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### Assessing sheep husbandry practices in Kargil sub-division: Implications for policy and livelihood security for sheep rearers in Ladakh

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#### Abstract

Livestock is one of the most remunerative enterprises among the farming community the present study was undertaken to know the scientific sheep management practices by sheep owners in. The data was collected through structured schedule and the data were analysed by using appropriate statistical methods. The survey was conducted to study the Housing practices/management and Feeding management, Healthcare and sanitation facilities/practices of sheep rearers in 4 villages (Manzee, Karkichu, Gramthang, and Kannour) of kargil Sub-Division in Kargil district. This region is having cold arid high-altitude climate. A total of 80 respondents were interviewed through a pre-structured questionnaire. Results revealed that majority of respondents had the findings of the study indicated (85.00%) of the cases were located adjacent to the house of the owner, Intensive system represented the most prevalent system of sheep rearing as reported by majority (82.50%) of sheep rearers in Kargil Sub- Division. Measurement standard/ Space requirements (BIS): Housing measurements in majority (85.00%) of shelters did not conform to Indian standards. Orientation of Pucca and Tin shelters Kacha houses had no definite orientation as such pucca and tin sheds have been reported. Orientation in majority (72.72%) of sheep shelters (pucca and tin sheds) was East-West followed by North-South (27.27%). Sheep houses/ shelters in majority of the cases (67.50%) were Kacha type, Proportion of tin-based temporary sheep shelters was 12.50% in the sub-division and Pucca constructions were negligible (20.00%) in the Sub- División. Floor and Wall material used in majority (66.25%) of the cases was wood in the overall Sub-division. Proportion of tin-based temporary sheep shelters was 12.50% in the sub-division with Pucca constructions were negligible (20.00%) in the Kargil Sub- División. Condition of Floor used in majority (66.25%) of the cases was Laveled in the overall Sub-division with Small proportion (33.75%) of the respondents reported Sloppy as the Condition of Floor. Measurement standard/ Space requirements (BIS): Housing measurements in majority (75.00%) of shelters did not conform to Indian standards. reported by majority (67.50%) During spring and summer, only grazing was practiced across all villages. Majority (75.00%) were practicing grazing only in autumn and stall feeding in winter (100%). They (38.75%) offered a combination of green fodder (GF)+ dry fodder (DF)+ Concentrate (conc.). Feeds/fodders offered to sheep were partly home-grown and partly purchased from the market (75.50%) feeding. With Frequency of Feeding Majority (75.00%) twice a day and Regularity of Feeding Majority (87.50%) were offering fodder to their sheep without any prior treatment or value addition. They were feeding their animals on hit and trial basis without any consideration for physiology (78.75%) and body weight (81.25%) of the animal. Thus, it can be concluded that government policies need to be reoriented with focus on Management of Sheep farming for employment, nutritional and livelihood security of the residents of the Kargil region

**Keywords:** Kargil, high-altitude, sheep housing practices, feeding management

#### Introduction

Livestock rearing forms the cornerstone of the rural economy and cultural identity in Kargil, Ladakh, a region characterized by its high altitude and cold desert climate. The indigenous livestock, primarily sheep, survive the harsh environmental conditions. However, despite these inherent adaptations, the productivity and reproductive performance of these animals remain significantly lower compared to

their counterparts in more temperate zones. This disparity is primarily attributed to persistent challenges related to feed and fodder scarcity, extreme climatic stress, and prevalence of high-altitude specific health issues, and traditional breeding practices that may not always optimize productivity.

High-altitude cold-arid regions, such as those found in the Union Territory of Ladakh and specifically Kargil district,

present unique challenges that constrain conventional agricultural productivity but offer opportunities for extensive sheep rearing. These agro-ecological zones are characterized by low temperatures; hypobaric hypoxia, limited fodder availability, and short grazing seasons mean temperatures increased steadily from 13–14 °C in May to a seasonal peak of 20–22 °C in July. Night temperatures also rose from 5–7 °C in May to 12–14 °C in July, indicating improved thermal conditions for vegetation growth and livestock activity. (Bharti V. K *et al* 2017) <sup>[4]</sup>.

The Union Territory of Ladakh, especially Kargil district, is characterized by a cold arid, high-altitude climate with a short cropping season and limited agricultural productivity. Under these conditions, sheep rearing constitutes an important livelihood activity for rural households. Sheep provide meat, wool, manure, and regular income, thereby contributing to livelihood diversification and resilience in mountainous ecosystems. However, productivity in such regions is highly dependent on the adoption of scientific management practices, including systematic vaccination, deworming, improved housing, reproductive management, and balanced feeding (Kumar S *et al* 2017) <sup>[10]</sup>.

Livestock production remains a fundamental component of rural economies globally, underpinning food security, employment, and income generation for millions of households. In India, the livestock sector has demonstrated sustained growth, contributing substantially to the agricultural Gross Domestic Product and supporting socio-economic resilience among small and marginal farmers. (Goi 2023) Small ruminants, particularly sheep, occupy a strategic niche in this landscape due to their adaptability to diverse and marginal environments, efficient feed conversion, and multiple productive outputs including meat, wool, and manure.

In these mountainous ecosystems, sheep rearing is not merely an agricultural enterprise but a pivotal livelihood strategy. Sheep contribute to household income, nutritional security, and social capital, particularly in regions where arable land is scarce and alternative income sources are limited. Studies have shown that in high-altitude zones of Kargil and nearby regions, sheep farming sustains a large proportion of rural households, with women actively participating in various sheep rearing activities and a significant portion of incomes derived from livestock sales. Despite the clear importance of sheep production in such settings and the documented benefits of scientific management, there remains a substantial knowledge gap regarding the actual extent and determinants of adoption of these practices among sheep owners in cold-arid regions. (Khandi, S. A., *et al* 2021) <sup>[9]</sup>.

Empirical research conducted in comparable contexts, including studies in arid plains and hyper-arid environments in other Indian states, echoes similar themes: production constraints, limited awareness of improved practices, and inadequate institutional support often inhibit optimal management. Strategies proposed to enhance sheep farming in these environments emphasize coordinated action across research institutions, extension agencies, and local communities to promote integrated management practices that balance productivity with sustainability. Choudhary, D *et, al* 2025 <sup>[5]</sup>.

## Materials and Methods

To study Management practices, of sheep rearers of Kargil in Kargil district, a field survey was undertaken from mid July 2022 to mid -September 2022 in 4 villages (Karkichu, Gramthang, Kannour, and Manzee) of Kargil sub division in Kargil district. This region is having cold arid high-altitude climate. A total of 80 respondents were face to face interviewed through a pre-structured questionnaire. Kargil is a sub-division in district Kargil of Ladakh. Proportionate random sampling was followed wherein 20% of the villages of the region were selected and from each village 20 respondents were considered for the survey. A total of 4 villages with 80 respondents were interviewed by contact method on key indicators of Management practices of sheep farmers (Housing practices and Feeding practices).

## Statistical analysis

The data collected during the period of study was coded, compiled systematically, tabulated and subjected to statistical analysis (average and percentage) using Statistical Package for Social Sciences (SPSS, 2020) computer programme.

## Results and Dictation

### 1. Housing management

#### 1.1 Location of the house/ shelter

The results have been presented in table 1 for ease of interpretation. It is evident from the results that majority of sheep rearers sheep houses/shelters in majority (85.00%) of the cases were located adjacent to the house of the owner with proportion of such respondents being higher in Manzee (95.00%) followed by Kannour (90.00%) Karkichu (85.00%) and (75.00%) Gramthang Villages. houses/shelters in a very small proportion (15.00%) of the cases were attached to the house of their owner with proportion of such respondents being higher in Gramthang (25.00%) followed by Karkichu (20.00%) Kannour (85.00%) and Manzee Villages (15.00%). Results similar to present findings have been reported earlier have also reported higher proportion of sheep rearers having sheep houses adjacent to farmers dwellings in Kanchipuram District of Tamil Nadu (Usha *et al.* 2022) <sup>[18]</sup>; 84.06% in Anantnag and (82.95%) in Pulwama districts of Jammu and Kashmir (Manzoor 2020); (75.60%) in Bandipora district of Jammu and Kashmir (Shah 2017) <sup>[15]</sup>.

majority of the houses constructed adjacent to the house of the owner. Further farmers prefer to keep animal shelters adjacent of their house for ease of operations, watch and ward of the livestock and reducing labour. Housing system: Intensive system represented the most prevalent system of sheep rearing as reported by majority (82.50%) of sheep rearers with higher proportion of such sheep rearers being higher in Manzee Karkichu (90.00%) followed by (90.00%) Gramthang, Manzee (80.00%) and (75.00%) Kannour Villages houses/shelters in a very small proportion (17.50%) of the cases were Semi-intensive system the house of their owner with proportion of such respondents being higher in Kannour (25.00%) followed by Manzee (20.00), Gramthang (15.00%) and Karkichu Villages (10.00%). However, the Village -wise comparisons were statistically in-significant. However, the Village -wise comparisons were statistically

in-significant. In similar studies closed type housing (100%) was also reported in Gurez valley of Kashmir (Beigh *et al.* 2020) [3]. Closed type housing is preferred in the region because of its harsh climatic conditions (cold arid type) wherein temperature drops to sub-zero during most part of the year.

#### Measurement standard/ Space requirements (BIS):

Housing measurements in majority (85.00%) of shelters did not conform to Indian standards with proportion of such shelters being higher in all Villages; Manzee (95.00%) followed by Kannour (90.00), Karkichu (80.00%) and

Gramthang Villages (75.00%) Negligible houses were fulfilling the BIS guidelines regarding space requirement for animals. These factors under traditional farming system may be contributing to majority of Kacha shelters in the region. Further, being subsidiary occupation farmers do not construct pucca structures keeping in view the paucity of resources. Awareness about the space requirements was not there with the respondents. The shelters were prepared just to accommodate the animals and protect them from harsh weather and wild predators without any scientific knowhow about planning, design and space requirements.

**Table 1:** General housing/ shelter considerations

| Parameter                  | Variant           | Manzee (20)   | Karkichu (20) | Gramthang (20) | Kannour (20)  | Total (80)    |
|----------------------------|-------------------|---------------|---------------|----------------|---------------|---------------|
| Location of Animal house   | Adjacent to House | 19<br>(95.00) | 16<br>(80.00) | 15<br>(75.00)  | 18<br>(90.00) | 68<br>(85.00) |
|                            | Attached to House | 1<br>(5.00)   | 4<br>(20.00)  | 5<br>(25.00)   | 2<br>(10.00)  | 12<br>(15.00) |
| Housing System             | Intensive         | 16<br>(80.00) | 18<br>(90.00) | 17<br>(85.00)  | 15<br>(75.00) | 66<br>(82.50) |
|                            | Semi- intensive   | 4<br>(20.00)  | 2<br>(10.00)  | 3<br>(15.00)   | 5<br>(25.00)  | 14<br>(17.50) |
| Measurement standard (BIS) | BIS Followed      | 1<br>(5.00)   | 4<br>(20.00)  | 5<br>(25.00)   | 2<br>(10.00)  | 12<br>(15.00) |
|                            | Not followed      | 19<br>(95.00) | 16<br>(80.00) | 15<br>(75.00)  | 18<br>(90.00) | 68<br>(85.00) |

Figures in parenthesis indicate percentage within a column with respect to each parameter

#### 1.2 Orientation of Pucca and Tin shelters

Kacha houses had no definite orientation as such pucca and tin sheds have been reported. Orientation in majority (72.72%) of sheep shelters (pucca and tin sheds) was East-West followed by North-South (27.27%). Gramthang Villages had a higher proportion of sheep shelters with East-West orientation (82.38%). East- west orientation is

preferred mostly in hot areas as it reduces the direct entry of solar radiation inside the shed, which helps to keep shed cool from inside and thus provides comfort for the confined animals. Sun rays are thus available for paddocks facing North. Kargil district being cold arid region the probable reason for East- west orientation may be the religious beliefs rather than any scientific know-how.

**Table 2:** Orientation of the house/shelter of Pucca and Tin shelters

| Parameter   | Variant      | Manzee (16)   | Karkichu (18) | Gramthang (17) | Kannour (15) | Total (66)    |
|-------------|--------------|---------------|---------------|----------------|--------------|---------------|
| Orientation | East-West    | 12<br>(75.00) | 13<br>(72.23) | 14<br>(82.35)  | 9<br>(60.00) | 48<br>(72.72) |
|             | North- South | 4<br>(25.00)  | 5<br>(27.77)  | 3<br>(17.65)   | 6<br>(40.00) | 18<br>(27.27) |

Figures in parenthesis indicate percentage within a column with respect to each parameter

#### 1.3 Housing Types

The details of type of housing/ shelter and nature of floors, walls, Condition of floor and Arrangement for inclement weather condition have been presented in table 3 for ease of interpretation. Sheep houses/ shelters in majority of the cases (67.50%) were Kacha type with proportion of such shelters being higher in Karkichu (85.00%) followed by Kannour (90.00) Manzee (60.00%) and Gramthang Villages (60.00%) Proportion of tin-based temporary sheep shelters was 12.50% in the sub-division with Kannour Village having higher proportion (20.00%) of such sheep shelters than elsewhere in the Sub- division. Pucca constructions were negligible (20.00%) in the Sub- División.

Similar studies conducted in various parts of the country are in agreement with the present findings i.e., majority of the respondents had kachaa type houses (Usha *et al.* 2022;

Beigh *et al.* 2020; Shirsat *et al.* 2019) [18, 3, 16] in Kanchipuram District of Tamil Nadu, Gurez valley of Kashmir and Pune and Sangli districts of Western Maharashtra, respectively. Farmers generally follow traditional practices and use cheap locally available raw material for making livestock sheds. Traditional mud houses are easy to erect, environmentally friendly and are not permanent structures. Further, logs of wood are also easily available for roofing of the shelters.

Results indicate that Floor and Wall material used in majority (66.25%) of the cases was wood in the overall Sub-division. The proportion of such respondents was comparable within the Village; in Karkichu (85.00%) followed by Kannour (90.00%) Manzee (60.00%), and Gramthang Villages (60.00%) Small proportion (33.75%) of the respondents reported Concrete as the roof material. The

proportion of such respondents was higher in Gramthang (45.00%) followed by Manzee (40.00%) Kannour (35.00%), and Karkichu Villages (15.00%) sub divisions. In studies conducted earlier thatched roofing material has been reported by majority of the respondents (Usha *et al.* 2022; Divyalakshmi *et al.* 2021; Choudhary *et al.* 2014) <sup>[18, 8, 6]</sup> in

Kanchipuram District of Tamil Nadu, Tiruvallur District of Tamil Nadu and arid and semi-arid region of Rajasthan respectively. In Gurez wood has been reported as the choice for roof material (Beigh *et al.* 2020) <sup>[3]</sup> which is in agreement with the present findings.

**Table 3:** Housing type, floor and walls, Condition of floor and Arrangement for inclement weather condition

| Parameter                                                                                  | Variant                  | Manzee (20)   | Karkichu (20) | Gramthang (20) | Kannour (20)  | Total (80)    |
|--------------------------------------------------------------------------------------------|--------------------------|---------------|---------------|----------------|---------------|---------------|
| Housing type                                                                               | Pucca                    | 6<br>(30.00)  | 2<br>(10.00)  | 5<br>(25.00)   | 3<br>(15.00)  | 16<br>(20.00) |
|                                                                                            | Katcha                   | 12<br>(60.00) | 17<br>(85.00) | 12<br>(60.00)  | 13<br>(65.00) | 54<br>(67.50) |
|                                                                                            | Temporary tin shelters   | 2<br>(10.00)  | 1<br>(5.00)   | 3<br>(15.00)   | 4<br>(20.00)  | 10<br>(12.50) |
| Floor and wall Materials                                                                   | Concrete                 | 8<br>(40.00)  | 3<br>(15.00)  | 9<br>(45.00)   | 7<br>(35.00)  | 27<br>(33.75) |
|                                                                                            | Kutchu                   | 12<br>(60.00) | 17<br>(85.00) | 11<br>(55.00)  | 13<br>(65.00) | 53<br>(66.25) |
| Condition of Floor                                                                         | Leveled                  | 12<br>(60.00) | 17<br>(85.00) | 11<br>(55.00)  | 13<br>(65.00) | 53<br>(66.25) |
|                                                                                            | Sloppy                   | 8<br>(40.00)  | 3<br>(15.00)  | 9<br>(45.00)   | 7<br>(35.00)  | 27<br>(33.75) |
| Arrangement for inclement weather condition                                                | Bedding & Gunny bag used | 6<br>(30.00)  | 4<br>(20.00)  | 7<br>(35.00)   | 3<br>(15.00)  | 20<br>(25.00) |
|                                                                                            | not used                 | 14<br>(70.00) | 16<br>(80.00) | 13<br>(65.00)  | 17<br>(85.00) | 60<br>(75.00) |
| Figures in parenthesis indicate percentage within a column with respect to each Parameters |                          |               |               |                |               |               |

Results indicate that Condition of Floor used in majority (66.25%) of the cases was Laveled in the overall Sub-division. The proportion of such respondents was comparable within the Village; in Karkichu (85.00%) followed by Kannour (65.00%) Manzee (60.00%) and Gramthang Villages (55.00%) Small proportion (33.75%) of the respondents reported Sloppy as the Condition of Floor. The proportion of such respondents was higher in Gramthang (45.00%) followed by Manzee (40.00%) Kannour (35.00%), and Karkichu Villages (15.00%) sub divisions.

#### Measurement standard/ Space requirements (BIS)

Housing measurements in majority (75.00%) of shelters did not conform to Indian standards with proportion of such shelters being higher in all Villages; Kannour (85.00%) followed by Karkichu (80.00%) Manzee (70.00%) and Gramthang Villages (65.00%) Negligible houses were fulfilling the BIS guidelines regarding space requirement for animals.

Awareness about the space requirements was not there with the respondents. The shelters were prepared just to accommodate the animals and protect them from harsh weather and wild predators without any scientific knowhow about planning, design and space requirements. In mountains primary focus of the respondents remains on their own welfare rather than the livestock.

#### Roof material and type

Results indicate that Roof material majority (67.50%) of the

cases was Wooden with proportion of such shelters being higher in all Villages; Karkichu (85.00%) Kannour (65.00%) followed by Manzee (60.00%) and Gramthang Villages (60.00%) followed by (20.00%) of the respondents reported Roof material was Pucca Wooden with proportion of such shelters being higher in all Villages; Karkichu (85.00%) Manzee (30.00%) followed by Gramthang Villages (25.00%) Kannour (65.00%) and Karkichu Village (85.00%) Small proportion (12.50%) of the respondents reported Roof material was tin with proportion of such shelters being higher in all Villages; Kannour (20.00%) followed by Gramthang (15.00%) Manzee (10.00%) and Karkichu Village (05.00%) with Flat roof was preferred by all the respondents.

In studies conducted earlier thatched roofing material has been reported by majority of the respondents (Usha *et al.* 2022; Divyalakshmi *et al.* 2021; Choudhary *et al.* 2014;) <sup>[18, 8, 6]</sup> in Kanchipuram District of Tamil Nadu, Tiruvallur District of Tamil Nadu, arid and semi-arid region of Rajasthan and, respectively.

Local availability and insulating properties of wood to combat cold during winters may be the reason for having wood as the choicest material for roof. Tin sheds have been given under various government schemes/TSP's. as such some of the respondents had tin as roof material.

Flat roof was preferred by all the respondents. Contrary to it Usha *et al.* 2022 reported gable type roof in majority of cases.

**Table 4:** Roof material and type

| Parameter                                                                                 | Variant                                  | Manzee<br>(20) | Karkichu<br>(20) | Gramthang<br>(20) | Kannour<br>(20) | Total<br>(80) |
|-------------------------------------------------------------------------------------------|------------------------------------------|----------------|------------------|-------------------|-----------------|---------------|
| Roof material                                                                             | Wooden                                   | 12<br>(60.00)  | 17<br>(85.00)    | 12<br>(60.00)     | 13<br>(65.00)   | 54<br>(67.50) |
|                                                                                           | Tin                                      | 2<br>(10.00)   | 1<br>(5.00)      | 3<br>(15.00)      | 4<br>(20.00)    | 10<br>(12.50) |
|                                                                                           | Pucca                                    | 6<br>(30.00)   | 2<br>(10.00)     | 5<br>(25.00)      | 3<br>(15.00)    | 16<br>(20.00) |
| Condition of roof                                                                         | All houses were having Single Slope roof |                |                  |                   |                 |               |
| Figures in parenthesis indicate percentage within a column with respect to each parameter |                                          |                |                  |                   |                 |               |

## 2. Feeding Management

Results of the survey on feeding method, type and source of feed besides regularity of feeding have been presented in table-5. The results indicate that during spring and summer, only grazing is practiced across all Villages. Majority (75.00%) of the sheep rearers were also practicing grazing only although a smaller proportion (25.00%) reported concentrate supplementation of their sheep in addition to grazing during this season. Results similar to present findings have been reported earlier in Guntur, Prakasam, and Krishna districts of Andhra Pradesh (Reddy *et al.* 2020). Having Mountain specificity, the rearing/feeding of sheep varies from season to season in contrast to sheep of tropical areas. The sheep here are being reared under semi-migratory production system whereas in tropical areas mostly migratory flocks are found. In spring sheep are reared in CPRs, barren lands and nearby low-lying pastures. All the sheep rearers across the villages reported stall feeding as the only mode of feeding their sheep during harsh winter months. With regard to the type of feed being offered to sheep, majority (38.75%) of sheep rearers reported a combination of green fodder (GF)+ dry fodder (DF)+ Concentrate (conc.) although the choice of feed/fodder varied between seasons. This was followed by a slightly lesser proportion (33.75%) of sheep rearers who reported feeding of green fodder and dry fodder. reported feeding of green and dry fodder only with no concentrate or mineral mixture. Similarly, A comparatively smaller proportion of sheep rearers (31.25%) green fodder (GF) + dry fodder (DF)+ Concentrate (conc.) + Mineral mixture (Mm). Similarly, a minuscule proportion (8.75%) of sheep rearers in the sub-divisions reported feeding their sheep green and dry fodder but no concentrate. then green fodder (GF)+ dry fodder (DF) mineral mixture (MM) of sheep rearers in the reported feeding their sheep with mineral mixture in addition to green and dry fodder but no concentrate.

Feeds/fodders offered to sheep were partly home-grown and partly purchased from the market among majority of sheep rearers (75.50%) with proportion of such sheep rearers being higher in Manzee (90.00%) than Karkichu (85.00%) than Gramthang (70.00%) and (65.00%) Kannour Villages. A small proportion of sheep rearers in the sub-divisions (13.75%) completely relied on home-grown feeds/ fodders for feeding their sheep and the proportion of such sheep

rearers was higher in Kannour (25.00%) than elsewhere in the sub-divisions. Similarly, a smaller proportion of sheep rearers in the Villages (8.75%) completely relied on purchase of feed/fodder for sheep from the market with proportion of such sheep rearers being higher in Gramthang (15.00%) than elsewhere in the sub- Division. Results similar to present findings have been reported earlier in Anantnag and Pulwama districts (Manzoor 2020) and Bandur sheep rearers of Karnataka (Aparna *et al.* 2016). Feeds and fodders offered to livestock comprised of fodder grass Alfa alfa (*Medicago sativa* and *Medicago fulcata*), Straws (wheat straw and barley straw), tree/plant toppings (*Chenopodium* spp., IRIS, mulberry, mulberry, poplar and apple tree leaves), stubbles of cereal crops, grains (oats, barley and wheat) (Baba *et al.* 2018; Alam *et al.* 2023) <sup>[2, 11]</sup>. A substantial quantity of fodder is supplied by extra territorial collection and free grazing of livestock on village common lands and lands not available for cultivation including permanent fallow lands.

Frequency of feeding (other than grazing) of sheep was twice a day among majority (75.00%) of sheep rearers in the villages with proportion of such sheep rearers being higher in Manzee (90.00%) followed by Kannour (75.00%) than Karkichu (70.00%) and (65.00%) Gramthang Villages. A smaller proportion (20.00%) of such sheep rearers reported feeding their sheep thrice a day with proportion of such sheep rearers being higher in Karkichu (30.00%) than elsewhere in the villages. Regularity of feeding sheep was maintained by majority of sheep rearers in the sub-divisions (87.50%) with proportion of such sheep rearers being higher in Manzee (95.00%) followed by Kannour (90.00%) than Karkichu (85.00%) and (80.00%) Gramthang Villages. Results similar to present findings have been reported earlier (84.06%) in Anantnag and (82.95%) in Pulwama districts of Jammu and Kashmir (Manzoor 2020); (75.60%) in Bandipora district of Jammu and Kashmir (Shah 2017) <sup>[15]</sup> and in Srinagar districts of Jammu and Kashmir. In livestock production system regular, timely feeding is must to maintain optimum production of the animals. Environmental understanding and vast traditional knowledge system have enabled people in mountains to plan and implement activities, such as traditional land and livestock management practices that are still fundamental for low intensity production systems at high altitudes.

**Table 5:** Feeding method, type and source of feed, frequency and regularity of feeding by respondents

| Parameter                                                                                | Variant                   | Manzee (20)   | Karkichu (20) | Gramthang (20) | Kannour (20)  | Total (80)    |
|------------------------------------------------------------------------------------------|---------------------------|---------------|---------------|----------------|---------------|---------------|
| <b>Feeding method</b>                                                                    |                           |               |               |                |               |               |
| <b>During spring and summer only, grazing is practiced</b>                               |                           |               |               |                |               |               |
| During Autumn                                                                            | Grazing                   | 14<br>(70.00) | 12<br>(60.00) | 16<br>(80.00)  | 18<br>(90.00) | 60<br>(75.00) |
|                                                                                          | Grazing + Supplementation | 6<br>(30.00)  | 8<br>(40.00)  | 4<br>(20.00)   | 2<br>(10.00)  | 20<br>(25.00) |
| <b>Harsh winters only stall feeding is practiced</b>                                     |                           |               |               |                |               |               |
| Type of feed                                                                             | GF+D+Conc.+Mm             | 8<br>(40.00)  | 4<br>(20.00)  | 7<br>(35.00)   | 6<br>(30.00)  | 25<br>(31.25) |
|                                                                                          | GF+DF+ Conc.              | 6<br>(30.00)  | 5<br>(25.00)  | 6<br>(30.00)   | 10<br>(50.00) | 31<br>(38.75) |
|                                                                                          | GF+DF                     | 7<br>(35.00)  | 10<br>(50.00) | 5<br>(25.00)   | 1<br>(5.00)   | 27<br>(33.75) |
|                                                                                          | GF+ DF+ Mm                | 1<br>(5.00)   | 1<br>(5.00)   | 2<br>(10.00)   | 3<br>(15.00)  | 7<br>(8.75)   |
| Source of feed/fodder                                                                    | Homemade                  | 1<br>(5.00)   | 2<br>(10.00)  | 3<br>(15.00)   | 5<br>(25.00)  | 11<br>(13.75) |
|                                                                                          | Purchasd from Markt       | 1<br>(5.00)   | 1<br>(5.00)   | 3<br>(15.00)   | 2<br>(10.00)  | 7<br>(8.75)   |
|                                                                                          | Both                      | 18<br>(90.00) | 17<br>(85.00) | 14<br>(70.00)  | 13<br>(65.00) | 62<br>(75.50) |
| Frequency of Feeding                                                                     | Once                      | 1<br>(5.00)   | 0<br>(0.00)   | 2<br>(10.00)   | 1<br>(5.00)   | 4<br>(5.00)   |
|                                                                                          | Twice                     | 18<br>(90.00) | 14<br>(70.00) | 13<br>(65.00)  | 15<br>(75.00) | 60<br>(75.00) |
|                                                                                          | Thrice                    | 1<br>(5.00)   | 6<br>(30.00)  | 5<br>(25.00)   | 4<br>(20.00)  | 16<br>(20.00) |
| Regularity of Feeding                                                                    | Maintained                | 19<br>(95.00) | 17<br>(85.00) | 16<br>(80.00)  | 18<br>(90.00) | 70<br>(87.50) |
|                                                                                          | Not-maintained            | 1<br>(5.00)   | 3<br>(15.00)  | 4<br>(20.00)   | 2<br>(10.00)  | 10<br>(12.50) |
| Figures in parenthesis indicate percentage within a Colum with respect to each parameter |                           |               |               |                |               |               |

**Treatment of fodder and bas is of feeding**

The results have been presented in table 6 for ease of interpretation. It is evident from the results that majority of sheep rearers (87.50%) were offering fodder to their sheep without any prior treatment or value addition with proportion of such sheep rearers being higher in Gramthang (95.00%) followed by Karkichu (90.00%) Kannour (85.00%) and (80.00%) Manzee Villages. Very small proportions of sheep rearers (12.50%) in the sub-divisions reported some treatment/enrichment of fodders before feeding their sheep. Enrichment/treatment increases the

nutritive value of the low-quality roughages through different processes (physical, chemical etc.). It seems the farmers have not been trained for such activities or the adoption level of such technologies has not gained the desired impetus. Straws which are readily available and forming a major source of ration of the animal during stall feeding needs to be enriched/fortified for better performance of the livestock and overall farm economy. Extension functionaries besides field veterinarians have a role to play in TOT (transfer of technology).

**Table 6:** Treatment of fodder and basis of feeding by respondents

| Parameter                                                                                | Variant | Manzee (20)   | Karkichu (20) | Gramthang (20) | Kannour (20)  | Total (80)    |
|------------------------------------------------------------------------------------------|---------|---------------|---------------|----------------|---------------|---------------|
| Feed as per Productivity                                                                 | Yes     | 4<br>(20.00)  | 2<br>(10.00)  | 1<br>(5.00)    | 3<br>(15.00)  | 10<br>(12.50) |
|                                                                                          | No      | 16<br>(80.00) | 18<br>(90.00) | 19<br>(95.00)  | 17<br>(85.00) | 70<br>(87.50) |
| Feed as per Physiological Status                                                         | Yes     | 6<br>(30.00)  | 4<br>(20.00)  | 2<br>(10.00)   | 5<br>(25.00)  | 17<br>(21.25) |
|                                                                                          | No      | 14<br>(70.00) | 16<br>(75.00) | 18<br>(90.00)  | 15<br>(75.00) | 63<br>(78.75) |
| Feed as per body weight                                                                  | Yes     | 4<br>(20.00)  | 2<br>(10.00)  | 3<br>(15.00)   | 6<br>(30.00)  | 15<br>(18.75) |
|                                                                                          | No      | 16<br>(75.00) | 18<br>(90.00) | 17<br>(85.00)  | 14<br>(70.00) | 65<br>(81.25) |
| Figures in parenthesis indicate percentage within a Colum with respect to each parameter |         |               |               |                |               |               |

Majority of sheep rearers reported feeding their animals on hit and trial basis without any due consideration to productivity (87.50%), physiology (78.75%) and body weight of the animal (81.25%). Considerably smaller proportions of sheep rearers reported feeding their sheep on the basis of productivity (12.50%), physiological status (21.25%) and body weight (18.75%), respectively. Physiological status thus represented the only parameter among the.

Three studied parameters which received more attention by some sheep breeders while feeding their sheep. Physiological status thus represented the only parameter among the three studied parameters which received some attention by the sheep breeders while feeding their sheep. Although the proportion of sheep rearers varied across the sub-divisions with regard to all these parameters, the comparisons were statistically in-significant.

Shortage of feed and fodders is the major concern in cold-arid ecologies wherein deficiencies to the tune of 40 to 70 percent have been reported in different regions of Ladakh including Kargil (Tewari *et al.* 2016) [17]. Deficiency coupled with illiteracy and lack of knowledge may be the probable reason for the same.

### Conclusion and Future Directions

The sustainability of sheep production, however, is conditioned by the adoption of scientifically grounded management practices that encompass feeding, breeding. Evidence research underscores that evidence-based interventions-such as systematic This paradigm of sustainable livestock management aligns with global agriculture agendas advocated by organizations such as the Food and Agriculture Organization, which emphasize climate-resilient, context-specific practices tailored to local ecologies and socio-economic realities.

Livestock breeding and feeding management in Kargil, Ladakh, demands a multi-pronged, adaptive, and sustainable approach. By integrating selective breeding of indigenous adapted animals, implementing scientific feeding strategies that address fodder scarcity and nutritional deficiencies, and strengthening veterinary services, the productivity and resilience of livestock can be significantly enhanced. The success of these interventions' hinges on robust governmental support, active community participation, and continued research. Future research should focus on: The structural inventory of sheep housing in the Kargil Sub-Division reveals a system heavily reliant on traditional, residential-adjacent setups, with 85.00% of shelters located beside owner homes and 82.50% utilizing intensive rearing. While 67.50% of units are traditional Kacha, 75.00% to 85.00% of total housing fails to meet Bureau of Indian Standards (BIS) metrics. Furthermore, 66.25% of structures use wood as primary materials and feature level floors, while 72.72% of structured sheds are oriented East-West.

- Detailed nutritional profiling of local fodder resources and development of region-specific balanced feed formulations.
- Further genetic characterization of native breeds to identify markers for high-altitude adaptation and productivity.
- Evaluation of cost-effective and energy-efficient fodder cultivation and preservation technologies suitable for

small-scale farmers.

- Impact assessment of climate change on livestock production and development of adaptation and mitigation strategies.
- Socio-economic analysis of the adoption of improved practices and their impact on farmer livelihoods.

Kargil, situated in the high-altitude cold desert of Ladakh, presents unique and formidable challenges for livestock rearing. The region experiences extreme temperatures, low oxygen levels, limited vegetation, and prolonged winters, severely impacting animal health, productivity, and reproductive efficiency. This paper explores the critical issues surrounding livestock breeding and feeding management in Kargil and proposes comprehensive, sustainable strategies for enhancing animal well-being and productivity in this fragile ecosystem. The study synthesizes existing knowledge on high-altitude animal physiology, traditional pastoral practices, and modern interventions, emphasizing the need for a holistic approach that integrates improved genetics, tailored nutritional plans, robust healthcare systems, and community participation. Ultimately, this research aims to contribute to the long-term socio-economic resilience of livestock-dependent communities in Kargil.

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