Iosr Journal Of Agriculture And Veterinary Science (Iosr-Javs)
E-Issn: 2319-2380, P-Issn: 2319-2372. Volume 17, Issue 12 Ser. 1 (December. 2024), Pp 32-38
Www.Iosrjournals.Org

Phenotypic Traits of Yaks Breed in The Upper and Lower Mustang District of Nepal

Maheshwar Dahal[1*], Shanker Raj Barsila[2], Shiva Hari Ghimire[3], Pratik Hamal[3]
[1]*Nepal Agricultural Research Council, Singh Durbar Plaza, Kathmandu, Nepal*
[2]*Agriculture And Forestry University, Rampur, Chitwan, Nepal*
[3]*National Cattle Research Program, Rampur, Chitwan, Nepal*

**Corresponding author: dr.maheshwardahal@gmail.com*

Abstract
Yak (Bos grunniens) is one of the lesser-known cattle breeds of Nepal. The present study embodies the field-based observations of yak rearing tracts in the two sites of Mustang district. Phenotypic information on conformation and traits at the farmer level was collected through direct measurements of different body parts questionnaires. Body measurements were taken during the survey, visual estimation, and measurement of adult yaks and were based on interviews with yak herders. A total of 34 adult yaks were randomly selected to measure the different elevated sites in the upper and lower mustangs of their native tracts during June 2024. Descriptive and inferential statistical methods were used in data processing and data interpretation. The overall morphometric traits of body length, heart girth, wither height, ear length, horn length, rump length, rump length, tail length, skull length and muzzle circumstances found in upper mustang were found to be 106.56±1.28 cm, 140.16±1.60 cm, 101.82±1.16 cm, 13.07±0.23 cm, 30.14±1.15 cm, 33.75±0.68 cm, 33.21±0.52 cm, 34.44±0.61 cm, 41.82±0.65 cm and 35.98±0.67 cm respectively. Most traits showed significant positive correlations at the 5% ($p < 0.05$) and 1% ($p < 0.01$) levels. Specifically, the correlation between body length and wither height was 0.381, significant at the 5% level. The correlation between body length and ear length was 0.494, and between body length and horn length was 0.526, both significant at the 1% level. Similarly, the correlation between body length and rump length was 0.491, significant at the 1% level. The correlation between wither height and ear length was 0.536, while the correlation between wither height and horn length was 0.494, both remained significant to body length.

Keywords: *Body measurements, performance, production traits*

Date of Submission: 08-12-2024 Date of Acceptance: 18-12-2024

I. Introduction

Yak (*Bos grunniens*), a high-altitude bovine species, plays a vital role in the livelihoods of Himalayan communities in Nepal. These animals are reared primarily above 3,000 m in mountain districts such as Dolpa, Mustang, Manang, Humla, and Solukhumbu. Owing to their unique adaptability to extremely cold, rugged terrains and sparse vegetation, they are indispensable for the survival of communities in these remote areas (Joshi et al., 2021). Yaks are found in the Himalayan region, including Nepal, China, Bhutan, and India, as well as Mongolia and Russia. China has the largest population of domesticated yaks, while wild yaks are predominantly found on the Tibetan Plateau. In Nepal, yaks are integral to the economy and culture of high-altitude communities. They provide essential resources such as milk, meat, wool, and transportation services while also playing an important role in local social and cultural practices (Dong, 2016). Yak rearing in Nepal follows traditional practices, characterized by extensive grazing systems with minimal emphasis on selective breeding. However, interest in improving yak productivity through selective breeding and modern techniques is growing. Crossbreeding with high-altitude cattle such as the local Siri has been practiced to improve milk production and adaptability (Joshi et al., 2020). Yak populations in Nepal have been declining over the years. Kharel (2000) attributed this reduction to factors such as increased crossbreeding, a shift from agriculture to the tourism industry, predation, diseases, reduced availability of fodder, and declining interest among herders. Despite these challenges, yaks remain a multipurpose livestock species, providing milk, meat, wool, hides, and dung for fuel. They are also indispensable as pack animals, facilitating trade and transportation in challenging mountainous regions (Tulachan, 2019). Presently, yak production does not yield high economic returns compared with those of other enterprises. Enhancing the productivity of both purebreds and crossbreds is essential for sustaining yak farming in Nepal (Sherchand & Karki, 1996). The domestic yak (*Bos grunniens*)

and the wild Himalayan yak (Bos mutus) are the two primary yak types in the country, with the latter being found primarily in high-altitude areas (Smith, 2018). Yaks are characterized Phenotypic level (Neopane and Shaha,2002). Very few studies have been conducted on the phenotypic characterization of yaks in Nepal, as highlighted by Neopane et al. (2002), Shrestha and Shrestha (1998), M Kharel (2000), J Shrestha et al (2019) and Gorkhali et al. (2021), along with limited research on production systems. There is noticeable variation in yak sizes between the lower and upper regions of the Himalayan range. The absence of a well-structured breeding program and organization (Wiener et al., 2003), along with insufficient data on the genetic and phenotypic diversity and the current status of existing yak genetic resources (ILRI, 2014), poses a risk of irreversibly losing the genetic diversity and distinctive traits of yaks. This loss could jeopardize the agro-ecological balance and socio-cultural heritage of the entire system. Therefore, it is crucial to urgently document the genetic and phenotypic diversity of yak populations and develop strategies for their sustainable conservation.

To validate and compare previous findings, this study was carried out in different regions of Mustang district, with a focus on the upper areas of Lomanthang and the lower regions of the district. The main objective of this study was to evaluate the productive performance and linear body measurements of adult yaks in Mustang district. This information is expected to contribute significantly to the development of effective yak improvement strategies.

Yak status of Nepal Province: Yak/chauries distribution in Nepal

Table 1. Province-wise and year-specific populations of yaks and chauries in Nepal

Province	2070/71	2071/72	2072/73	2074/75	2075/76	2076/77	2077/78	2078/79
Koshi	21850	22110	22797	21377	21377	21293	17787	17596
Bagmati	11651	11774	12484	11527	11527	11935	14493	14407
Gandaki	10722	10859	14823	15765	15765	13997	12181	10217
Karnali	25385	25298	17773	19646	19646	21761	19846	19417
Sudurpaschim		969	892	1225	1225	1003	1079	924
Total	**69608**	**71010**	**68769**	**69540**	**69540**	**69989**	**65386**	**62561**

MOALD, Statistical Information (2023)

The table presents yak data from various provinces in Nepal over the fiscal years 2070/71 to 2078/79. Koshi Province shows an initial upward trend, reaching a peak of 22797 in 2072/73, followed by a steady decline to 17596 in 78/79. In Bagmati Province, the values remain relatively stable, with slight fluctuations and a notable increase in 2077/78 before dipping slightly to 14407 in 2078/79. Gandaki Province shows an upward trend up to 15765 in 2074/75, followed by a consistent decline, ending at 10217 in 2078/79. Karnali Province starts with the highest value of 25385 in 2070/71, experiences a sharp decrease in 2072/73, and fluctuates in subsequent years, settling at 19417 in 2078/79. Finally, Sudurpaschim Province records the lowest values overall, with slight variations, ranging from 892 in 2071/72 to a peak of 1225 in 2074/75. In summary, the data illustrate varied trends across the provinces, with some showing growth while others experiencing declines of yak/ chauries population in Nepal.

Yak Breeding in Nepal

Yak breeding in Nepal is practiced primarily in high-Himalayan regions, including districts such as Dolpa, Mustang, Manang, Rasuwa, Solukhumbu, and Taplejung, where the cold, high-altitude environment is ideal for yak rearing. Yaks crossbred with local cattle (Bos indicus) produce hybrids such as "Chauri" and "Jhopa," which are more productive and better suited to lower altitudes. Chauries and Jhopkyos production (kind of hybridization) in Nepal is unique in the world. They represent a small proportion of total cattle population in the country; however, are very important commodity for mountain and high hill people (Shrestha and Shrestha, 1998). However, yak farming faces several challenges, including a declining yak population, low productivity, inadequate veterinary services, and the impact of harsh environmental conditions such as heavy snowfall and predation by wild animals such as snow leopards. Conservation efforts, including preserving yak genetic diversity and improving breeding practices, along with research, development, and policy support, are crucial to sustaining yak farming in Nepal and enhancing the livelihoods of mountain communities.

The Government of Nepal has initiated efforts to prevent inbreeding in yak populations by facilitating the exchange of male yaks between different breeding sites. This practice helps maintain genetic diversity within the yak population and improves overall herd health and productivity. Inbreeding, which occurs when closely related animals are mated, can lead to reduced fertility, increased susceptibility to diseases, and lower productivity. By exchanging breeding males, the government ensures that genetic material is diversified, reducing the risks associated with inbreeding. This intervention is particularly crucial in remote Himalayan

regions, where isolated yak herds are relatively prone to inbreeding due to limited breeding stock. These programs also highlight the need for continuous monitoring and support to improve yak farming practices and conserve the genetic diversity of Nepal's yak population. Purebred mating among yaks in the subalpine region of Nepal is not very popular because of its relatively low productivity (Kharel, 2000). Domestic yaks play a vital role and often serve as the sole means of livelihood for transhumant agro-pastoralists in these regions, supplying milk, meat, wool, hair, and hides (Khan et al., 2016; Rasool et al., 2000). Hybridization between yaks and local hill cattle has resulted in hybrids known as *chauries*, which are valued for their increased milk production (Barsila et al., 2014; Barsila et al., 2016) and ability to thrive in the middle hills (Barsila et al, 2014; Barsila.,2015; Bhatta et al., 2015, Sapkota et al., 2024), however, this practice is in declining trend due to poor labor available for herding, although their milk is known for good nutritional quality (Marquardt et al., 2018).The metabolic and behavioral differences in the purebred yak and its hybrids with cattle, however, have also been reported(Barsila et al., 2013a; Barsila et al., 2013b).

Despite their importance, organized breeding programs are limited, leading to challenges such as inbreeding, low productivity, and a declining purebred yak population (Shrestha & Gurung, 2020). Declining population: Climate change: Rising temperatures and erratic snowfall patterns affect pasture availability and yak health (Paudel et al., 2018). There are cross-breeding issues. Overreliance on crossbreeding for *chauries* threatens the genetic purity of native yaks, reducing their adaptability to high-altitude conditions (Bhatta et al., 2015). Limited research and support are needed. There is insufficient investment in yak breeding research, veterinary services, and organized breeding centers in Nepal (Shrestha & Gurung, 2020). Genetic conservation is needed to establish gene banks, and in situ conservation programs can help preserve purebred yaks. Scientific Breeding Programs: The use of artificial insemination (AI) and selective breeding can improve productivity and genetic diversity. Capacity Building, training yak herders on modern husbandry practices and sustainable pasture management is essential. Policy Support: The government should prioritize yak farming through subsidies, improved veterinary care, and infrastructure development in remote regions (Joshi et al., 2021). The Government of Nepal, through the Ministry of Agriculture and Livestock Development and the Cabinet, has decided to observe Baishakh 7 as National Yak Day every year (Himalaya times 2024). This significant decision aims to support the conservation and promotion of Nepal's yaks. It is a commendable step for yak owners and all Nepalese, highlighting the importance of our indigenous breeds and reaffirming the government's commitment to their preservation.

II. Materials And Methods

Study area

Mustang District, located in Gandaki Province, is one of its eleven districts, covering an area of 3,573 km^2. As of the 2011 census, it had a population of 13,452, making it the second least populated district in Nepal. This remote district lies between Manag to the east, Nepal's least populated district, and Dolpa to the west, which ranks third in terms of sparse population density. The region experiences an average annual rainfall of less than 260 mm, particularly in Jomsom, which is located in Lower Mustang, due to its position in the rain shadow region of the Himalayas. While spring and autumn remain predominantly dry, the summer monsoon brings some rainfall, averaging 133 mm annually between 1973 and 2000. Mustang's climate exhibits significant temperature variations, with mean minimum monthly temperatures decreasing to -2.7℃ in winter and maximum temperatures reaching 23.1°C during summer. Both diurnal (day–night) and annual temperature fluctuations are substantial, highlighting its arid and extreme climate.

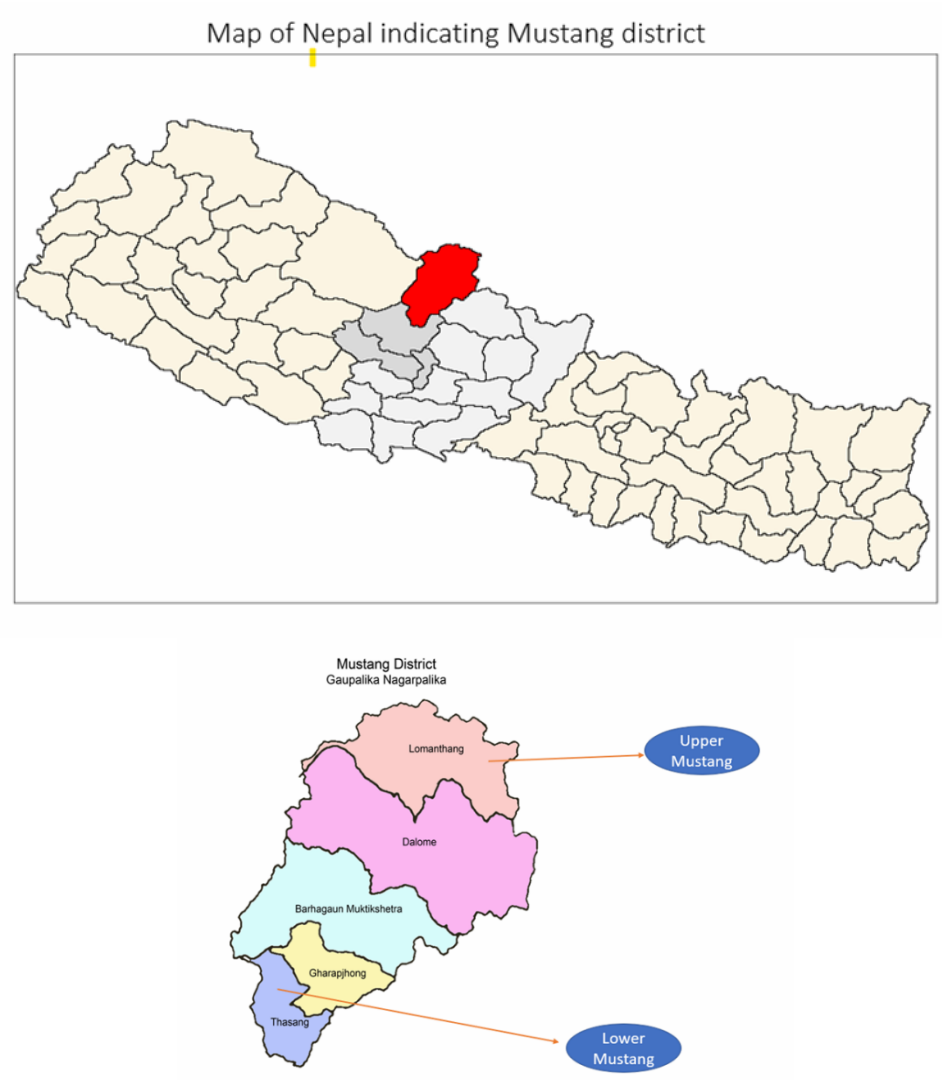

Fig. 1. Map of Mustang district indicating the upper and lower mustang.

Sampling and data collection

Data was collected through Yak farm visits and interactions with yak owners and Yak caretakers using a structured and modified questionnaire. The sampling sites were selected from native yak habitats, and a total of 34 yaks from two locations, one in upper Mustang (Lomanthang rural municipality ward no. 5) and in lower Mustang (Thasang rural municipality, Nupsang), were assessed for various linear body measurements. The yaks sampled were adult yaks, exhibiting black, white, or mixed coat colors. Morphometric traits, including body length (from the point of the shoulder to the point of pin bone), heart girth, wither height, head length, horn length, and tail length, were measured via a measuring tape. All morphometric data were recorded in centimeters. These measurements provide valuable insights into the performance of yaks in the Mustang district. (fig 1).

Fig. 2. Measurement of tail length and wither height at upper Mustang (Lomangthan-5)

Fig 3. Measurement of ear length at Lower Mustang (Thasang-2)
Fig 4. Yak grazing areas at lower Mustang

Statistical analysis

Descriptive and inferential statistical methods were used in data processing and data analysis.

III. Results And Discussion

The average means and standard errors of the phenotypic traits of the yak population across different localities are presented in Table 2. The overall mean values for body length, heart girth, wither height, ear length, horn length, rump length, rump width, tail length, head length, and muzzle circumference were 106.56±1.28 cm, 140.16±1.60 cm, 101.82±1.16 cm, 13.07±0.23 cm, 30.14±1.15 cm, 33.75±0.68 cm, 33.21±0.52 cm, 34.44±0.61 cm, 41.82±0.65 cm, and 35.98±0.67 cm, respectively. In comparison, Das et al. (2008) reported higher values for Indian yaks, with a body length of 133.2±2.62 cm, wither height of 127.9±0.85 cm, and heart girth of 182.4±1.814 cm. Similarly, the body length of Chinese yaks has been reported to range from 112-170 cm (Cai ,1985), indicating significantly larger body dimensions than those of Nepalese yaks, whose body length in this study ranged from 105-107 cm. The morphological characteristics recorded in this study provide critical information for the effective management and conservation of yak genetic resources. These data are essential for identifying phenotypically superior yaks, which can be used for targeted selection and breeding improvement strategies.

Table 2. Morphological measurements of Yaks (mean± SE) in the Mustang district

Traits	Lower Mustang (n=16)	Upper mustang (n=18)	Overall mean (n=34)
Body length (cm)	105±1.86	107.67±1.78	106.56±1.28
Heart Girth (cm)	141.781±2.54	138.72±2.01	140.16±1.60
Wither height (cm)	103.88±1.61	100±1.59	101.82±1.16
Ear length (cm)	13.55±0.36	12.65±0.28	13.07±0.23
Horn length (cm)	27.27±1.82	32.69±1.22	30.14±1.15
Rump length (cm)	32.46±1.02	34.88±0.85	33.75±0.68
Rump width (cm)	33.5±0.66	32.94±0.81	33.21±0.52

Tail length (cm)	32.69±0.82	36±0.737	34.44±0.61
Head length (cm)	42.59±0.99	41.13±0.85	41.82±0.65
Muzzle circumference (cm)	36.40±1.07	35.61±0.87	35.98±0.67

Source: Field data, 2024.

Table 3. Correlations between various phenotypic traits of yak

Phenotypic traits	Body length (cm)	Wither height (cm)	Ear length (cm)	Horn length (cm)	Rump length (cm)
Body length (cm)	1	0.381*	0.494**	0.526**	0.491**
		0.026	0.003	0.001	0.003
Wither height (cm)	.381*	1	.536**	0.187	0.236
	0.026		0.001	0.289	0.179
Ear length (cm)	.494**	.536**	1	0.03	0.09
	0.003	0.001		0.865	0.611
Horn length (cm)	.526**	0.187	0.03	1	.494**
	0.001	0.289	0.865		0.003
Rump length (cm)	.491**	0.236	0.09	.494**	1

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

The table to revealed that correlation between various morphometric parameters of yak in the study areas. Most traits showed significant positive correlations at the 5% ($p < 0.05$) and 1% ($p < 0.01$) levels. Specifically, the correlation between body length and wither height was 0.381, significant at the 5% level. The correlation between body length and ear length was 0.494, and between body length and horn length was 0.526, both significant at the 1% level. Similarly, the correlation between body length and rump length was 0.491, significant at the 1% level. The correlation between wither height and ear length was 0.536, while the correlation between wither height and horn length was 0.494, both significant at the 1% level.

IV. Conclusions

The performance and body measurements of yaks under field conditions in the Mustang district have provided valuable insights into their current status. These findings shed light on the physical traits and overall conditions of yaks in the region in early spring, highlighting their adaptability to high-altitude environments. However, further research is essential to improve the productivity and long-term sustainability of yak farming. Yak farming in Mustang is traditionally practiced, with limited commercialization. It primarily serves as a supplementary source of income and fulfills the basic needs of farming households. Despite its importance, yak farming faces several challenges, including water scarcity, inadequate veterinary services, declining interest among younger generations, limited farmer awareness, predation by wild animals, and the adverse effects of heavy snowfall. Yak breeding plays a vital role in supporting high-altitude agriculture and sustaining mountain communities in Nepal. However, issues such as genetic erosion, climate change, and insufficient policy support pose significant threats to the viability of yak farming. Addressing these challenges requires immediate action. Strengthening conservation efforts, modernizing husbandry practices, and introducing scientific breeding methods are critical for enhancing the sustainability and productivity of yak farming in Nepal. Efforts should focus on conserving genetic diversity, improving yak production systems, and implementing targeted breeding strategies to ensure the long-term viability of this important livestock species.

Acknowledgments

The authors extend their heartfelt gratitude to the yak farmers, owners, and caretakers for their invaluable cooperation and support. They express special thanks to Mr. Pradip Gauchan, President of the Yak Association of Mustang and Thasang Rural Municipality, for his leadership and assistance; Mr. Devi Prasad Adhikari, Chief of the National Cattle Research Program in Rampur, under the Nepal Agricultural Research Council, for his guidance; and Dr. Lal Mani Aryal, Chief of the Veterinary and Livestock Expert Center in Mustang, for his coordination and overall support. The authors are also grateful to Mr. Pasang Gurung for his help in Upper Mustang (Lo Manthang) and to Mr. Gautam Sherchan, Ward President of Ward No. 2, Thasang Rural Municipality, for his support in Lower Mustang (Nupshe). Finally, they deeply appreciate the entire team of yak farmers and caretakers for their valuable contributions, including sharing critical information and allowing access for yak body measurements, which were essential for the effective completion of this study.

References

[1] Barsila, S. R. (2019). Effect Of Parity In Different Grazing Seasons On Milk Yield And Composition Of Cattle× Yak Hybrids In The Himalayan Alpines. Journal Of Applied Animal Research, 47(1), 591-596.

[2] Barsila, S. R., Barshila, I., & Devkota, N. R. (2016). Milking Performance Of Transhumant Cattle× Yak Hybrids Grazing High Altitude Rangelands In The Eastern Himalayas. In 10th International Rangeland Congress (P. 840).

[3] Barsila, S. R., Devkota, N. R., Kreuzer, M., & Marquardt, S. (2015). Effects Of Different Stocking Densities On Performance And Activity Of Cattle× Yak Hybrids Along A Transhumance Route In The Eastern Himalaya. Springerplus, 4, 1-12.

[4] Barsila, S. R., Devkota, N. R., Kreuzer, M., & Marquardt, S. (2013a). Activity, Physiology And Milk Production Of Yaks And Two Different Yak Crossbreds Grazing Himalayan Pasture Sites At 4700 M And 3000 M. In Revitalising Grasslands To Sustain Our Communities: Proceedings 22nd International Grassland Congress: 15-19 September 2013 (Pp. 587-588). New South Wales Department Of Primary Industry.

[5] Barsila, S. R., Kreuzer, M., Devkota, N. R., Ding, L., & Marquardt, S. (2014). Adaptation To Himalayan High Altitude Pasture Sites By Yaks And Different Types Of Hybrids Of Yaks With Cattle. Livestock Science, 169, 125-136.

[6] Barsila, S., Devkota, N. R., Kreuzer, M., & Marquardt, S. (2013b). Response To High Altitude Grazing In Metabolic Traits And Performance By Yak Crossbreds And Yaks. In Energy And Protein Metabolism And Nutrition In Sustainable Animal Production: 4 Th International Symposium On Energy And Protein Metabolism And Nutrition, Sacramento, California, Usa 9-12 September 2013 (Pp. 73-74). Wageningen Academic Publishers.

[7] Bhatta, R., Shinde, A. K., & Verma, D. L. (2015). Yak Husbandry In The Himalayan Region: Status And Challenges. Himalayan Livestock Journal, 12(2), 34-45.

[8] Cai, L. (1985). Yak Breeds (Or Population). Domestic Animal Breeds And Their Ecological Characteristics In China. (Ed). Chen Pieliu.Pp 45-59. Beijing, China Agricultural Press.

[9] Das K P R, S, R P. S. Bandopadyaya, B.C. Saravanan, G Khrishna, M Sarkar, &M Bhattachrya (2008) Indian Journal Of Animal Science 78 (9): 1034-1035, September.

[10] Gorkhali, N.A., Sapkota, S., Bhattarai, N., Pokharel, B.R., & Bhandari, S. (2021). Indigenous Livestock Breeds Of Nepal: A Reference Book. Published By National Animal Breeding & Genetics Research Center, National Animal Science Research Institute, Nepal Agricultural Research Council, Khumaltar, Lalitpur.

[11] Https://English.Himalayatimes.Com.Np/2024/09/84975/.

[12] Ilri. (2014). Domestic Animal Genetic Resources Information System (Dagris). Http://Dagris.Ilri.Cgiar.Org/Node/4371.

[13] Joshi, B. R., Paudel, B. R., & Lama, T. (2021). Status And Conservation Of Yak In Nepal. Nepal Agricultural Journal, 19(3), 56-67

[14] Joshi, D.D. (1982). Yak And Chauri Husbandry In Nepal. Government Press, Singha Durbar, Kathmandu, Nepal, Xvii, 145 Pp.

[15] Joshi, D.D. (2000) Impact Of National Parks And Tourism On Yak Farming System In The Alpine Himalayan Region Of Nepal. Yak Newsletter (International Yak Information Centre [Iyic]) No. 5 (September 2000) Pp. 12-13

[16] Joshi, D.D. Et Al., (1994). Yak Production In Nepal. Proceedings Of The First International Congress On Yak. Journal Of Gansu Agricultural University (Special Issue, June 1994). Pp. 105-112. [Reprinted In Asian Livestock (Fao Bangkok), 1994, Xix (10), 132136.]

[17] Joshi, D.D., Awasthi, B.D. & Sharma, M. (1999) An Assessment Of The Yak Cheese Factories In Nepal. National Zoonoses And Food Research Center, Kathmandu, Nepal. 75 Pp.

[18] Joshi, P (2024). A Review On Yak Farming Practices In Nepal. Malaysian Animal Husbandry Journal, 4(1): 05-07.

[19] Khan, B., Abbas, S., Khan, M. Z., Khan, G., Anjum, M., Baig, S., & Jamal, S. (2016). Indigenous Practices Of Yak Breeding In Gilgit- Baltistan: Current Status And Future Prospects For Transbound Ary Yak Husbandry In The Karakoram-Pamir Mountain Area. In W. Ning, Y. Shailiang, S. Joshi, & N. Bisht (Eds.), Yak On The Move: Transboundary Challenges And Opportunities For Yak Raising In A Changing Hindu Kush Himalayan Region (Vol. 38, Pp. 167– 180). International Centre For Integrated Mountain Development (Icimod).

[20] Kharel, M. (2000). Yak, Jholang, Mountain Cattle And Their Crossbreds In Nepal. Proceedings Of Fourth Global Conference On Conservation Of Domestic Animal Genetic Resources Held In 17–21 August 1998, Narc, Nepal And Rbi, Uk Neopane S.P., Pokharel P.K. And Shrestha S. 1999. Evaluation Of The Productive Performance Of Yak At Solukhumbu. In: Neopane S.P And Khanal R.C(Eds), Proceedings Of The Third National Workshop On Livestock And Fisheries Research In Nepal, 26-28 June, 1999. Nasri, Khumaltar, Lalitpur, Nepal

[21] Marquardt, S., Barsila, S. R., Amelchanka, S. L., Devkota, N. R., Kreuzer, M., & Leiber, F. (2016). Fatty Acid Profile Of Ghee Derived From Two Genotypes (Cattle–Yak Vs Yak) Grazing Different Alpine Himalayan Pasture Sites. Animal Production Science, 58(2), 358-368.

[22] Neopane, S.P., & Shaha, B.K.P. (2002). Policies And Programs For Livestock Conservation. Paper Presented At Workshop Organized By Ministry Of Agriculture And Coperatives In Kathmandu, Nepal 0n 16 July,2003.

[23] Nepal Livestock Statistics. (2020). Department Of Livestock Services, Ministry Of Agriculture And Livestock Development, Nepal.

[24] Paudel, K. P., Shrestha, R., & Thapa, S. (2018). Climate Change And Its Impact On Yak Husbandry In Nepal. Journal Of Mountain Science, 15(5), 487-495.

[25] Pokhrel, M., & Chetri,M. (2006). Traditional Grazing System And Seasons Pasture Use In Upper Mustang, Nepal. Our Nature 4:29-31.

[26] Sapkota, S., Laven, R., Barsila, S. R., Kells, N., Mueller, K. R., & Dc, D. (2024). Assessment Of Welfare In Transhumance Yak Hybrids (Chauris) In The Lower Himalayan Region Of Nepal. Ruminants, 4(1), 136-151.

[27] Sherchand, L., & Karki N. P. S. (1996). Conservation And Management Of Yak Genetic Diversity In Nepal. In: Miller D. J., Craig S. R. And Rana G. M. (Eds), Proceedings Of Conservation And Management Of Yak Genetic Diversity, Workshop, 29-31 October, 1996. Kathmandu, Nepal. Pp. 47-56. Fao Regional Office For Asia And The Pacific, Bangkok, Thailand

[28] Shrestha, J., & Gurung, R. (2020). Yak Breeding And Sustainable Livelihoods In Nepal: Challenges And Prospects Journal Of Himalayan Research, 22(1), 67-80.

[29] Shrestha, S.L. And Shrestha, Np (1988). Indigenous Cattle Genetic Resources. Proceedings Of The First National Workshop On Animal Genetic Resources Conservation And Genetic Improvement Of Domestic Animals In Nepal (Edited By J N B Shrestha). Nepal Agricultural Research Council, Khumaltar, Lalitpur, Nepal Pp 16-19.

[30] Smith, J., (2018). The Main Yak Breeds In Nepal: A Comparative Analysis Journal Of Animal Studies, 12 (4), Pp. 55-67.

[31] Statistical Information On Nepalese Agriculture (2023). Ministry Of Agriculture And Livestock Development, Planning & Development Cooperation Coordination Division Statistics And Analysis Section, Singh Durbar, Kathmandu.

[32] Tulachan, P. M. (2019). Socioeconomic Importance Of Yak In Nepal's Mountain Communities. Himalayan Economy And Society, 11(4), 78-89.

[33] Wiener, G., Jianlin, H., & Ruijun, L. (2003). The Yak (2nd Ed.). Fao Regional Office For Asia And The Pacific (Rap).