

CAMEL GENETIC RESOURCES OF INDIA

SINDHI

C A M E L



ICAR-NATIONAL RESEARCH CENTRE ON CAMEL

Post Box-07, Bikaner-334001 (Rajasthan) India



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SINDHI *Camel*

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**Network Project on AnGR
Characterization of Sindhi Camel**



ICAR-National Research Centre on Camel

Post box No-07, Bikaner-334001 (Rajasthan)



Citation:

Prakash V. Sawal, R. K. Jyotsana, B. Sharma, R. Tantia M. S. and Sahoo, A. 2022-Camel Genetic Resources of India-Sindhi Camel, NRCC /Technical Bulletin /2022 /published by ICAR-National Research Centre on Camel, Bikaner, Rajasthan

Publication:

March, 2022

Published by:

Director, ICAR- National Research Centre on Camel, Bikaner-334001 (Raj.)

ISBN: 978-81-927935-8-0

Printed at:

M/s Royal Offset Printers, A-89/1, Naraina Industrial Area, Phase-I,
New Delhi 110 028.

PREFACE

Nothing symbolises the cultural identity and life of desert state of Rajasthan better than Camel. This iconic animal is now state animal of Rajasthan. By virtue of several adaptive features, it has served the mankind for centuries under harsh climatic conditions. The traditional use of camel for long distance trade and transport, and as a draught power has drastically reduced. However, the use of camel in local transportation of goods, in the religious and ceremonial processions and by the border security forces of the country is still in vogue and contributing to its sustenance. In recent times its use in ecotourism and as a milch animal has increased significantly.

Around 28% of the Indian camel population is still non-descript. The characterisation of Sindhi breed of camel is an attempt to identify one of the non-descript Indian camel population. The characterisation of the breed will lead to documentation of its physical feature, production potential, population statistics as well as identification of the problem faced by the Sindhi camel breeders. With proper information available for the breed it will be possible to get increased support for improving the production potential of the breed. This can be boon for its sustenance under changing camel production scenario. It is truly said that utility of a species conserves it.

The support received from Co-PI Dr. R. K. Sawal, Pr. Scientist and project supervisors Sh. Gajanand, Rajendra Kumar, Amit Kumar, Danaram, Arjun Kumar and Jaskaran Dan, officers of Animal Husbandry Department, enumerators and the camel owners is highly acknowledged. The All India Radio Team of “Untan Ri Bataan” programme and all experts who delivered talks deserve hearty appreciation.

Sincere thanks are due to the higher authorities of Indian Council of Agricultural Research, New Delhi for sanctioning the project and to Dr. M.S. Tantia, PS & In-charge, Dr. Rekha Sharma, Dr. Rahul Behl, Dr. K. N. Raja, Dr. Arjava Sharma, Ex-Director, and Dr. R. K. Vijn, Ex-Director, and Dr. B.P. Mishra, Director, ICAR-National Bureau of Animal Genetic Resources, Karnal for the support rendered in successful execution of the project. The Director, scientists and staff members of ICAR-National Research Centre on Camel, Bikaner who have extended their whole hearted support in successful execution of the project, is duly acknowledged.

The kind of relationship that was established with the camel farmers and other stakeholders during the programme will be carried forward in future for betterment of the camel and camel herders.



Ved Prakash

Senior Scientist &
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SINDHI Camel

INTRODUCTION

The camel is ideally suited to desert life. They are found in hot as well as cold deserts. According to the zoological classification, camel, llama, alpaca, guanaco and vicuna constitute one family, camelid. The camelids belong to order Artiodactyla (even-toed ungulates), and sub-order Tylopoda. Camelids as ruminating animals are classified in proximity to ruminants but are not part of the suborder Ruminantia. Differences such as foot anatomy, stomach system and the absence of horns confirm this fact (Schwartz and Dioli, 1992; Fowler, 1998; Werney, 2003). They are considered pseudo ruminants, having no horns, an elongated neck, a long head, split upper lip, and feet in the shape of broad pads. The genus camelus has two species, the one humped camel found in Africa, Arabia, Iran, Afghanistan and India and two humped camel found in Central Asia reaching up to Mongolia and Western parts of China. It is a multipurpose animal and used for milk, meat, hides and transport. According to Rathore (1986) the word 'camel' is derived from the Greek word *Kremal*. The Greeks borrowed this word from the original sanskrit word *kreluk* which means "throwaway legs". This word might have been given to the camel in Sanskrit because when they runs they actually throws out their legs in the air and has very little control over them. In Hindustani the camel is called *oont* and in persian *ustra*. Both these words are borrowed from the Sanskrit word *ustra*, which literally means "over blacked colour" that is blackish brown. The name of the dromedary derived from the Greek, "*dromeus*" which means runner or *droma* means running (Jassim and Naji, 2002). The Egyptians called it 'evil animal' probably because all the invaders during ancient days came on camel back from Arabia to Egypt (Rathore, 1986).

Many researchers indicated that the origin of camels can be traced to the Protylopus, a rabbit-sized animal with four toed feet and low crowned teeth that occupied the North American continent during the eocene period or 45-50 million years ago (Indra et al., 1998). Around 35 million years ago, camelids such as poebrotherium were about the size

of a present day goat. The family diversified and prospered but remained confined to the North American continent until only about 2 or 3 million years ago, when representatives arrived in Asia and South America. The one-humped or dromedary camel (*Camelus dromedarius*) reached the eastern limit of its continuous distribution area in the Indian subcontinent.

Classification of any regional local type camel population as a breed should not be only according to its physical or performance characteristics but should also be based on examination of socio-historical context in which camel breeding was practiced in India (Kohler-Rollefson, 1992a). Many non-literate pastoral societies have developed distinct breeds because of social mechanisms which precluded the commercial sale of breeding stock, essentially leading to a well demarcated and stable gene pool (Kohler-Rollefson, 1992 b). In India there were several regional situations in which camel subpopulations were sequestered and distinct breeds could develop. Before the camel became popular as a draught animal, the breeding and ownership of camels was largely restricted to only two castes, the Rajputs and Raikas. Evidences for involvement of Sindhi trader community in long-distance commerce and the caravan trade also indicates towards their interest in camel ownership. The Rajputs, composed of the ruling elite of Maharajahs, Rajas and lesser feudal landowners, required large numbers of camels for warfare among themselves and against muslim invasions. For this purpose, the majority of the states of Rajputana, including Bikaner, Jaisalmer, Jodhpur and Jaipur maintained camel corps. The Rajputs employed members of a specialized caste, the Raikas, to look after their tolas or camel breeding herds (Kohler-Rollefson 1992a; Srivastava, 1991). Even after the feudal system was abandoned and the royal camel tolas were dispersed at the beginning of the 20th century, many of the Raikas continued their camel breeding tradition, and today most large scale camel breeding is still practiced by them (Kohler-Rollefson, 1992a).

The camelids occupy most difficult lands on the earth and hence they have developed several unique adaptive features for their continued survival. Some of the important features are:-

1. They have a three-chambered (omasum absent) rather than a four-chambered digestive tract.
2. The upper lip splits in two parts, with each part separately mobile.
3. They have single-domain antibodies (also known as nanobodies or VHs)

which lack a light chain and are composed of two identical heavy chains.

4. They have padded foot (Tylopoda) instead of hooves.
5. They have long eyelashes and the unique ability of closing their nostrils to face sandstorms.
6. They can fluctuate their body temperature to avoid excess perspiration and have specialized kidneys, which make them able to tolerate even more than 30 % water loss.
7. They have unique red blood cells (Erythrocytes). The red blood cells are non-nucleated but oval in shape.
8. They can live for several days without drinking water, surviving extreme dehydration and safely losing 40 % of its body weight.
9. They are capable of expanding their red blood cells up to 240 % of their original volume without rupturing, whereas most animals' cells can expand only up to 150%.

According to Faye (2020), there are officially 46 countries in the world declaring camel stock, of which 20 countries are in Africa, 25 in Asia and one in Europe (Ukraine). The dromedaries are found in African countries and in near and Middle Eastern and Southern Asian countries, and bactrians inhabit only Central Asia. The two species, however, are cohabiting in a few countries only, mainly in Kazakhstan. The total number of camels recorded in the world is more than 3.5 million (FAOSTAT 2020). As per National Bureau of Animal Genetic Resources (NBAGR), Karnal, India has nine registered breed namely Bikaneri, Jaisalmeri, Marwari , Jalori, Mewari, Mewati, Kachchhi, Kharai and Malvi. Since the population of camel in India has gone down from its ever highest of 1.10 million in 1977 to 0.25 million in the year 2017, several of the camel rearing tracts now possess very few animals without any breeding group. The dwindling camel population in the country is a matter of major concern for the conservation biologist, policy makers and the state governments.

A large Indian camel population (around 28%) are still uncharacterised. The efforts of ICAR-National Bureau of Animal Genetic Resources (NBAGR), Karnal helped to reach those population, identify their unique features, characterise them and recognise them as a breed. The journey to reach the areas which were not covered earlier are still on to achieve the Zero-non descript status.

ORIGIN OF SINDHI CAMEL

In India, camel breeds are mainly named after the region in which they have originated. Sindhi camel originates from the Sindh province of Pakistan. It is named after Sindhu gotra Jats. The descendants of Maharaja Sindhu are Sindhu gotra Jats. Jats appear to be the original race of Sindh valley, stretching from the mouth of Indus to as far as the valley of Peshawar. According to Anjum, (2006) use of the dromedary in Sind was noticed by Chinese pilgrim Huien Tsang when he visited Sind in 7th century. He noticed that in Sin-tu (Sind) “the camels are small in size and have only one hump”. When in 712 A. D. Muhammad Bin Qasim conquered Sind, he led a composite army of horses, dromedaries (ushtra) and infantry. In Mughal India camels were mainly bred in the north-western part of the empire. Abul Fazl noted that they were bred near Ajmer, Jodhpur, Nagor, Bikaner, Jaisalmer, Bhatinda, Bhatnir and in Gujarat, Sind, etc. Certain communities specialised in breeding and rearing of camels. In the pargana of Alor in Bhakkar, people called Pawar bred camels in abundance and they let them on hire for transporting goods to Jaisalmer, Multan and Qandahar etc. A smaller number of people crossed the Thar desert border area by camel during partition.

GEOGRAPHICAL DISTRIBUTION AND BREEDING TRACT

The geographical distribution of the breed encompasses border areas of Jaisalmer and Barmer districts. Jaisalmer share boundary with Pakistan border on the west and south-west. The length of the international border attached to Jaisalmer district is around 464 km. The western part of Barmer also share boundary with Pakistan. Thus, the Sindhi camel is found mostly in west and south-west Jaisalmer and west Barmer, the area which lies in vicinity of Pakistan Border. However, some animals are also present in the tehsils/ villages which are not in close proximity of the international border. The camel farmers consider all the animals which shared some lineage with Sindhi breed as Sindhi camel. Any calves born to Sindhi female or female with some Sindhi inheritance are reported as Sindhi. However, they are cross bred camel with Jaisalmeri and Marwari. During the morphometric measurement such animals were not recorded. Due to this the number of animal on which morphometric measurement made and total number of Sindhi camel reported differed. With reduced movement of people and animals across the border the number is very limited. The animals are not as attractive as Bikaneri and Jaisalmeri breed in physical appearance hence Sindhi males are not preferred much, which has also served as a deterrent in its population expansion.

Extent of survey

Characterization is an integral part of conservation because only after proper characterization the availability of breeding males, females and the population of a breed can be estimated. The survey work was carried out in 186 households from 61 villages of 6 tehsils covering Jaisalmer and Barmer district of Rajasthan (Table-1).

Table 1: Extent of survey for characterization of Sindhi camel

S.No.	District	Tehsil	No. of Villages	No of farmers
1.	Barmer	Barmer	07	15
		Gadra	07	47
		Shiv	07	12
2.	Jaisalmer	Pokhran	07	14
		Jaisalmer	18	48
		Fatehgarh	15	50



Sindhi camel breeding area

Socio-economic profile of Sindhi camel breeders

The Sindhi camel breeders are mostly from Rajput (60.00%), Muslim (16.60%), and Raika/Dewasi (15.50%) community. Less than 10% farmers belonged to other community like Jaat, Bheel, Meghwal and Rajpurohit. Average household size was 6.62 with average composition of 1.76 adult male, 1.48 adult female, 1.90 male child and 1.48 female child. Literacy level was poor (20%) among Sindhi camel farmers. 80% farmers were illiterate of which 32% farmers were capable of doing their signature. Among the literate also 55.56% can only read and write and 44.44 were 10th pass and above. Among the surveyed Sindhi camel farmers 34.92% were landless and 65.08% have land. The 84.55% of the farmers with land possessed non-irrigated land. Average landholding per farmer was 26.21 bigha which included 1.67 bigha of irrigated and 24.54 bigha of non-irrigated land. Main source of income was agriculture (65.67%) and animal husbandry (73.13%). Some of the farmer (10.38%) also worked as a labour and has other sources of income. Farmers reported little or no income from camels as it has limited uses now days. Some of the farmers are using it for carrying load and also earning income through the sale of extra male animals. Even through sale of the animals has drastically reduced, the use of camel for domestic purpose, transport of water in border areas and in tourism adds to the income of camel breeders. The use of camel hairs for preparation of items of domestic need contribute to indirect income of the camel owners. Many farmers does not have income through it but they are rearing it as their forefathers reared it and it is associated with their family tradition.

More than 93% of the camel owners rear cattle, 66% rear sheep and 86% rear goat (Table-2). Some of the farmers also kept donkey and horses. Average camel herd size was higher in Jaisalmer (35.59) and lower in Barmer (19.60). The Sindhi camel keepers maintained large sheep and goat flocks.

Table 2: Livestock species reared by the camel owners in the breeding tract

S No.	Districts	No. of Household	Cattle	Sheep	Goat	Camel	Horse	Donkey
1.	Barmer	74	557 (71)	2629 (58)	2915 (68)	1451 (74)	25 (11)	67 (15)
2.	Jaisalmer	112	795 (102)	2906 (66)	3231 (93)	3987 (112)	09 (5)	9 (04)
3.	Total	186	1352 (173)	5535 (124)	6146 (161)	5438 (186)	34 (16)	76 (19)

Figures in brackets indicate number of households.

SOCIO-ECONOMIC PROFILE



Age-wise and sex-wise distribution

The status of a particular breed with respect to its age-wise and sex-wise distribution in different area of the breeding tract is very important. Among the two districts in which survey work was carried out, distribution of the Sindhi camel was more in villages which are in close proximity to the international border. Only 32% farmers reported exclusive herd of Sindhi camel. These herds were mostly in the areas of Harnau, Murar, Kramwali, Khara Jhanda in Jaisalmer district and Magra, Trisingada of Barmer district. The average herd size was 12.44 with farmers having exclusive Sindhi camel herd. In the other villages of the district few camels of Sindhi breed were found with the farmers. The morphometric traits were recorded for 768 camels. Though farmers reported more animals belonging to this breed but when individual camel was judged for the breed characteristics some of the animals were not found true to the breed but were counted as Sindhi as it shared some lineage with Sindhi. In the present survey the ratio of breedable males to females was around 1:4 for Sindhi. The age-wise and sex-wise population of Sindhi camels recorded during survey in the breeding tract is presented in Table 3, 4 and 5 below.

Table 3: Age-wise and sex-wise camel population with Sindhi camel owners

Age Group	≤1 years			1-4 years			Above 4 years			Over all		
Category	Sindhi	Others	Total	Sindhi	Others	Total	Sindhi	Others	Total	Sindhi	Others	Total
Male	231	217	448	186	301	487	270	328	598	687	846	1533
Female	260	258	518	269	440	709	1082	1596	2678	1611	2294	3905
Total	491	475	966	455	741	1196	1352	1924	3276	2298	3140	5438

Table 4: District-wise distribution of Sindhi camel population (Male)

Age Group	≤1 years		1-4 years		Above 4 years		Total	
Category	Sindhi	Others	Sindhi	Others	Sindhi	Others	Sindhi	Others
Barmer	96	24	101	60	60	46	257	130
Jaisalmer	135	193	85	241	210	282	430	716
Total	231	217	186	301	270	328	687	846

Table 5: District-wise distribution of Sindhi camel population (female)

Age Group	≤1 years		1-4 years		Above 4 years				Total	
					Dry		Lactating			
Category	Sindhi	Others	Sindhi	Others	Sindhi	Others	Sindhi	Others	Sindhi	Others
Barmer	99	25	137	78	192	62	223	248	651	413
Jaisalmer	161	233	132	362	421	588	246	698	960	1881
Total	260	258	269	440	613	650	469	946	1611	2294

BREED CHARACTERISTICS

Body colour

The physical appearance of camel is chiefly defined by the body colour followed by stature and other phenotypic characteristics. The predominant colour of Sindhi camel is brown and sand brown. However, it varies from sand brown to dark brown. When the calves are born, the body colour is generally lighter and the hairs are curly. The body colour gets darker and the curls open with age.

Head Profile

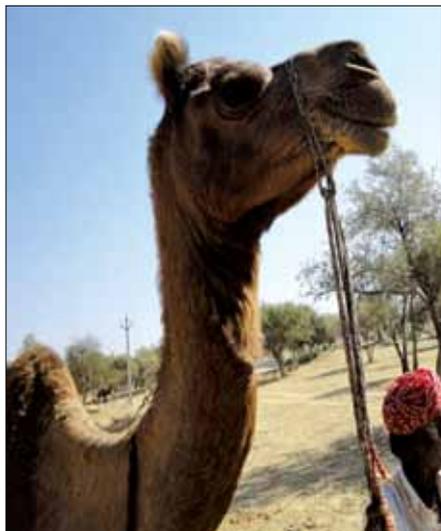
The head in Sindhi camel is medium to large in size. Lips are normal but lower lips are droopy in some animals. They have small ears set well apart from the head.

Body and stature

The Sindhi camels have medium to large body size. They have active temperament. The hump is medium in size. Chest pads are well developed. The body hairs are coarse in quality and medium in length.

Udder Characteristics

The animals have good milk yield potential. Udder is mostly round but some animals have pendulous udder. There are four quarters and each quarter has mostly cone shaped teat with two canals in it. Milk vein is well developed which is mostly of medium size.





Sindhi Male

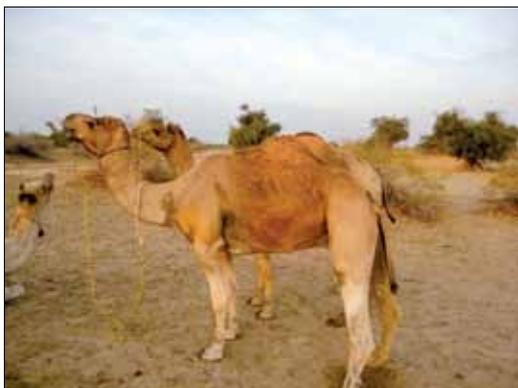
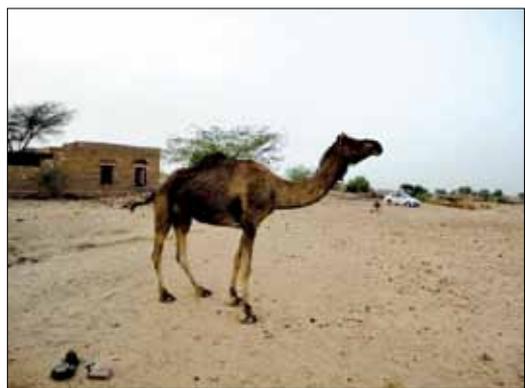


Sindhi Female



Sindhi Herd

COLOUR PATTERN OF SINDHI CAMEL



MORPHOMETRIC CHARACTERISTICS AND GROWTH PROFILE

Body measurements

The camels of four year and above age are considered adult. At this age the permanent incisors starts erupting and males and females attains puberty. However, the camels continue to gain weight significantly till eight year of age, which is generally noticed by the presence of prominent canines in the mouth. Looking at the length of growth phase, the morphometric traits have been presented separately for the calves (up to one year age), followed by adolescent camels (1 to 4 years of age) and then for adult male and female camels of above four year age (Table 6, 8 and 7).

Table 6: Morphometric measurement (cm) of Sindhi camels (≤ 1 year age)

S.No.	Characters	Female(30) Mean \pm S E	Male (29) Mean \pm S E	Overall (59) Mean \pm S E
1	Heart girth	138.17 \pm 4.56 (85-178)	140.93 \pm 5.46 (100-200)	139.53 \pm 3.52 (85-200)
2	Body length	104.23 \pm 4.35 (60-167)	110.17 \pm 5.64 (66-182)	107.57 \pm 3.55 (60-182)
3	Height at wither	146.23 \pm 3.71 (92-187)	146.07 \pm 3.34 (118-194)	146.15 \pm 2.48 (92-194)
4	Tail length	40.90 \pm 1.02 (26-50)	40.20 \pm 1.12 (25-57)	40.55 \pm 0.75 (25-57)
5	Neck length	84.20 \pm 3.61 (50-112)	87.60 \pm 4.02 (50-122)	85.90 \pm 2.69 (50-122)
6	Face length	34.23 \pm 1.29 (18-46)	36.23 \pm 1.39 (23-48)	35.23 \pm 0.95 (18-48)
7	Distance between eyes	18.90 \pm 0.55 (11-23)	19.80 \pm 0.58 (12-29)	19.35 \pm 0.40 (11-29)
8	Ear length	9.83 \pm 0.19 (7-11)	10.37 \pm 0.37 (7-19)	10.10 \pm 0.21 (7-19)
9	Fore leg length	114.47 \pm 2.67 (59-130)	116.33 \pm 2.47 (92-140)	115.40 \pm 1.81 (59-140)
10	Hind leg length	127.63 \pm 3.03 (63-144)	130.53 \pm 2.92 (104-171)	129.08 \pm 2.09 (63-171)
11	Foot pad (L/W)			
11 a	Fore leg (length)	14.13 \pm 0.57 (7-18)	14.80 \pm 0.66 (9-22)	14.47 \pm 0.43 (7-22)
	Fore leg (width)	13.90 \pm 0.59 (8-18)	14.53 \pm 0.68 (8-20)	14.22 \pm 0.45 (8-20)
11 b	Hind leg (length)	12.55 \pm 0.50 (7-16)	13.03 \pm 0.59 (8-19)	12.80 \pm 0.38 (7-19)
	Hind leg (width)	12.31 \pm 0.52 (7-16)	12.80 \pm 0.62 (7-18)	12.56 \pm 0.40 (7-18)

(Value in parenthesis are range values)

Table 7: Morphometric measurement (cm) of Sindhi camels (1 to 4 year age)

S.No.	Characters	Female (34) Mean± S E	Male (31) Mean± S E	Overall (65) Mean± S E
1	Heart girth	189.94±1.70 (147-202)	193.10±1.42 (175-208)	191.45±1.12 (147-208)
2	Body length	150±1.87 (130-170)	153.91±1.91 (138-180)	151.89±1.35 (130-180)
3	Height at wither	182.24±1.90 (168-225)	183.29±2.01 (170-208)	182.74±1.35 (168-225)
4	Tail length	47.06±0.51 (42-55)	49.03±1.02 (42-65)	48.00±0.56 (42-65)
5	Neck length	114.94±1.70 (82-131)	116.39±1.66 (92-132)	115.63±1.18 (82-132)
6	Face length	45.53±0.67 (35-57)	45.35±0.53 (37-51)	45.45±0.43 (35-57)
7	Distance between eyes	22.76±0.23 (20-27)	23.16±0.25 (21-26)	22.95±0.17 (20-27)
8	Ear length	11.82±0.13 (10-13)	12.10±0.14 (11-14)	11.95±0.07 (10-14)
9	Fore leg length	135.50±0.97 (128-145)	137.87±1.31 (130-155)	136.63±0.81 (128-155)
10	Hind leg length	151.35±1.15 (143-170)	153.55±1.65 (143-175)	152.40±0.99 (143-175)
11	Foot pad(L/W)			
11a.	Fore leg (length)	19.41±0.14 (17-22)	19.48±0.14 (18-20)	19.45±0.11 (17-22)
	Fore leg (width)	19.27±0.21 (15-20)	19.26±0.17 (17-20)	19.27±0.13 (15-20)
11b.	Hind leg (length)	17.29±0.16 (15-18)	17.48±0.13 (16-18)	17.38±0.10 (15-18)
	Hind leg (width)	17.18±0.21 (13-18)	17.29±0.18 (15-19)	17.23±0.14 (13-19)

(Value in parenthesis are range values)

Table 8: Morphometric measurement (cm) of adult Sindhi camel

S. No.	Characters	Female (535) Mean± S E	Male (109) Mean± S E	Overall (644) Mean± S E
1	Heart girth	206.80±0.47 (158-260)	204.13±0.75 (188-230)	206.35±0.41 (158-260)
2	Body length	164.54±0.49 (118-152)	167.40±0.67 (146-190)	165.03±0.42 (118-200)
3	Height at wither	194.43±0.42 (110-238)	193.72±1.23 (115-242)	194.31±0.41 (110-242)
4	Tail length	56.18±0.24 (34-125)	66.11±2.40 (42-122)	57.85±0.47 (34-125)
5	Neck length	119.51±0.48 (53-152)	118.09±1.02 (99-144)	119.27±0.44 (53-152)
6	Face length	47.05±0.15 (38-60)	46.87±0.32 (40-55)	47.02±0.14 (38-60)
7	Distance between eyes	25.92±0.10 (14-48)	25.82±0.15 (22-30)	25.90±0.08 (14-48)
8	Ear length	12.19±0.03 (10-18)	12.19±0.07 (11-15)	12.19±0.03 (10-18)
9	Fore leg length	141.96±0.27 (120-169)	142.90±0.50 (133-163)	142.12±0.24 (120-169)
10	Hind leg length	164.54±0.34 (142-190)	162.17±0.79 (145-185)	164.14±0.32 (142-190)
11	Foot pad(L/W)			
11a.	Fore leg (length)	20.65±0.05 (16-24)	20.56±0.11 (18-24)	20.64±0.04 (16-24)
	Fore leg (width)	19.68±0.05 (15-26)	19.79±0.15 (16-24)	19.70±0.50 (15-26)
11b.	Hind leg (length)	18.09±0.04 (15-23)	18.28±0.12 (15-22)	18.12±0.04 (15-23)
	Hind leg (width)	17.17±0.05 (14-23)	17.52±0.15 (14-22)	17.24±0.05 (14-23)

(Value in parenthesis are range values)



Body Weight

Growth of an animal is considered as index of its health, production and reproductive performance. Thus, maintenance of proper body weight is essential for work performance as well as milk production. In the field conditions actual body weight measurements are not possible in large species like camel hence body weights (Table-9) were calculated by the formula suggested by Wilson, (1978).

$$\text{Body weight (kg)} = [507 \times \text{Chest Girth (m)}] - 457$$

Table 9: Body weight of Sindhi camel

Age Group	Mean± Standard Error (kg)		
	Male	Female	Over all
Up to 1 year	257.45±27.24 (29)	243.53±23.13 (30)	250.37±17.87 (59)
1-4 year	521.94±7.22 (31)	505.97±8.66 (34)	513.58±5.73 (65)
Adult (> 4 year)	577.93±3.80 (109)	591.50±2.42 (532)	589.19±9.12 (641)

Figures in parenthesis indicate number of animals



MOLECULAR CHARACTERIZATION

Genetic Variability

The molecular characterization of Sindhi camel was done using microsatellite markers. A battery of 25 microsatellite markers were used to estimate the genetic variability of Sindhi camel population. All the microsatellite loci excluding VOLP32 and CMS50 amplified unambiguously (Table 10) and a total of 196 alleles were detected across the 23 loci. An exact test for genotypic linkage disequilibrium yielded no significant P values across the population, therefore independent assortment of all the loci was assumed. Reasonable polymorphism in Sindhi camel was evident from the allele frequency data. VOLP10 showed the highest number of observed alleles per locus (22) while VOLP08, YWLL08, CVRL06, YWLL09 and YWLL38 showed the lowest (4) with the mean allele number of 8.522 (Table-10). Expected number of alleles varied from 1.485 (CVRL08) to 9.313 (VOLP10) with mean of 3.937.

Shannon's information Index (I) is a parameter indicative of the informative degree of a marker, which ranged from 0.675 (CVRL08) to 2.588 (VOLP10) (Table 10). Most of the markers had high I values and thus can potentially be used for diverse genetic applications including linkage mapping, individual identification and parentage testing. Sindhi camel had moderate genetic variation based on its gene diversity in addition to the average number of alleles per locus. The observed and expected heterozygosity values ranged from 0.191 (CMS16) to 0.872 (VOLP67) and from 0.326 (CVRL08) to 0.893 (VOLP10) with an overall mean of 0.594 ± 0.038 and 0.682 ± 0.029 , respectively (Table-10). Observed heterozygosity was less than the expected heterozygosity indicating non-random mating in the population. F_{IS} value reinforced that the population is not in Hardy-Weinberg equilibrium as it ranged from -0.170 to 0.673 with a mean of 0.122 ± 0.048 (Table 10). Heterozygote deficiency of 12.2% along with the allele and gene diversity suggests existence of moderate genetic variation in the Sindhi camel population and need for scientific management or conservation programs.

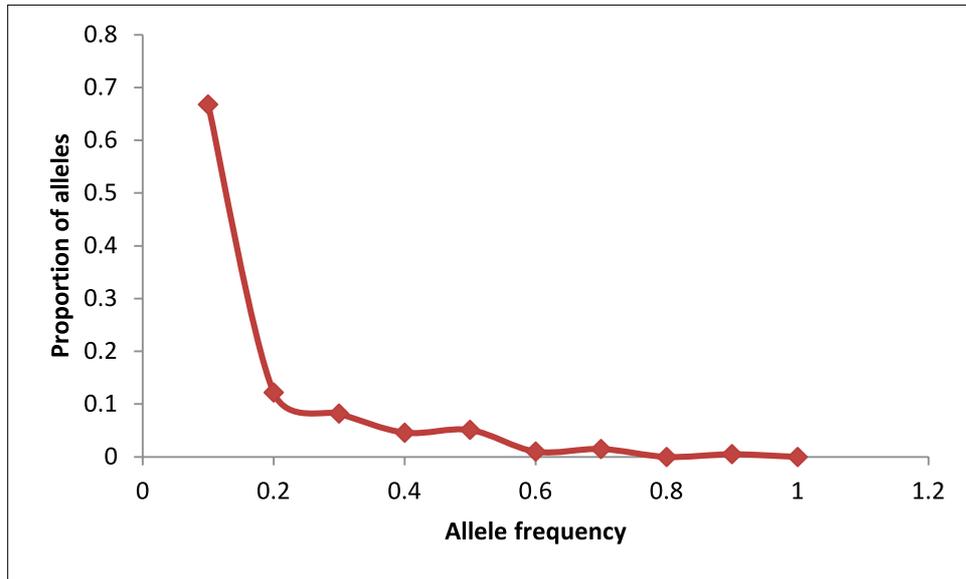
Genetic bottleneck analysis

Bottleneck influences the distribution of genetic variation within and among populations. In recently bottlenecked populations, the majority of loci will exhibit an excess of heterozygotes, exceeding the heterozygosity expected in a population at mutation drift equilibrium. To estimate the excess of such Heterozygosity, Sign, Standardized Differences and Wilcoxon Sign Rank Tests were utilized. All the three

Table 10: Genetic diversity parameters estimates of Sindhi camel

S. No.	Locus	N	Na	Ne	I	Ho	He	F
1	LCA63	43	7	4.109	1.525	0.744	0.757	0.016
2	LCA77	44	12	3.176	1.698	0.227	0.685	0.668
3	VOLP08	45	4	1.982	0.874	0.444	0.496	0.103
4	YWLL44	43	8	6.663	1.971	0.674	0.850	0.206
5	CMS13	46	7	3.367	1.437	0.565	0.703	0.196
6	CVRL04	47	8	3.725	1.601	0.851	0.732	-0.163
7	CVRL05	48	6	3.313	1.351	0.688	0.698	0.015
8	LCA66	45	8	4.313	1.660	0.644	0.768	0.161
9	VOLP67	47	18	8.925	2.460	0.872	0.888	0.018
10	CVRL01	48	18	6.898	2.288	0.833	0.855	0.025
11	CVRL08	45	5	1.485	0.675	0.333	0.326	-0.021
12	LCA90	48	5	2.963	1.164	0.688	0.663	-0.038
13	YWLL08	48	4	2.349	0.975	0.646	0.574	-0.125
14	CMS58	45	10	2.260	1.297	0.467	0.558	0.163
15	CVRL06	47	4	2.535	1.067	0.468	0.605	0.227
16	CVRL07	47	10	5.185	1.844	0.702	0.807	0.130
17	VOLP03	46	14	4.692	1.931	0.696	0.787	0.116
18	YWLL09	45	4	1.923	0.852	0.511	0.480	-0.065
19	CMS16	47	5	2.414	1.031	0.191	0.586	0.673
20	LCA18	41	5	3.349	1.345	0.585	0.701	0.165
21	LCA37	46	8	2.584	1.260	0.717	0.613	-0.170
22	VOLP10	41	22	9.313	2.588	0.439	0.893	0.508
23	YWLL38	48	4	3.028	1.179	0.667	0.670	0.005
	Mean	45.652	8.522	3.937	1.481	0.594	0.682	0.122
	SE	0.443	1.063	0.447	0.108	0.038	0.029	0.048

N, Number of animals; Na, Number of observed alleles; Ne, Number of effective alleles; I, Shannon information index for polymorphism content; Ho, Observed heterozygosity; He, Expected heterozygosity; F, Heterozygote deficiency/ Inbreeding coefficient



Graphic representation of proportion of alleles and their distribution

models; Infinite allele model (IAM), stepwise mutation model (SMM) and two-phase model of mutation (TPM) were applied. Non-significant heterozygote excess on the basis of different models, (Wilcoxon rank test, IAM and TPM models of Sign test) suggested that there was no recent bottleneck in the existing Sindhi population. A graphical representation utilizing allelic class and proportion of alleles showed a normal 'L' shaped distribution. The L shaped curve indicated the abundance of low frequency (<0.10) alleles. This finding suggested absence of any detectably large, recent genetic bottleneck (last 40-80 generations) in this population.

Differentiation of Sindhi camel population

Distinctness of Sindhi camel population from the Marwari and Kharai, two registered breeds of Indian camel was supported by all the approaches utilized to study genetic relationships and differentiation such as genetic distances, phylogenetic relationship, correspondence analysis, clustering method based on Bayesian approach and individual assignment (Sharma et al., 2020). Sindhi camel population was identified to be a separate gene pool.

MANAGEMENT SYSTEM

Housing and Grazing Management

Sindhi camels are mostly reared under extensive system of management. No housing is provided during day as well as night time except to those which are reared for transportation, tourism or entertainment. The camels are kept in open and occasionally some shelter is provided during night time. Some of the farmers makes temporary housing arrangement in the village outskirts or fallow land close to their household. These farmers' moves within a limited area around their habitation for the grazing purposes and return back to the village in the evening with their tolas. Some camel owners identify a place for temporary living for a period of about 4-5 days or longer depending on the availability of vegetation in the area. This place is generally referred as Dera in local dialect. This place can be any barren land or an agriculture field after harvesting of the crop. From these deras, they run their life for the period of stay.

The animals move out from here during grazing hours and return in the evening. Farmer start very early in the morning for the grazing between 6-8 am and normally return in the late evening between 6-8 pm. The average daily grazing distances is around 5-7 km and grazing hours are around 10-12 hrs. depending on the season and fodder resources available in the tract. However, the migratory camels travel higher distances and hence the average grazing distance is around 11 km per day.

Calves are kept in temporary enclosures made by arranging pieces of tree branches in a circular manner close to any tree with good canopy. This arrangement for calves around shady trees during day time protect them from heat. Young calves are allowed to suckle their dams immediately when they return to stay place in the evening. Depending on the need, the camel owners milk the she-camels in the evening. The evening milk is generally consumed by the camel owners and their families and is not sold in the market. In the late evening, the camel owners tie the legs of their camels in sitting position to restrain them in the night as well as to prevent the calves from sucking their dams. Some farmer keep the calves in separate enclosures to prevent suckling. Some farmers use locally made udder covers to prevent access of udder and teats to calves, thus disallowing further suckling. In the early morning, the camel owners milk the she-camels and the collected milk is sold in the markets either by the camel owners themselves or by their relatives.

Many farmers leave the camel herd in the wild and camel roam around in the oran, community pastures, fallow stretches of the land. The animals are herded together and brought close to farmer's habitation during rainy season (chaumas) when the crops are grown, during calving and breeding season to monitor and keep record of the breeding and calving. The farmer keep track of the animals through other farmers in the area through mobile phones and identification marks on body made for the identification purpose. The camel owners tie one bell in the neck of a leader camel, generally the adult male camel, which helps the camel owners in locating the camels during grazing. The spotting of foot marks and lying camel dung is also utilized for tracking the camels during grazing and migration.

Feeding Management

The animals are solely dependent upon grazing. It was observed that apart from the camels which are being maintained for tourism, cart pulling and entertainment, other camels are not stall fed or supplemented with some dry fodder. However, the calves and sick animals in need of special attention are fed at the place of temporary stay i.e. Dera. The camels graze mainly on the trees, herbs, shrubs and grasses available in the breeding tracts. They are fed on the trees and the tree loppings offered by the accompanying grazer.

Neem (*Azadirachta indica*), Khejri (*Prosopis cineraria*), Babool (*Acacia arabica*), are the most common fodder tree available in the breeding tract. Rohida (*Tecomella undulata*), Kumatia (*Acacia senegal*), Israeli babool (*Acacia tortilis*), are other tree species available on which camel feed. Kheemp (*Leptadenia pyrotechnica*) Phog (*Calligonum polygonoides*), Jal (*Salvadora oleoides*), Kair (*Capparis decidua*), Bui (*Aerva tomentosa*), Bor (*Ziziphus mauratiana*), Bordi (*Ziziphus nummularia*), Lana (*Haloxylon salicoricum*), Arni (*Clerodendrum pholomidis*), Murali (*Lycium barbarum*), Kanker (*Maytenus emarginata*) are the common bushes and shrubs found in the tract and utilized by the camels. The crop residues e.g. fodder of locally grown cereals like Wheat straw (*Triticum aestivum*), Cadvi of Jowar (*Sorghum vulgare*), Bajra (*Pennisetum typhoideum*), leguminous crops like Guar Phalgati (*Cyamopsis tetragonoloba*), Moth chara (*Phaseolus aconitifolius*), Groundnut fodder (*Arachis hypogaea*), Chana Chara (Khariya) (*Cicer arietinum*) etc. are generally available in the harvested agricultural fields and are also utilized by the camels. Bhurat (*Cenchrus biflorus*), Doob (*Cynodon dactylon*), Bekario (*Indigofera spp.*), Dhaman (*Cenchrus ciliaris*), Karad (*Dicanthium annulatum*) are the common grasses which camel feed on but generally they are not available to camel as other livestock species like cattle, sheep, goat etc. feed on them.

A good number of camel owners provide salt to their camels. The quantity and frequency of offering sweet oil (Groundnut, Mustard, Sesame and Linseed) and concentrate feed depends not only on the know how and economic status of the farmer but also on the physiological state of the individual animal and economic returns expected out of it. Offering of sweet oil and jaggery to the breeding males, when used for mating is commonly practiced to maintain their energy level.

Sufficient amount of water is available in the area. In the survey area more than 80% farmers reported availability of water in sufficient quantity. Around 28% farmers also reported availability of salty water for drinking purposes. Tube well, haud, Ponds are main water sources for animals. Hand pump, well, tanka, canal, nadi (Rivers) are the other sources of drinking water for camel.

Breeding and Reproduction Management

The Sindhi camels generally exhibits signs of estrus at 3.75 years of age, successful mating takes place at an age of about 4.30 years and the first calving takes place at 5.20 years of age. Accordingly the number of calving in life goes up to 7-8. The gestation period is 13 months and the inter-calving period is about 2 years. The females are induced ovulator and do not exhibit the sings of estrus. However, a receptive female is considered in estrus.

The Sindhi male camels show puberty at an age of about 5-6 years. The signs of vocalization, lack of appetite, frequent micturition and restlessness can be seen during rut period in the male camels. They make peculiar sound by taking out their inflated soft palate out of the mouth. The mating takes place, when the female camel is in sitting position. Human assistance in guiding the penis facilitates the mating. The average copulation time is about 4-5 minutes and the semen volume ejaculated per copulation is about 2.5 to 3 ml. The camel owners generally maintain one breeding male per herd, if they have about 15-20 breedable females. They do share the males for breeding. Generally, 1-2 males of 1-3 years of age are kept in the herd as a replacer of the main breeding stud. Breeding males are selected on the basis of physical feature like height of animal, hump size, dam's milk yield, breed purity, production capacity and pedigree of the males.

The survey on breeding practices adopted by farmers revealed, physical feature as main criteria for the selection of males, followed by pedigree, dam's milk yield and breed purity. More than 70% farmer considered more than one trait for selection of the males. Farmers mostly selected male from own herd as future breeding bulls. The bulls are also used on exchange basis. Few farmers purchased the breeding bulls

based on their own wisdom from other herds or from camel fairs as per the need. The selection of female is done on the basis of milk yield, breed characteristics and past records of its parents.

Health Management

In the breeding tract, mange is the most common disease and cause of worry to the camel breeders. It has been observed in the breeding tract of Sindhi camels too. It is caused by sarcoptic mite *Sarcoptes scabiei var. cameli*. Mange spreads by contact with infected animals or soil or surrounding. Improper management, malnutrition and overcrowding are generally the predisposing factors. Fungal infection was also found associated with it. Ivermectin injections along with antifungal treatment and external spray of deltamethrin were found effective in management of the animals from this ailment.

Trypanosomiasis, is the second cause of worry to the camel breeder across the breeding tracts. It is popularly known as Surra or Tibarsa because the disease causes progressive weakness and lasts for about 3 years. It is caused by a blood protozoa *Trypanosoma evansi*. Almost every camel owner goes for prophylactic as well as curative treatment of this disease. A number of chemotherapeutic agents are available in the market but the combination of Quinapyramine sulphate and Quinapyramine chloride is one among the safest drug.

Pneumonia, camel pox, mumadi, wound, hematuria, diarrhea are also seen in camels but the incidence is relatively low compared to mange and trypanosomiasis. The progressive camel farmers follow prophylactic medication with Fenbendazole or Albendazole for the management of helminthes. However, when clinical signs were observed, the camel owners consult veterinarian for the treatment. Generally, the broad spectrum antibiotics along with antipyretic and vitamins therapy cure the camels. For contagious ecthyma seen in young animals the symptomatic treatment generally cures the animals.



Migration of Sindhi Camel

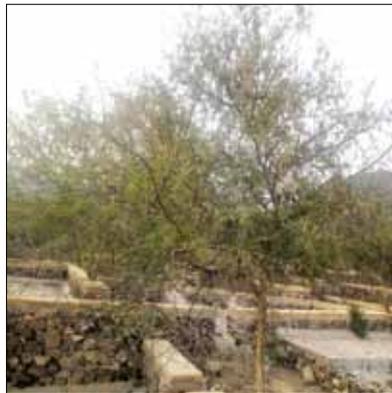
The camel farmers rely on the common property resources, forest, wastelands and harvested fallow fields for feed and fodder resources. As a result of which camels generally move in the range of about 50-100 km all through the year. The average grazing distance is about 8-10 km and the average grazing hours are 8-10 hrs per day. Some farmer's from Lodrwa (Jaisalmer) travelled to Ramgarh, Tanot, Mohangarh and reached up to Nachna in Jaisalmer. Similarly, some farmer from Jaisalmer moved to Pokhran, Mohangarh, Devikot, Fatehgarh area of Jaisalmer and Shiv area of Barmer. The farmers from Jhanakali (Barmer) migrated to the villages like Gunga, Shiv, Nimbala, Bhaikha etc of Barmer district covering a distance of around 50-60 km along with camel. They migrated during December-January months and returned back in the months of April-May after 4-5 month. During migration night halt is done in places where the sun sets. The animals and the accompanying person stay in the field area. In old time during the drought the farmers used to migrate to other districts and even other states also.



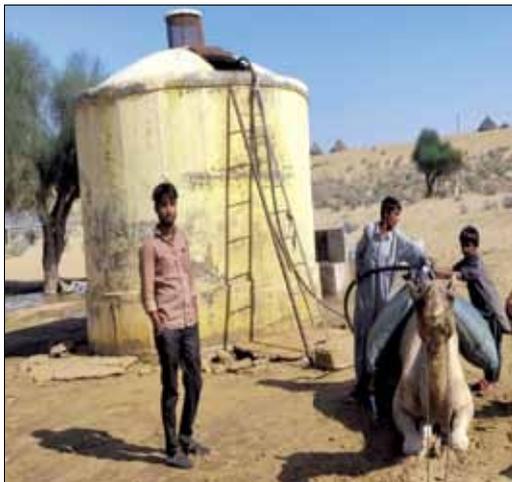
FEED AND FODDER RESOURCES



FEED AND FODDER RESOURCES



SOURCES OF WATER



PRODUCTION OF SINDHI CAMEL

Milk Production

The future of the Indian camel holds on the milk production potential of the camel breeds. Sixteen she-camels were continuously recorded for a period of 13 months in the field area for their milk production potential Table-11. Out of 16 females, milk yield of 12 camel was recorded once in a day (Morning) and milk yield of 4 camel was recorded twice in a day (morning and evening both). Weekly/fortnightly milk recording was carried out at the farmer's doorstep. No special feed was given by the farmers. Health was monitored throughout the lactation and milk production of only healthy animals were recorded. Normally animals were milked once in the field conditions. As per the practice adopted in the breeding tract, the farmers allow the calves to suckle in the evening and then separate the calves in enclosures to prevent suckling. Some farmers use locally made udder covers to prevent access of udder and teats to calves, thus preventing further suckling. In the morning, they milked the animals and after that they allowed the calves to be with them for few hours and then separated the calves and took the dams for grazing. However, to know the actual milk production potential some of the animals were milked twice both in the morning and evening. The calves were separated from mother on previous day night and in the morning milk yield was recorded. After morning milking calves were again separated from mother till evening recording. For milk let down suckling response of calves was essential.

Average morning milk yield was 2.39 ± 0.02 liters and evening milk yield was 2.74 ± 0.05 liters (Table-11). The average daily milk recorded for Sindhi camels was 5.71 ± 0.10 liters (Table-12). Up to 8 month of lactation daily milk yield was around 6.00 liters. During this period it varied between 5.94 to 6.74 liters. Wide variation ranging from (1.90 to 8.20 liters) in the individual daily milk yield was observed. The selection of elite milch animals for breeding and proper feed supplementation can further increase the milk production which can supplement the income of camel farmers in the breeding tract.

In the breeding tract the camel milk is mostly used for self-consumption and sold for human use by some of the farmers. It is generally consumed raw or used for the preparation of tea by farmers. The preparation and sale of products from camel milk may further add to the income of the farmers. ICAR-National Research Centre on Camel, Bikaner has successfully prepared variety of products from the camel milk.

Table 11: Average morning and evening milk yield (L) of Sindhi camel

Month of lactation	N	Morning	Range	N	Evening	Range
1	17	2.76±0.14	(2.0-3.5)	13	3.06±0.20	(1.7-3.8)
2	36	2.63±0.12	(1.5-4.0)	14	2.88±0.21	(1.5-3.8)
3	61	2.57±0.10	(1.3-4.2)	14	3.30±0.16	(2.2-4.0)
4	51	2.43±0.11	(1.0-4.0)	15	2.92±0.16	(1.8-3.8)
5	42	2.53±0.13	(1.0-4.0)	16	3.01±0.14	(1.7-3.7)
6	43	2.51±0.11	(1.5-4.0)	14	3.02±0.16	(2.0-3.7)
7	46	2.39±0.11	(1.5-3.8)	15	3.04±0.13	(2.2-3.6)
8	64	2.41±0.07	(1.5-3.8)	18	2.86±0.08	(2.2-3.5)
9	62	2.41±0.05	(2.0-3.4)	11	2.73±0.08	(2.3-3.2)
10	65	2.42±0.05	(1.9-3.3)	17	2.37±0.10	(1.6-3.0)
11	62	2.32±0.04	(1.5-3.0)	13	2.16±0.10	(1.4-2.6)
12	55	2.04±0.05	(1.2-3.0)	8	1.65±0.18	(1.0-2.2)
13	49	1.95±0.05	(1.1-2.5)	7	1.52±0.16	(0.8-2.0)
Mean	653	2.39±0.02	(1.0-4.2)	175	2.74±0.05	(0.8-4.0)

N= Number of observations

Table 12: Average daily milk yield (L) of Sindhi camel

Month of lactation	N	Total	Range
1	13	6.06±0.31	(3.7-7.0)
2	14	5.94±0.40	(3.5-7.8)
3	14	6.74±0.33	(4.2-8.2)
4	15	6.08±0.33	(3.8-7.8)
5	16	6.31±0.28	(3.7-7.7)
6	14	6.36±0.30	(4.2-7.7)
7	15	6.32±0.26	(4.6-7.4)
8	18	5.95±0.17	(4.7-7.3)
9	11	5.71±0.16	(4.8-6.6)
10	17	5.04±0.24	(3.5-6.2)
11	13	4.57±0.21	(3.0-5.6)
12	8	3.53±0.35	(2.2-4.6)
13	7	3.32±0.32	(1.9-4.2)
Average	175	5.71±0.10	(1.9-8.2)

N= Number of observations

Milk Composition

The analysis of milk composition of 23 lactating camel revealed concentration of Fat, SNF (Solid Not Fat), Protein, Lactose and Salt as 3.12%, 6.96%, 2.85%, 4.31% and 0.84%, respectively (Table-13). The fat composition was highly variable between individuals.

Table 13: Milk composition (%) of the Sindhi camel (N=23)

Components	Mean	Range	CV %
Fat	3.12±0.29	0.78-6.15	42.83
SNF	6.96±0.18	7.77-11.04	9.94
Protein	2.85±0.33	2.87-4.07	10.72
Lactose	4.31±0.48	3.88-5.52	9.96
Salt	0.84±0.02	0.73-1.06	9.71

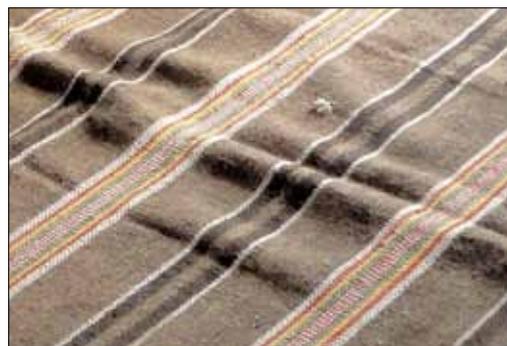
Hair production

The camel hair is being utilized in India since ancient times for the making of carpets, blankets, ropes and other items of daily use. Fine quality hair is utilized for blanket making whereas coarse quality hair is used for carpet and rope making. These carpets and blankets are very cheap and durable. The rope made of camel hair is used for tying the animals and in making cots. Camel hair is harvested in the period coinciding with Holi festival. The animals are sheared using scissors or hair clippers. The annual hair production from an adult camel is about 500- 700 g. Patni and Dhillon (1988) reported that it is worthwhile to blend camel hair with polyester, wool or silk waste. It has been estimated that a camel hair fabric of 620 g weight will be as warm as a pure wool fabric of 900 g weight (Khanna and Rai, 1991). The camel hair is stronger and warmer as compared to wool (Khanna and Rai, 1990). The handicraft articles made up of camel hair, provide work to women in the field of grading of hair, tops preparation, spinning of wool, weaving, embroidery with 100% speciality hair and blending with sheep wool, goat hair, cotton and other natural man made fibres. Hair samples from 65 animals (16 male and 49 female) were collected for hair quality parameter study. The average fiber length was 3.84±0.09 cm, the average fiber diameter was 59.75±2.20µ and total medullation was 85.83±1.31% (Table-14).

Table 14: Hair quality parameters of Sindhi camel

Fibre Parameters	Male (16)	Female (49)	Overall (65)
Fibre Length (cm)	3.76±0.13 (3.0-4.6)	3.89±0.13 (2.5-5.5)	3.84±0.09 (2.5-5.5)
Mean Diameter (μ)	57.25±5.83 (8.57-120.62)	60.57±2.24 (35.58-98.54)	59.75±2.20 (8.57-120.62)
Pure Fibre (%)	14.87±3.30 (1.67-44.67)	13.88±1.43 (1.34-42.00)	14.11±1.33 (1.34-42.00)
Medullation: Hetero (%)	15.56±1.91 (2.33-28.33)	6.28±1.02 (0-34.33)	8.56±1.02 (0-34.33)
Medullation: Hairy (%)	69.37±4.46 (40-95.33)	79.96±1.02 (36.35-95.67)	77.31±1.81 (36.33-95.67)
Total Medullation (%)	84.94±3.09 (55.33-98.33)	86.12±1.43 (58-98.66)	85.83±1.31 (55.33-98.16)

Figure in parenthesis are range values.



MULTIPURPOSE USES OF SINDHI CAMEL



CONSERVATION OF CAMEL

Camel: Declared as the State Animal of Rajasthan

The camel became the first domesticated animal to be declared as “state animal” in India. The policy support related to ban on camel slaughter, new breeding policy with emphasis on camel milk, incentive for camel breeding, formation of breed registration societies and breeder association, etc. has been promulgated. The Rajasthan Camel (Prohibition of Slaughter and Regulation of Temporary Migration or Export) act, 2015” was enacted.

Camel Insurance

The insurance scheme named “Bhamashah Pashu Bima Yojana” for the livestock species including camel at subsidized rate has been launched by the Govt. of Rajasthan. Under the scheme camel owner can get maximum of five camels with a maximum cost of Rs. 50000/- per camel insured at a subsidized rate of 3.5 % for a period of one year or 9 % for a period of 3 years. This premium is further reduced by 70% in case of Scheduled Caste (SC), Scheduled Tribe (ST) and Below Poverty line (BPL) category, and by 50 % for general category.

Calf-Subsidy

A calf subsidy scheme was started by govt. of Rajasthan in order to promote interest in camel breeding by camel breeder, to encourage the camel breeders to breed their camels at regular interval and to have a check on the declining population of the species. Under this scheme, a camel owner on registering his pregnant female camels was given cash incentive of Rs. 10000/- in three installments. First installment of Rs. 3000/- was given when the calf was born and attained an age of 1 month. The second installment of Rs. 3000/- was given when the calf attained an age of 9 month and the third installment of Rs. 4000/- was given when the calf attained the age of 18 months. Farmers have to insure these animals and when they sold these animals, they have to inform to the nearest veterinary hospital. The treatment of these animals was done free of cost.

FSSAI Approval

The Food Safety and Standards Authority of India (FSSAI) had set the all India standards for camel milk (Raw, pasteurized, boiled, flavored and sterilized) a minimum of 2.0 % Fat and 6.0% SNF from 1st June 2017.

Talks of Camel: Untan Ri Bataan

An All India Radio Programme “Untan Ri Bataan” (Talks of Camel) was broadcasted on every second and fourth Friday of the month in which twelve episodes were broadcasted between November, 2018 to April, 2019. The program was aimed at popularising camel milk. Hence different subject matters like improving the milk productivity of the camels, product development from camel milk, camel milk marketing etc. were covered in different episodes. The program was broadcasted in Pali, Sirohi, Jodhpur, Jaisalmer, Barmer and Bikaner districts. For camel farmers who doesn't listen to the radio or have access to radio, group listening of the radio talk with the camel owners on the every second and fourth Friday of the month was also organized.

Meeting and health camps with the camel farmers

Meetings were also organized wherein apart from the deliberation on a particular topic, discussion on policy issues, question and answer sessions and on site treatment of sick animals was done. Sick camels were treated for various ailments during these health camps and meetings.

In order to create awareness, World Camel Day was celebrated in Jaisalmer on 22 June, 2019. People from various walks of life like farmers, consumers and scientists participated in the world camel day celebration. Farmers were made aware about the importance of purity of the breeds, scope of camel milk marketing and the consumers were made aware about importance of health benefits of camel milk.

Society for breed conservation

Farmers in the Jaisalmer area having keen interest in organizing the camel milk marketing and trade, registered a cooperative society “Shree Degrai Ustra Sanrakshan Evam Dugdha Vipnana Vikas Seva Samiti, Sanwata” at Devikot in Jaisalmer district under Rajasthan Societies Registration Act, 1958 (Rajasthan Act No1958). The society is committed to trade camel milk and milk products in addition to conservation of local germplasm of camel.

Way forward for improvement and conservation

The utility of the species conserves it. In the Sindhi camel breeding tract of Jaisalmer and Barmer camel has limited utility in the current scenario. In the remote area it is used for transport of water and carrying load. In terms of commercial utilization its use is limited to tourism in the Sam area of Jaisalmer and local transport of goods. Other sources of income to the camel farmers is through the sale of surplus animals but in recent years sale of animals have drastically reduced. Few farmers are selling the camel milk but the volume of milk sold is of limited quantity but the camel milk trade holds promise. The Open Nucleus Breeding Programme for increasing the milk production with its nucleus at the government farm or research centre and associated herds with camel owners may lead to significant improvement in the production potential of the animals and increase in their income. In the breeding tract the milk production and sale activities should be encouraged. The camel riding, camel dancing, camel carts, camel safari and other aspect of camel draught utility present in the breeding tract should be further improved. These activities need to be supported and encouraged by promoting ecotourism in the area. The breeder's societies and Farmer Producer Organization (FPO) should be set up in the breeding tract. Institutional support to camel farmers for undertaking ecotourism activities should be provided. The camel festivals should be organized at regular intervals with price incentive to the farmers for higher production, decoration, hair design, dancing skills etc. The entrepreneurship in camel milk products processing and development, camel handicraft and camel ecotourism can attract the rural youth in camel rearing and management. An integrated rotational grazing system, silvipasture development programme along with proper nutritional and health care support will not only help the camel owners in maintaining the Sindhi camel along with diverse livestock species under optimum production but will also boost their morale by bringing economic prosperity to them.



राष्ट्रीय उष्ट्र अनुसंधान संस्थान बीकानेर द्वारा प्रायोजित कार्यक्रम सुनिए आकाशवाणी बीकानेर की प्रस्तुति

"उंटा री बातां"

विषय:- उंटनियों में दुध उत्पादन क्षमता वृद्धि के लिए चयन प्रक्रिया



डॉ. वेद प्रकाश





एनआरसीसी से प्रशिक्षित उंट पालकों को मिला ब्रीड सेवियर अवॉर्ड



एनआरसीसी से प्रशिक्षित उंट पालकों को ब्रीड सेवियर अवॉर्ड प्रदान किया गया।

एनआरसीसी से प्रशिक्षित उंट पालकों को ब्रीड सेवियर अवॉर्ड प्रदान किया गया।



सिंधी नस्ल के उंटों के संरक्षण को लेकर पदमसिंह को मिला ब्रीड सेवियर अवार्ड



जैसलमेर, हरियाणा में कार्यक्रम में पदमसिंह को सम्मानित करते आदिपि।

जैसलमेर | एनबीसीआर कन्सल व सेवा समिधान मद्रुराई तमिलनाडु द्वारा हरियाणा में आयोजित एक कार्यक्रम में जैसलमेर के लैटरब्रा खोब के उंट पालक पदमसिंह पुत्र लक्ष्मणसिंह को ब्रीड सेवियर अवार्ड से सम्मानित किया गया है। खोब सेवियर अवार्ड के तहत पदमसिंह को एक प्रमाण पत्र व 10 हजार रुपये का नकद पुरस्कार देकर सम्मानित किया गया।

विश्व उष्ट्र दिवस • उंट पालकों, उद्यमियों व वैज्ञानिकों के बीच संगोष्ठी

उंट पालक मिलकर आधुनिक डेयरी उद्योग की संभावना तलाशें: डॉ. सांवल



गुरु जयभद्रर उंट पालन समिति गजेट

BREED DESCRIPTOR FOR SINDHI CAMEL

A.	GENERAL DESCRIPTION	
1.	Name of the Breed	: Sindhi
2.	Local names/synonyms	: Sindhi, Sindhan
3.	Species	: Camel (<i>Camelus dromedarius</i>)
4.	Background for such name	: Named after area : Sindh
5.	Since when breed is known	: Since long
6.	Communities responsible for breeding	: Rajput, Muslim, Raika
7.	Native environment	:
	a. Soil Description	: Sandy clay, Sandy loam, Saline
	b. Mean min. temperature (Summer)	: 22°C, Jaisalmer
	c. Mean min. temperature (Summer)	: 49°C, Jaisalmer
	d. Mean min. temperature (Winter)	: 9.5°C, Jaisalmer
	e. Mean min. temperature (Winter)	: 28°C, Barmer
	f. Mean relative humidity	: 25-55%
	g. Annual rainfall	: 176-243 mm
8.	Feed and Fodder	:
	a. Dry feeds	: Wheat straw (<i>Triticum aestivum</i>), Cadvi of Jowar (<i>Sorghum vulgare</i>), Bajra (<i>Pennisetum typhoideum</i>) Guar Phalgati (<i>Cyamopsis tetragonoloba</i>), Moth chara (<i>Phaseolus aconitifolius</i>), Groundnut fodder (<i>Arachis hypogaea</i>), Chana chara (<i>Khariya</i>), (<i>Cicer arietinum</i>) etc.
	b. Green fodder	: Bajra (<i>Pennisetum typhoideum</i>), Jowar (<i>Sorghum Vulgare</i>) and Jai (<i>Avena fatua</i>).
	c. Grasses	: Bhurat (<i>Cenchrus biflorus</i>), Doob (<i>Cynodon dactylon</i>), Bekario (<i>Indigofera spp.</i>), Dhaman (<i>Cenchrus ciliaris</i>), Karad (<i>Dicanthium annulatum</i>)

	d. Bushes	: Kheemp (<i>Leptadenia pyrotechnica</i>), Phog (<i>Calligonum polygonoides</i>), Jal (<i>Salvadora oleiodes</i>), Kair (<i>Caparis decidua</i>), Bui (<i>Areva pseudotomentosa</i>), Bor (<i>Zizphus mauritiana</i>), Bordi (<i>Ziziphus nummularia</i>), Lana (<i>Haloxylon alicoricum</i>), Arni (<i>Clerodendrum pholomidis</i>), Morali (<i>Lycium barabarum</i>), Kankera (<i>Maytenus emarginataus</i>)
	e. Trees	: Neem (<i>Azadirachta indica</i>), Khejri (<i>Prosopis cineraria</i>), Babool (<i>Acacia Arabica</i>), Rohida (<i>Tecomella undulata</i>), Kumta, Kumatia (<i>Acacia senegal</i>), Isareli babool (<i>Acacia tortilis</i>)
	f. Others	: Sweet oil (<i>Groundnut, Mustard, Sesame, Linseed</i>), Jaggery, Turmeric, Ajwain and common salt
9.	Housing	
	a. Nights	: Mostly temporary enclosures without overhead sheds
	b. Day	: None
	c. Housed in Kacha	: Mostly
	d. Housed in pucca	: None
	e. Open house	: Mostly
	f. Closed type house	: None
10.	Water sources	
	a. Haud (%)	: 19.09
	b. Canal, beries (wells), Hand Pump (%)	: 10.00
	c. Nadi (%)	: 10.00
	d. Ponds (%)	23.64
	e. Tanka (%)	8.18
	f. Tubewell (%)	29.09
11.	Management	
	a. Semi-intensive (%)	: Negligible
	b. Extensive (%)	: Mostly
12.	Mating method	: Natural service only (Breeding season: December to February)

B. PHYSICAL CHARACTERISTICS		
1.	Coat colour	
	a. Light Brown (%)	: 13.00
	b. Sand Brown (%)	: 38.00
	c. Brown (%)	: 27.00
	d. Dark brown (%)	12.00
	e. Deep dark brown (wenge) (%)	10.00
3.	Hair length	
	a. Small (%)	: 7.00
	b. Medium (%)	: 84.00
	c. Large (%)	: 9.00
4.	Head	:
	i. Size	
	a. Small (%)	: 08.00
	b. Medium (%)	: 69.00
	c. Large (%)	: 23.00
	ii. Fore Head	:
	a. Normal/Flat (%)	: 85.00
	b. Prominent	15.00
	iii. Muzzle	: Tight
	a. Normal (%)	: 62.00
	b. Sharp (%)	: 38.00
	iv. Lips	
	Upper lips	Normal
	Lower lips	
	a. Normal (%)	77.00
	b. Slightly drooping (%)	23.00
5.	Body size	:
	a. Small (%)	: 5.00
	b. Medium (%)	: 70.00
	c. Large (%)	: 25.00

6.	Chest pad	: Developed
	Normal (%)	86.00
	Prominent (%)	14.00
7.	Hump size	
	a. Small (%)	: 11.00
	b. Medium (%)	: 86.00
	c. Large (%)	: 03.00
8.	Udder (Females)	
	a. Round (%)	: 87.00%
	b. Pendulous (%)	: 13.00 %
9.	Milk vein (Females)	
	a. Small (%)	: 7.00
	b. Medium (%)	: 86.00
	c. Large (%)	: 7.00
10.	Temperament	
	a. Active (%)	78.00
	b. Dull (%)	22.00
11.	Morphometric characters (cm)	: Adult Female
	i. Heart girth	: 206.80±0.47
	ii. Body length	: 164.54±0.49
	iii. Height at wither	: 194.43±0.42
	iv. Tail length	: 56.18±0.24
	v. Neck length	: 119.51±0.48
	vi. Face length	: 47.05±0.15
	vii. Distance between eyes	: 25.92±0.10
	viii. Ear length	: 12.19±0.03
	ix. Fore leg length	: 141.96±0.27
	x. Hind leg length	: 164.54±0.34
	xi. Foot pad(L/W)	
Xi a.	Fore leg (length)	: 20.65±0.05
	Fore leg (width)	: 19.68±0.05
Xi b.	Hind leg (length)	: 18.09±0.04

	Hind leg (width)	: 17.17±0.05
12	Body Weight	
	Age Group	Weight (Kg)
	i. Up to 1 year	: 233.78±8.58 (Male) 195.76±10.14 (Female)
	ii. 1-4 year	: 486.14±9.43 (Male) 496.68±5.88 (Female)
	iii. Adult	: 664.38±7.83 (Male) 642.46±2.57 (Female)
C. PERFORMANCE		
1.	Draught	: Good
2.	Dairy Performance	
	a. Daily milk yield	: 5.71 liters per day (with calf suckling)
	b. Lactation length	: 13-16 months
3.	Hair production (Annual)	: 500-700 gm per annum
4.	Hair Quality	
	a. Fibre length (cm)	: 3.84±0.09
	b. Fibre diameter (μ)	: 59.75±2.20
	c. Medullation (%)	: 85.83±1.31
D. REPRODUCTION		
	Female	
	Age at first oestrus	: 3.73 Years
	Age at first mating	: 4.31 Years
	Age at first calving	: 5.21 Years
	Inter calving period	: 2.00 Years
	Gestation period	: 13 months
	No. of calving	: 7-8 in life time
	Service period	: 1.14 years
	No of service per conception	: 1.13
	Male	
	Age at first ejaculation	4.66 years
	Age at first service	5.49 years

REFERENCES

- Anjum, N. A. (2006). Camel as transport animal in Mughal India. *Proceedings of the Indian History Congress*, vol. 67, pp. 244–250.
- Faye, B. (2020) How many large camelids in the world? A synthetic analysis of the world camel demographic changes. *Pastoralism* 10:25. <https://doi.org/10.1186/s13570-020-00176-z>.
- Fowler, M.E. (1998). *Medicine and surgery of South American camelids*. 2nd ed. USA: Iowa State Press Blackwell.
- Indra, R. Magash, A. and Biichee N. (1998). *Studies of Bactrian camel*. Ulaanbaatar, p. 303. Institution Press, Washington.
- Jassim, S. A. A. and Naji, M. A. (2002). The desert ship: heritage and science - unique camel antibodies. *Middle. East. Lab.*, 5: 6 – 11.
- Khanna, N.D. Rai, A. K. and Tandon S.N. (2004). Camel breeds of India. *Journal of Camel Science* 1: 8-15.
- Khanna, N. D. and Rai, A. K. (1990). Scientific camel management can check desertification. *Indian Farming* 40: 33-35.
- Khanna, N. D. and Rai, A. K. (1991). Camel rearing in the Indian arid zone. *Annals of Arid Zone* 30(1): 1-10.
- Köhler-Rollefson, I. (1992a). The Raika dromedary breeders of Rajasthan: A pastoral system in crisis. *Nomadic Peoples* 30: 74–83.
- Köhler-Rollefson, I. (1992b). The camels of India in social and historical perspective. *Animal Genetic Resource Information* 10:53–64.
- Patni, P. C. and Dhillon, R.S. (1988). Areas and prospects of utilization of camel hair and hide. National seminar on perceptions and potentials of camel research in India. 9-10 October 1988, at the NRCC, Bikaner.
- Rathore, G.S. (1986). *Camels and their management*. New-Delhi: Indian Council of Agricultural Research.
- Saxena, R. K. (1989). *The army of the Rajputs*. New Delhi: Munshiram Manoharlal Publisher Pvt. Ltd.
- Schwartz, H.J. and Dioli, M. (1992). *The one-humped Camel in Eastern Africa. A Pictorial Guide to Diseases, Health Care and Management*. Verlag Josef Margraf Scientific Books Editions.
- Sharma R. Ahlawat, S. Sharma, H. Prakash, V. Shilpa, Khatak, S. Sawal, R.K. and Tantia, M.S. (2020). Identification of a new Indian camel germplasm by microsatellite markers based genetic diversity and population structure of three camel populations. *Saudi Journal of Biological Sciences* 27: 1699-1709.

- Srivastava, V. K. (1991). Who are the Raikas/Rabaris? *Man in India* 7191: 279-304.
- Wernery, U. (2003). *New observations on camels and their milk*. Berlin: Blackwell Wissenschafts-Verlag.
- Wilson, R.T. (1978). Studies on livestock of southern Darfur, Sudan. V: Notes on camels. *Tropical Animal Production* 10 (1): 19-25.
- Mehta, S.C. Dahiya, S.S. Sharma, R. Tantia, M. S. and Sharma, A. (2017). *Camel Genetic Resources of India-Jalori Camel*, NRCC /Technical Bulletin /2017/3 /published by ICAR-National Research Centre on Camel, Bikaner , Rajasthan





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