

# Characterization and Evaluation of Tibetan Sheep: a key source of livelihood in alpine ecosystem of Sikkim Himalaya

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## ABSTRACT

The Tibetan sheep is one of the key sources of livelihood for the Dokpas; the high altitude tribal community, designated as the poorest of poor and remotest of the remote in India. Tibetan sheep is very hardy and thrives well in very harsh climatic conditions of Tibetan plateau. At higher altitude, sheep is reared under transhumance system (seasonal cyclic movement) with almost zero input and their movements are mostly governed by weather and pasture availability. Their migratory patterns include alpine pastures at altitude of 4754.88 m above msl in Phalung valley to as high as at altitude of 5638.8 m above msl of cold desert region near the border of Tibetan Autonomous Region, China. The Tibetan sheep is medium size breed with height of adult male and female 77 cm (70 to 80 cm) and 64 cm (60 to 67 cm), respectively and average adult weight 42 kg (37 to 50 kg). The coat colors of Tibetan sheep are mostly white with black or dark brown neck and face. The ewes are polled while the rams are horned with average horn size of  $18.40 \pm 0.73$  cm. Their ears are drooping with average length of  $11.09 \pm 0.20$  cm and  $6.29 \pm 0.06$  cm for male and female respectively. The sheep also acts as rejuvenator of the whole alpine agro-ecosystem as its act of grazing prunes of the vegetation, maintaining soil fertility through urine and its pallets. It also helps in seed dispersal, pollination and seed germination. Presently, Tibetan sheep population is declining and only 235 animals are present in Sikkim, which is very alarming for the existence of this valuable sheep and needs immediate conservation.

**Key Words:** Tibetan sheep, Transhumance, highlanders

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## INTRODUCTION

Sikkim is a small, beautiful and land locked state of India, surrounded by vast stretches of the Tibetan plateau in the north, Nepal on the west, Bhutan and Chumbi valley of Tibet Autonomous Region of China in the east and Darjeeling District of West Bengal in the south. At higher altitudes where agriculture practices are subtle; nomadic pastoralism or transhumance and agro-pastoralism are practiced as primary means of livelihood. Although yaks characterize agro-pastoralism at higher reaches of North Sikkim yet sheep are usually economically as well as ecologically more important. The Tibetan sheep breed, locally known as "Luk" synonymous to Goddess Laxmi (Goddess of wealth) is reared by the nomadic highland herdsman of Tibetan origin *i.e.* Dokpas and Lachenpas (Schedule Tribe of North Sikkim) in the alpine meadows of Phalung and cold desert area of Dongkong, Yumchho, Gurudongmar, Cho-Lhamu and Dorjila ranges in North Sikkim (Kumar et al. 2015). The breed is originally native to Tibet, which later migrated to Sikkim along with Tibetan traders and herdsman and is well adapted to North Sikkim agro-climatic conditions. Before the closure of the border in 1962, the area/route was very much important for trade in the barter system that was practiced. Tibetan traders visited Sikkim and Darjeeling with Tibetan salt, tea, carpet, gold, stone ornaments and

meat of Tibetan sheep and yak that was exchanged with cloth, rice, sugar, wooden items, natural dye and bamboo crafts *etc.*

The Tibetan sheep is well adapted to temperate climate and providing livelihood to the people in the region since time immemorial as their traditional occupation was wool trade and nomadic pastoralism. These animals are reared under transhumance pattern where the herdsman migrate along with their sheep flock from pasture to pasture depending upon season and availability of green fodder (Kumar et al. 2015). Tibetan sheep plays key role in sustaining the production system and maintaining balance in high altitude agro-ecology along with yak (Kumar et al. 2015). These sheep are unique and being adapted to the very harsh climate of alpine and cold desert; characterized by frequent snow fall, seasonal fodder availability, high speed wind, enhanced ultraviolet exposure and relatively oxygen tense environment.

The Tibetan sheep is considered as most rustic breed of sheep surviving in very harsh climate and partially starved condition during peak winter and providing livelihood security and ecological sustenance in alpine agro-ecosystem. However, population of Tibetan sheep decreased drastically in recent past (Banerjee, 2009) due to lack of regulated market, transport linkage, shrinkage pasture land, inbreeding, occurrence of diseases and very

harsh climate, geographical isolation all of which leads to failure to retain younger generation in sheep herding. Population have gone down from 30,000 (Acharya, 1982) to less than 250 in Sikkim (Livestock Census, 2012; Kumar, 2015; Sharma et al. 2016). Despite huge contribution to the livelihood of *Dokpas*; the high altitude sheep herding tribal community has been designated as *the poorest of the poor* and *remotest of the remote* in India and yet, ensure ecological sustenance to one of the most fragile Himalayan ecosystem. The Tibetan sheep had not given due attention, either by researchers or policy makers. It is first study under taken to describe the breeds, its rearing practices, role in sustaining the livelihood of high landers and alpine agro-ecosystem.

#### MATERIALS AND METHODS

The distribution of the breed was identified through personal discussion with officers of the Department of Animal Husbandry Livestock Fisheries and Veterinary Services and interaction with farmers in the different part of Sikkim. The hamlet visit was followed with the common principle of rapid rural appraisal (Chambers, 1994) to collect information on transhumance sheep production in alpine and cold desert of North Sikkim. Data on morphological traits color, shape and physical appearance were studied. Metric traits were measured with the help of hanging animal weighing scale, measuring tape, meter sticks Vernier Calliper and digital camera. Ecological observations were taken through personal observation. The market price of the items and cost of shepherding were initially collected from focus group discussion and further validated with in consultation with shepherd. Data is presented in the form of mean and standard errors.

#### RESULTS AND DISCUSSION

##### *Distribution*

Tibetan sheep are reared in transhumance manner by *Dokpas* (Sheep and Yak herders) and these migratory families live along with sheep in Thangu, Phalung, Dongkong, Gurudongmar and Cho-Lhamo area of North Sikkim. The *Dokpas* have very limited per capita land holding and pay nominal royalty per unit sheep to the State Forest Department or their local governing body known as the "Dzumsa". Rearing of Tibetan sheep is very difficult and demands enormous sacrifice from the herdsman since they have to live with sheep for long duration under harsh climatic conditions away from families and friends. The current population of sheep is 235 and details distribution explained in Table 1.

##### *Morphometric measurement*

The coat colors of Tibetan sheep are mostly white with black or dark brown neck and face. The face is black or brown spotted with white or complete white with black eyes are observed in the flock. The Tibetan sheep is medium size breed with height of adult males and females 77 cm (70 to 80 cm) and 64 cm (60 to 67 cm) respectively and average adult weight 42 kg (37 to 50 kg). The ewes are polled while the rams are horned with average horn length  $18.40 \pm 0.73$  cm. Their ears are drooping with average length and width  $11.09 \pm 0.20$  cm and  $6.29 \pm 0.06$  cm for males and  $10.33 \pm 0.25$  cm and  $5.65 \pm 0.09$  cm, for females respectively. Tibetan sheep have typical Roman nose with average Roman height  $13.49 \pm 0.24$  cm in males and  $12.41 \pm 0.15$  cm in females. The tail is short and thin type with length and base circumference is  $13.47 \pm 0.61$  cm and  $6.93 \pm 0.39$  cm respectively in males and  $13.93 \pm 0.30$  cm and  $7.57 \pm 0.41$  cm, in females respectively.

The Tibetan sheep is medium size breed and average adult male weight 46 kg (39 to 50 kg) and average adult female weight 44 kg (37 to 49 kg). The Tibetan sheep inhabit area where agriculture practices subtle to nil and clear vegetation dynamics exist at higher altitude. During winter season especially in month of January and February area experiences heavy snow fall and virtually no pasture or very little dried grass is present in the cold desert forcing sheep to live in partially starved condition apart from coping with severe snow fall. This leads to a weight loss of approximately 14 percent (12 to 16 percent) in adult sheep.

##### *Housing and feeding*

Tibetan sheep is housed in stone fenced enclosures during nights without any roof or any special weather protection strategies despite very harsh climate prevailing in their habitat. The Tibetan sheep is totally maintained on grazing over the alpine pasture and cold desert region with zero external input. Tibetan sheep is housed in stone fenced enclosures during nights without any roof or any special weather protection strategies despite very harsh climate prevailing in their habitat.

##### *Migration pattern*

Detailed study of migratory pattern of sheep revealed that sheep remain six months in cold desert pasture *i.e.* Dongkong and Gurudongmar area and six months in alpine pasture especially in Phalung valley. Though their migratory pattern is mainly governed by fodder availability but it is equally influenced by climatic

**Table 1.** Population distribution of Tibetan sheep in breeding tract

S. N.	Altitude	No. of Animal	Range (Flock Size)	No. of ownership
1.	Lower altitude <4,266 m above msl	40	(5-15)	4
2.	Higher altitude >4,266 m above msl	195	195	1
3	Total	235	-	5

conditions in the pasture area.

#### Disease prevalence

Limping is one of the major problems of higher altitude and recent study revealed that about 11.8 % of animals suffered with extremities gangrene because of frost bite. Other diseases like ectoparasitic infestation (45 %), diarrhea (8 %) and parasitological screening of fecal samples revealed 26.53 % animal suffering with various gastrointestinal parasites. Veterinary care are not reached at higher altitude that compelled *Dokpas* (sheep and yak herders) to rely on indigenous technological knowledge, which has been transferred from generation to generations without any documentation.

#### Wool and wool product

First shearing of the lamb is done at age of six months and adult animals are sheared once in a year in the month July in Phalung valley when *Dokpas* tribe celebrate their important festival *i.e. Drukpa Tshechi*. The average wool yield 700 gm per sheep average staple length and fiber diameter are 11.86 cm and 29.08  $\mu\text{m}$  respectively with 3.83 percent medulation. The quality trait of wool is sub white, full of glass, equal and long fiber. It is found that wool of Tibetan sheep efficiently utilized in making traditional attire and blankets; like making coats, *bhakku* (traditional attire) and blankets. It is believed that carpet made from the Tibetan sheep wool is one of the best qualities in the world. The various wool products and their Tibetan name are: *Shemay Chhuba*; (It is traditional attire made of pure sheep wool colored with vegetable dye and quite costly and used by people at higher position in society), *Chuktoo* (It is a blanket made up of pure sheep wool and the outer layer covered with sheep wool and inner surface bare) and *Pakcha* (similar to *chuktoo* but inner lining coated with lamb wool).

#### Meat and meat products

The *Dokpas* mostly slaughter their sheep in the month of November when sheep have maximum body weight and also occasionally slaughter during the festivities. The sheep meat is air dried and stored sufficient quantities for long duration for self consumption without any chemical preservative. It is found that the *Dokpas* use small amount of meat almost daily in their diet as seasoning agent and also for wholesome nutrition. The cut making of sheep carcass is different from the usual practice (Figure 1) and they name each part differently. Their utilization pattern is also fixed and generally start from the head goes to the back region. Sometimes, *Dokpas* remove the meat around the skull completely, boil it and thereafter sundries the skull. Such preserve skull is used in their prayer as sacred thing.

Intestines are used in sausage preparation with stuffing of clotted blood, minced meat and fat. The smoke dried sausages are used for prolong periods. They make sheep meat curry with spices and sheep fat but most often they cut the sheep meat in small pieces and cook with water and adding some amount of salt. It is also noticed that

sometimes they eat one or two raw pieces of sheep meat and it is believed that to be more beneficial for health due to its medicinal values. Sometimes they mix pieces of sheep meat in pulses and other vegetable preparation for enhancing the taste. Reticulum of the sheep is used for prolonged storage of processed/raw yak fat. Sometimes, a horn along with skull of ram is retained as trophy at home for worship.

#### Production system

The Tibetan sheep and yak are the key sources of livelihood for the *Dokpas*. The sheep also acts as rejuvenator of the whole alpine agro-ecosystem as its act of grazing prunes of the vegetation which is very much required for proper growth and maintenance of the pasture. It also helps in seed dispersal, pollination and seed germination because some plant seed with very hard coating require priming which is sometimes fulfilled by the Tibetan sheep. Occasionally sheep is also hunted by canines of the high altitudes. The sheep hooves are small, stiff cloven footed animals and graze in group and walk in multiple rows fashion which form mini tracks and micro ridges and rills on hill slopes which prevents soil erosion, especially from wind, as these areas experience high wind velocity throughout the year.

The Tibetan sheep is totally maintained by grazing over the alpine pasture and cold desert region with zero external input. It is found that every part of the Tibetan sheep is utilized; like wool for making coat, *bhakku* (traditional attire) and blankets, meat for self consumption and sale; beads as fertilizer for agricultural production. Generally, while grazing sheep manure the whole alpine agro-ecosystem with their beads and urine, while the night shelter manure accumulated over the months is taken to lower altitudes by *Bhutia ponies* for cultivation of vegetables, like potato, leafy mustard, pea, french bean and cereals like millets and maize apart from manuring their apple and peach orchards.

#### Economic of transhumance sheep farming

Instead of declining of transhumance sheep population, the system is dependent on the natural vegetation and cost



Figure 1. Different meat (*Lukshya*) cut parts Tibetan sheep

**Table 2.** Economic analysis of establishment of one flock unit (200 No.) of sheep in Alpine-Cold desert pasture under traditional (transhumance) pattern of rearing in North Sikkim

S. N.	Particulars	Rate (in rupees) (Lakh rupees)	1st Year (Lakh rupees)	2nd Year
A.	Capital Investment			
1.	Procurement of adult sheep @ of Rs. 6000	200 × 6000	1.20	0.00
2.	Transportation Charges	1,00000	1.00	-
3.	Cost of construction, stone fenced wall in migratory route of sheep @ Rs. 3000	4 × 3000	0.12	0.00
4.	Utensils and shearing items	10,000	0.10	0.00
	Total		2.42	0.00
B.	Operating Cost/Losses			
1.	Even in lean period very little additional feeding	10000Rs.	0.10	0.00
2.	Little amount of conc. with salt during lean period	10000	0.10	0.11
3.	Cost of medicine and vaccine	0.00	0.00	0.00
4.	Shepherd charges @ Rs. 7000/month	7000 × 12	0.84	0.92
5.	Adult Mortality losses 5 %	10 × 6000	0.60	0.66
6.	Lamb Mortality losses 10%	20 × 2500	0.50	0.55
7.	Contingencies	10000	0.10	0.11
	Total		2.24	2.35
C.	Gross Return			
1.	Sale of yearling lamb with 60 % lambing and 50 % lambs sale @ of Rs. 5000/lamb as prized meat	50 × 5000	2.50	2.75
2.	15% sale of old stock @ rate Rs. 7000/ sheep as prized meat	20 × 7000	1.40	1.54
3.	Sale of wool average 650 gm per sheep/year at cost of Rs. 400/ kg wool	0.650 × 290 × 400	0.75	0.83
4.	Sale of quality sheep manure a 350gm manure /sheep and sale @ Rs. 15/Kg	0.35 × 290 × 365 × 15	5.56	6.12
	Total		10.21	11.24
	Net Return	C-(A+B)	5.55	8.89
	Benefit : Cost		2.19: 1	4.78:1

very little to the unit sheep production. Concentrate feeding is not practiced in the traditional transhumance sheep farming except feeding of salt. The sheep herding is dependent merely upon natural seasonal pasture and has been recognized to be the low input system of rearing. The economics of sheep farming with traditional way of sheep rearing is given in table 2.

The details of benefit cost ratio revealed that in second year the benefit is just doubled of first year benefits (4.78:1) under transhumance system of rearing in North Sikkim.

The sheep rearing at higher altitude is quite economical as it is maintained under transhumance system with zero

input. However, sheep herding failed to attract younger generation and the sheep population is declined drastically in recent past and at present only 235 no in Sikkim which is very alarming. Seeing the importance of sheep herding at alpine zone in livelihood and ecological sustenance, this valuable sheep germplasm needs immediate conservation.

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