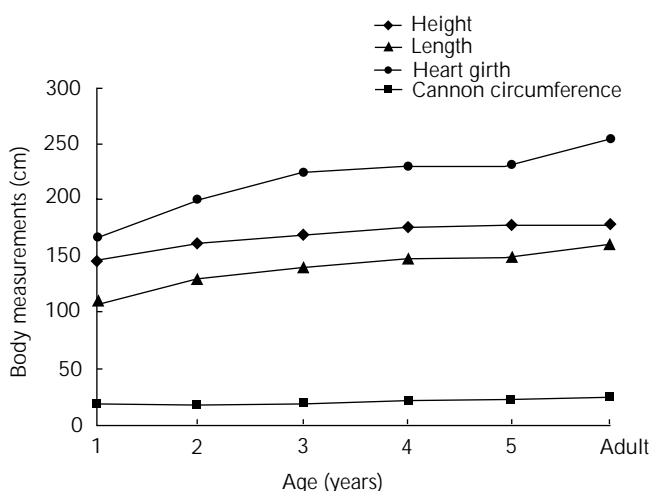


Figure 3 : Growth pattern of the male Sunit Bactrian camel.

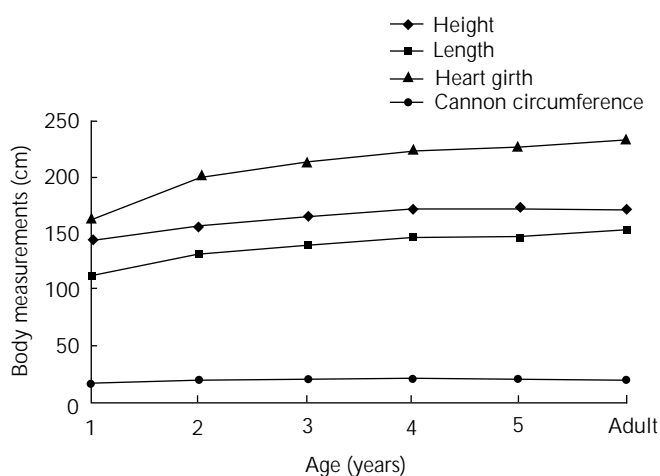


Figure 4 : Growth pattern of the female Sunit Bactrian camel.

The altitude range is 1000-2500 m above sea level. The area is surrounded in the northeast by the Grand Badanjilin and Grand Tengeli deserts, in the east by the Kumuda desert (3, 19).

Conformation and development

The Hexi Bactrian camel is characterized by an average height, a strong compact body, well-developed muscles, a thick skin, long and strong neck, wide and deep chest, average developed humps, strong legs with big foot disks, a short croup and poor developed hind trunk. Males' average body weight is 410.56-448.85 kg, females' is 356.69-357.65 kg and castrates' is 405.67-461.93 kg (3, 19).

Productivity

Wool yield of the Hexi Bactrian camel averages 3.33-6.45 kg, generally 4.67 kg for the castrates and 4.22 kg for the females. The variability in wool production between counties is low: 4-6 kg for males and 3.3-6.6 for females. Wool quality also varies between and within counties (table IX) (3). The wool production in Gansu province from 1978 to 1994 is shown in comparison with other wool products such as sheep wool, goat wool and goat mohair in figure 5. It can be seen from the figure that during that time, with changes in Chinese agricultural policy (provincial autonomy), camel wool had and still has an impact on the provinces' economy.

The Hexi Bactrian camel is the main working animal in the area, mostly used as a draft or pack animal. When used for drafting it can plough about 0.3 ha per day, when used for transporting it can move at about 15 km/h. A camel can transport about 150-200 kg and cover about 30 to 40 km per day.

Dressing of the Hexi Bactrian camel is about 51% and net meat 35.7%.

A female Hexi Bactrian camel produces about 0.5-2 kg of milk with 5.3% milk fat and the lactation period is 14-17 months.

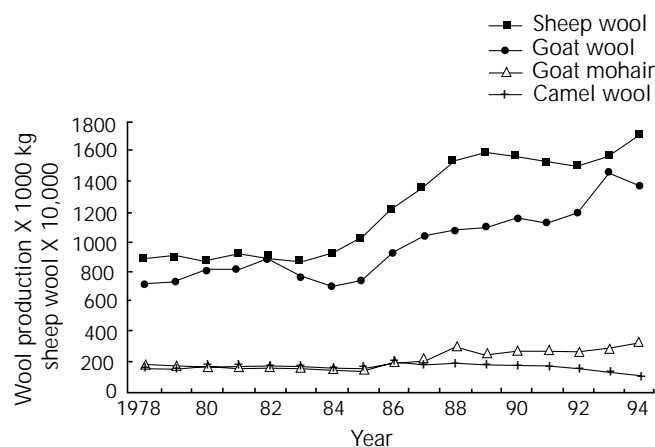


Figure 5 : Wool production in Gansu province from 1978 to 1994.

Table IX
Wool quality of the Hexi Bactrian camel

Age	Sex	Area	Num.	Depth of fur coat		Length of fiber		Density		Net wool %	
				Mean	SE	Mean	SE	Mean	SE	Mean	SE
1	Male	Anxi	9	6.22	0.25	9.29	1.89	3936.44	561.19	83.14	5.47
		Minqing	6	5.25	0.69	9.39	1.19	2703.05	640.88	82.10	5.21
	Female	Anxi	6	6.75	0.56	11.25	1.29			82.95	4.46
		Minqing	6	5.08	0.60	7.08	0.61			77.05	12.6
2.5	Male	Anxi	8	6.94	1.07	9.5	1.12	3491.14	281.85	83.55	5.17
		Minqing	9	5.94	1.44	3.28	1.84	2684.01	427.61	79.69	7.04
	Female	Anxi	9	6.72	1.18	10.56	2.06			85.02	4.52
		Minqing	8	5.06	0.58	7.69	2.06			84.46	6.31
Adult	Male	Anxi	6	5.76	1.16	9.17	1.57	3841.10	643.92	75.23	14.91
		Minqing	6	5.16	0.38	8.17	1.07			74.03	15.06

CONCLUSION

Although the Chinese Bactrian camel is scattered in usually limited areas and there are few socioeconomic differences between various breeds and types, obvious variations in its genetic structure have been observed under comprehensive factors such as the unique natural and social ecological environment and the artificial selection. According to the available data, there is a rich multi-level Chinese camel genetic diversity with regard to its body type, appearance, blood protein, chromosomal characteristics and DNA molecule, which are the material bases for the sustainable development of camel husbandry. Research, especially at the DNA level, protection and utilization of camel genetic diversity are still little developed, compared to those of other kinds of livestock. Therefore, more research in the Chinese camel genetic diversity, especially at the DNA level, are essential to further develop protection and utilization of camel genetic resources.

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Résumé

Zhao X.X. Types et races de chameau de Bactriane (*Camelus bactrianus*) en Chine

Le chameau de Bactriane (*Camelus bactrianus*) est une espèce importante au regard de l'activité de l'élevage en Chine. Malgré cela, elle reste insuffisamment connue en ce qui concerne les diverses races et types spécialisés utilisés. Le chameau de Bactriane est un animal à multi-usage principalement utilisé à des fins de production de fibres textiles, pour sa force de transport et de traction et, en dernier lieu, pour son lait et sa viande, une exploitation qui respecte le fragile équilibre écologique. Les classifications actuelles ont surtout été faites à partir de la situation géographique des animaux. L'article présente d'importantes informations sur les types et les races d'animaux distincts, leur environnement d'élevage, leur population, leur distribution géographique, leur conformation, leur caractérisation biométrique et leur productivité. Pour améliorer la production des chameaux et élaborer une stratégie de conservation, il est devenu essentiel et urgent d'affiner la caractérisation des races, des types et des populations par rapport à leurs caractéristiques morphologiques, leur niveau de production et leur différenciation génétique.

Mots-clés : *Camelus bactrianus* - Chameau d'Asie - Race - Conformation animale - Distribution géographique - Productivité - Chine.

Resumen

Zhao X.X. Tipos y razas de camello Bactriano chino (*Camelus bactrianus*)

El camello Bactriano (*Camelus bactrianus*) es una importante especie doméstica en China. Sin embargo, no se conoce lo suficiente sobre las diversas razas y tipos especializados. Los camellos Bactrianos son animales multipropósito, utilizados principalmente como productores de fibra y transporte o carga, proporcionando leche y carne como producto terciario, sin disrupción de un frágil ecosistema. Las clasificaciones actuales se basan principalmente en las localizaciones geográficas. El presente artículo introduce información importante para la distinción de los tipos y razas de camello en China, su medio ecológico, población, distribución, conformación, medidas corporales y productividad. Para el mejoramiento de la productividad y la estrategia de conservación del camello, debe darse, urgentemente, un énfasis a la caracterización de las razas, tipos y población, con especial interés en la morfología, niveles actuales de producción y diferenciación genética.

Palabras clave: *Camelus bactrianus* - Camello Bactriano - Raza - Conformación animal - Distribución geográfica - Productividad - China.