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Genetic Resources and Diversity in Pakistani Goats

MUHAMMAD SAJJAD KHAN[1], MUQARRAB ALI KHAN† AND SULTAN MAHMOOD‡
Department of Animal Breeding and Genetics, University of Agriculture, Faisalabad-38040, Pakistan
†*Department of Livestock and Dairy Development, NWFP, Peshawar, Pakistan*
‡*Livestock and Dairy Development Department, Government of Punjab, Pakistan*
[1]Corresponding author's e-mail: drsajjad2@yahoo.com

ABSTRACT

Goats are the fastest growing ruminants in Pakistan. Preference for goat meat is the major reason for its increased demand. There are 25 goat breeds in the country and two wild relatives such as Markhor and Ibex. Estimated goat population in the country in 2006 is 53.8 millions. Documentation of goat breeds have depended mostly on the annual reports of various research institutes involved in goat production. Meat is the primary breeding objective and milk gets the secondary importance. Appreciable diversity among and within goat breeds exists for morphological, growth, fertility and other traits. Adult body weight, for example, may vary from 20-200 kg. Crossbreeding at farmer level continues to some extent. Organized crossbreeding efforts include crossing of Hairy and imported Angora for the production of mohair. However, crossbreds could not achieve status of commercial animals and are being kept as pets. Any new attempt for crossbreeding should thus be recommended in the light of previous attempts, because short term breeding objectives and limited technical and financial resources could result in failures only. Within-breed selection is a preferred strategy for improvement of traits of economic importance but this requires capacity building of various stakeholders. Indigenous goat resources can be better utilized on sustainable basis if efforts of research and development address indigenous problems. Breed documentation both at phenotypic and genetic level is a priority research area.

Key Words: Pakistani goats; Genetic diversity; Production system; Conservation

INTRODUCTION

Pakistan is rich in goat genetic resources. It is the third largest goat producing country in the world after China and India. At present, there are 53.8 million goats in Pakistan and their population is increasing at the rate of more than 3% per annum (GOP, 2006). Punjab, Sindh, Balochistan and NWFP have 37, 23, 22 and 18% goat population, respectively. There are more than 25 recognized breeds of goat (Hasnain, 1985). Within and across breed diversity exists both at phenotypic and genetic level. Livestock and dairy development departments of different provinces generally manage the research and development activities of goats under the livestock umbrella. Punjab has, however, established a separate directorate for small ruminants which is expected to enhance the research capacity of various goat raising stations as well as those who keep goats. Breed specific development or conservation programs are, however, awaited for tangible outputs. Different aspects of diversity in Pakistani goats are discussed in this paper.

Goat breeds. Various reports do not agree on number of goat breeds in Pakistan. Conflict may be due to inclusion or exclusion of AJK etc, but nomenclature is probably the major reason for differences in the number. As dialect changes after about 100 km, color of the goat vary after some distance, names of the breeds may also change. Moreover, some breeds have names after the location while others carry their names on the basis of a specific attribute. For example, Nachi is named after its dancing gait. A detailed list is presented in Table I. The home-tracts of the goat breeds are not exact because they do not follow any circular or other pattern, they do overlap. The only synthetic breed, Pak-Angora (Angora x Hairy) developed in the 60's did not get popularity at farmer level and is restricted to a research station. Government farms inhabit breeds such as Beetal, Dera Din Pannah, Hairy, Kamori, Nachi and Teddy. Population trend is difficult to present but number of purebreds is expected to be reducing due to lack of any pure-breeding program. None of the goat breed was included in the 1986 livestock census, while 10 breeds were included in the 1996 census. In the 2006 census, number of breeds has increased to 12. Of these breeds, Teddy is the most abundant breed (13.4 millions) followed by Kamori (5.3 millions) and Beetal (4.2 millions).

Production system. In spite of preference for goat meat, goat raising is a low input activity. Grazing alone and grazing with provision of some fodder is the most common system of feeding. Concentrate feeding is rare. Flock size

varies in different production set-ups but 6-15 animals are most common. About 70% goats are distributed in flocks size of less than 50 and 28% are in flock size of more than 200 animals (GOP, 1996). There are a number of systems for (sheep) and goat raising in Pakistan. These include nomadic, transhumant and sedentary flocks and household goats. Nomadic flocks are constantly moving in search of grazing, whereas transhumant flocks have a fixed base to which they return during specific season of the year. Grazing available to both types is usually set by tribal/local customs. There are well-established migration routes usually based on water availability and grazing land. Most kids are born during early spring when flocks are in the milder climates. All female progeny are kept for flock replacement or build-up, but nearly all males are sold before one year of age. Most of the feed for nomadic flocks is derived from rangelands, which is generally free. Transhumant flocks have access to grazing of crop stubbles in their permanent bases, thus making feed supply more reliable. Goats are generally milked for subsistence needs as goat milk is rarely sold in the markets. Sedentary flocks derive most of their feed from grazing wasteland, crop stubbles and nearby rangelands and return to the village/base each night. Performance may be similar to transhumant flocks. Female offsprings are kept as replacements and all males are sold before the age of one year after weaning. Small units, of 4-5 animals, are kept by many rural householders. They are kept in confinement near the house and fed on scraps and weeds. Although some offspring are sold, most is kept for family consumption, especially for ceremonial sacrifice.

Breeding in goats is natural. Semen is not produced for any of the goat breeds for AI or any other purpose. Farmers' preference for superior germplasm varies across different agro-ecological zones. Government livestock farms are a good source of superior males but their contribution in the development of breeds is negligible. Also, with the two tier structure of nucleus flocks and the commercial flocks, government farms can not cope with the demand of good germplasm. The wastage due to diseases is major economic loss in goats. This is mainly due to lowered resistance, caused by under/mal nutrition resulting in deaths due to various diseases. Internal parasites (especially round worms) enterotoxaemia and pneumonia are considered as the major reasons for heavy losses. In institutional setups however, vaccination is routinely done for enterotoxaemia and pleuropneumonia. In some areas vaccination against foot and mouth disease and anthrax is also done.

Utilization of goats. The primary objective of goat raising is meat. The breeds are sometimes categorized as meat, dairy and hairy types but actually major objective of goat raising is meat while milk obtained from goats is also consumed and hair are also used domestically for producing rugs by poor and the needy families. Only fresh meat is sold. Hundred of thousand goats are sacrificed on religious occasions, especially on Eid. Being large in size, breeds such as Beetal and Kamori are preferred for sacrificial purposes. Teddy, the most prolific and one of the smallest breeds is most common as well. Religious customs in certain areas also encourage raising goats in separate flocks. Sacrificing goats is for example, a custom to celebrate deaths in Kafiristan and therefore, large goat flocks are common. Generally, however, mixed sheep and goat flocks are found throughout the country. Because of different feeding habits, sheep and goat flocks utilize the available grazing areas efficiently. Goats are also known for locating water and other resources better than other species and are therefore, preferred in the sheep flocks. In areas where wild animals are common, alarmed bleating by goats also helps the farmers in safeguarding the flocks. Generally, fresh milk is consumed but in cold areas, cheese is also manufactured from goat milk for domestic consumption.

Phenotypic diversity. Animal recognition is primarily based on physical/outward attributes such as body size, colour and shape of the horns. Black colour is commonly found (solid or in patches of various sizes) in most breeds except for Bugitoori of Sindh. Horns are generally curved but a lot of variation exists from being polled to being spiral (e.g., Bugitoori). Many breeds are clipped for hair. Wide variation exists in various productive and reproductive traits as well. The sub-optimal productivity of the existing flocks is generally attributed to low genetic potential, nutritional, management and disease control inadequacies. Most of the local goats breed more than once a year with some tendency (autumn & spring) of seasonality. Kidding percentages vary between 100 and 150%. Mortality may be as high as 25% in confined animals. Body weight may be as low as 20 kg for breeds like Teddy and may be more than 200 kg in certain well prepared animals of Beetal. Bahawalpuri strain has been seen to cross even these upper limits. Among the large breeds such as Beetal weaning weight 15 kg and yearling weight of 28 kg (Afzal, 2006) are not encouraging. Age at first kidding in the study was 877 days. In the smaller breeds such as Teddy weaning and yearling weight have been reported 10 and 20 kg, respectively (Hyder, 1999). Age at first kidding in the breed was reported as 343 days. Goat milk competitions are also included at various livestock shows where Beetal is the usual winner. Based on a comparative study with 20 animals of each breed, average lactation yield of Beetal goats was 147 L as compared to Dera Din Pannah and Nachi breeds with 160 and 187 L, respectively (Iqbal *et al*., 2003). Show-ring records, on the other hand, indicate milk yield of 12 L per day for Beetal goats (Tahir, 2004).

Genetic diversity. Studies on genetic diversity in Pakistani goats for specific traits are not available. Studies on the relationships among breeds and species have however emerged in the literature in the recent past. Sultana *et al*. (2003) analysed the complete mitochondrial DNA D-loop and the cytochrome b gene of 13 Pakistani domestic goat breeds and the Sindh Ibex (*Capra aegagrus blythi*). Breeds included were from Punjab (Beetal, Dera Din Panah, Long Hairy, Nachi, Pak Angora), Sindh (Patri, Barbari, Tapri,

Table I. Goat breeds of Pakistan

	Breed	Synonym	Utility	Geographic distribution	Pop. size* (2006 census)	Pop. trend
1.	Baltistani		Meat, milk, hair	AJK	190	Negative
2.	Barbari	Bari	Meat, milk	Sindh, Punjab	2306	Positive
3.	Beetal		Meat, milk	Punjab	4214	Positive
4.	Beiari	Chamber	Meat, milk	AJK	39**	NA
5.	Buchi		Meat, milk, hair	AJK	61**	NA
6.	Bugi Toori	Sindh Desi	Meat, milk, hair	Sindh	NA	NA
7.	Bujri		Meat, milk, hair	Sindh	NA	NA
8.	Chappar	Kohistani, Jablu	Meat, milk, hair	Sindh, Balochistan	106	Negative
9.	Damani		Meat, milk, hair	NWFP	1320	NA
10.	Dera Din Panah	DDP	Meat, milk, hair	Punjab	143	Negative
11.	Desi	Jattal	Meat, milk, hair	AJK	NA	NA
12.	Gaddi		Meat, milk, hair	NWFP, AJK	416**	NA
13.	Hairy		Meat, milk, hair	Punjab	NA	NA
14.	Jarakheil		Meat, hair, milk	AJK	129**	NA
15.	Jattan		Meat, milk	Sindh	1011	NA
16.	Kacchan		Meat, milk	Sindh		NA
17.	Kaghani		Meat, milk, hair	Punjab, Northern areas	532	Negative
18.	Kail		Meat, milk, hair	AJK	NA	NA
19.	Kajli	Kajlee, Pahari	Meat, milk, hair	Punjab, Balochistan	404	NA
20.	Kamori		Meat, milk	Sindh	5294	Positive
21.	Khurassani	Baluchi	Meat, milk, hair	Balochistan	436**	NA
22.	Kohai Ghizer		Meat, milk, hair	Northern Areas	238**	NA
23.	Kooti		Meat, milk, hair	AJK	45**	NA
24.	Kurri		Meat, milk	Sindh	NA	NA
25.	Labri		Meat, milk, hair	AJK	118**	NA
26.	Lehri		Meat, milk, hair	Balochistan	982	Positive
27.	Lohri		Meat, milk, hair	Sindh	290**	NA
28.	Nachi	Bikaneri	Meat, milk, hair	Punjab	114	Negative
29.	Pak-Angora		Mohair	Punjab	<0.5	NA
30.	Pateri		Meat, milk	Sindh	1383	NA
31.	Piamiri		Meat, milk, hair	Northern Areas	79**	NA
32.	Potohari	Salt Range	Meat, milk	AJK, Punjab	42**	NA
33.	Shurri		Meat, milk, hair	AJK	94**	NA
34.	Tapri	Lappi	Meat, milk	Sindh	NA	NA
35.	Teddy		Meat, milk	Punjab, AJK	13422	Positive
36.	Tharki	Tharri	Meat, milk	Sindh	NA	NA

*Thousand heads, if not available, estimates are given; ** 1986 estimates from DAD-IS [http://dad.fao.org]

Table II. Wild relative of goats in Pakistan

	Breed/species	Synonym	Habitat
1	Markhor	*Capra falconeri*	
	i. Kashmir markhor	i.*C.f.Cashmirensis*	i. Chitral, AJK, CGNP
	ii. Astor markhor	ii.*C.f.falconeri*	ii. Gilgit, Hunza, KuNP
	iii. Suleiman markhor	iii.*C.f. jerdoni*	iii. Balochistan
	iv. Chiltan markhor	iv.*C.f.Chialtanensis*	iv. Balochistan
	v. Kabul Markhor	v. *C.f.megaceros*	v. NWFP
2	Ibex		
	i. Siberian Ibex	*Capra ibex sibirica* Himalayan ibex Wild goat	Baltistan, Hunza, KuNP
	ii. Sindh Ibex	*Capra hircus aegagrus* Sindh wild goat Persian pasang Sarah (Sindhi)	Sindh & Balochistan, KiNP

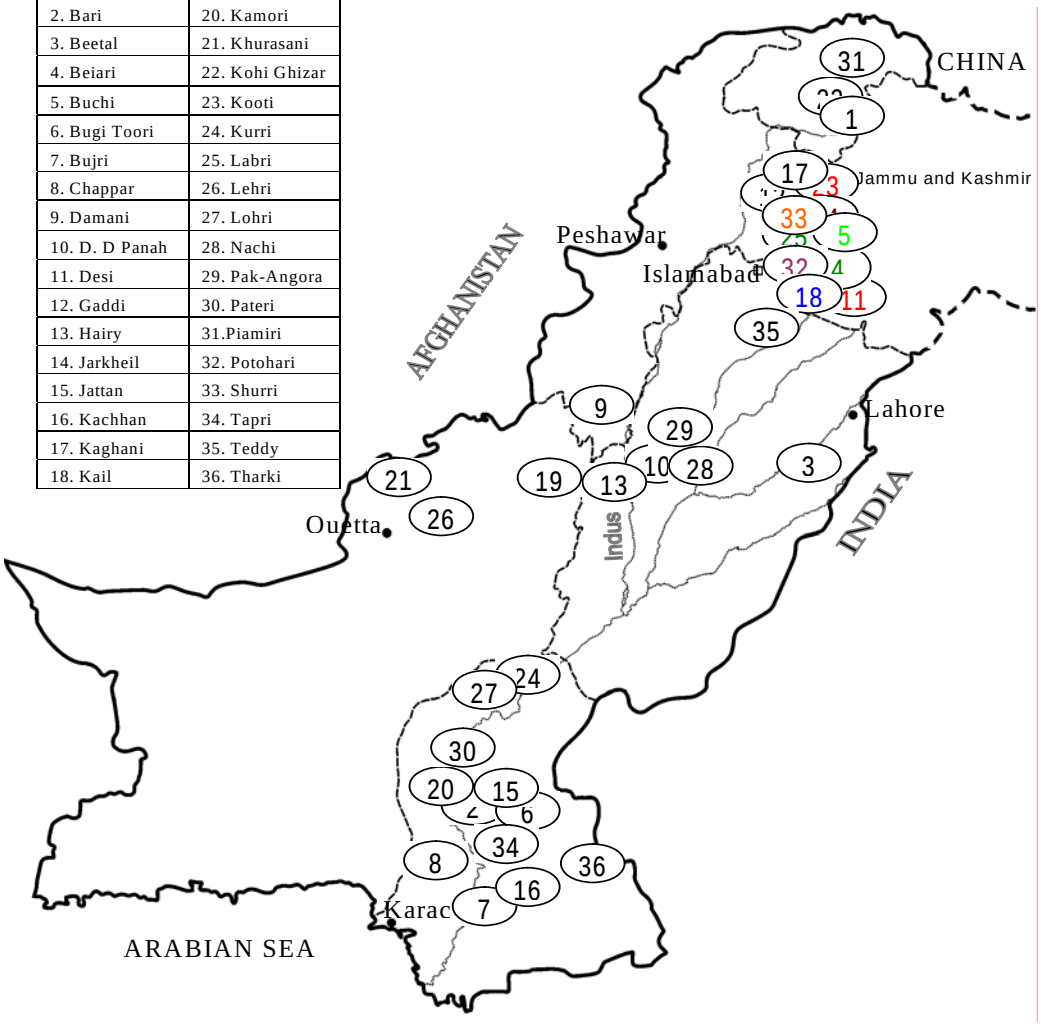
CGNP = Chitral Gol National Park; KuNP = Khunjrab National Park; KiNP = Kirthar National Park

Kohistani, Kamori), Balochistan (Khurassani, Lehri) and the North West Frontier (Teddy) provinces. The phylogenetic analyses and sequence divergence (SD) established four distinct mt-lineages termed as A, B and C (previously reported) and a new lineage D. The Sindh Ibex appeared as an outgroup of domestic goats. The scientists suggested that at least four different strains of wild Capra might have been the source of the modern domestic goats. The extensive and high mt DNA diversity in Pakistani domestic goat breeds also helped the scientists to further support the hypothesis that Mehrgarh (in Balochistan) may be one of the ancient centers of goat domestication.

Loss of diversity. One of the main enemies of diversity is inbreeding. Homozygosity within breeds is generally measured to judge if a breed is at a greater risk of loosing diversity or not. The inbreeding studies in goats are generally very few. Khan *et al*. (2007) studied level of inbreeding and its effects on growth and reproductive traits using 4554 kidding record. Level of inbreeding varied over the years; was zero in 1974 then increased @ 0.42% per year till 1987 when all the bucks and some of the does were replaced with unrelated animals. Thereafter (till 2000), inbreeding again increased @ 0.2% per year and declined when un-related bucks were introduced. The average level of inbreeding over the years varied from zero to 7%. For different years, percent inbred animals varied between zero and 89%. About 3.4% of animals were 25% or more inbred. Reproductive traits exhibited deterioration. Deterioration in weight at first service and at first kidding did not reach statistical significance yet, kidding interval increased due to

Fig. 1. Home-tracts of goat breeds in Pakistan

1. Baltistani	19. Kajli
2. Bari	20. Kamori
3. Beetal	21. Khurasani
4. Beiari	22. Kohi Ghizar
5. Buchi	23. Kooti
6. Bugi Toori	24. Kurri
7. Bujri	25. Labri
8. Chappar	26. Lehri
9. Damani	27. Lohri
10. D. D Panah	28. Nachi
11. Desi	29. Pak-Angora
12. Gaddi	30. Pateri
13. Hairy	31.Piamiri
14. Jarkheil	32. Potohari
15. Jattan	33. Shurri
16. Kachhan	34. Tapri
17. Kaghani	35. Teddy
18. Kail	36. Tharki



inbreeding. Effect of inbreeding on growth and reproductive traits in Beetal goats was not very pronounced in the flock but planned matings were suggested to avoid accumulation of inbreeding and appearance of its deleterious effects. As level of inbreeding is quite underestimated due to incomplete pedigrees and poor data quality, convincing flock owners of deleterious effects of inbreeding is difficult. Therefore, at farmer level, use of sires from own flock be discouraged as it is expected to reduce variability among members of the flock. Farmers should therefore be encouraged to have more males in their flocks to reduce inbreeding.

Wild relatives of goats. Wild relatives can potentially contribute to the diversity of domestic goats. In Pakistan, Markhor (*Capra falconeri*) and Ibex (*Capra ibex*) are the two main wild relatives of goats (*Capra hircus*) (Table II). Two subspecies of markhor are recognized: flare-horned markhor (*Capra falconeri falconeri*) which includes the Kashmir and Astore forms and straight-horned markhor (*C.f. megaceros*) which includes the Kabul and Suleiman forms (Roberts, 1997). The species is associated with dry, steep slopes at lower elevations that provide adequate escape terrain and shallow snow cover in winter. The distribution of this animal may range from an altitude as low as 700 m to 1,000 m in some of the hills bordering the Indus basin to as high as 4,000 m during summer in Chitral and Gilgit regions, where its distribution may seasonally overlap that of the Asiatic ibex. Flare-horned markhor is mainly confined to small, scattered populations along the Indus River and its tributaries in the North West Frontier Province (NWFP) and Northern Areas, as well as along the Kunar (Chitral) River and its tributaries in NWFP. Population estimates vary widely. Among five kinds of markhor, Suleman and Chiltan are considered endemic or near-endemic (http://www.wildlifeofpakistan.com/MammalsofPakistan/mammalsofPakistanmain.htm).

Ibex (wild goat) is an animal of higher elevations. The

Siberian Ibex is restricted to colder climate of Northern Areas especially the northern Hunza and Khunjerab valleys. The Sindh Ibex on the other hand is found in mountain ranges of southern Balochistan from Makran coastal range at Pasni right across to Sindh Kohistan and Kirthar Range in the east. Kirthar National Park in Sindh province inhabits few hundreds of these.

CONCLUSION

Diversity studies both on phenotypic and genetic diversity are very limited inspite of large number of goat breeds in Pakistan. Although, successful crossbreeding attempts using exotic breeds are not many, such expeditions are feared in future. Capacity of institutions to take up any genetic selection program is very low. Breeds therefore need to be documented and described immediately both at phenotypic and genetic levels. For any tangible improvement, a three-tier structure of nuclei, multipliers and commercial farmers should replace the two-tier structure (nuclei & commercial flocks). There is need to improve realization that it is a collective responsibility to leave the available genetic resources for coming generations, in a better form than what we inherited.

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