SMALL RUMINANT PRODUCTION SYSTEMS: STATUS AND PROSPECTUS FOR IMPROVEMENT IN POTOHAR REGION OF PAKISTAN

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ABSTRACT: The present study was conducted to characterize and evaluate the existing small ruminants (SR) production and management systems in Potohar region of Pakistan. The SR farmers (n=50; flock size > 05 animals) were interviewed.The majority of SR flockswere owned byilliterate males. The farmers were either landless (17.02%) or had >5 acres of land (34.04%). The farmers (86%) were mostly depending on free range areas for animal grazing. Feed supplementation was practiced during forage scarcity periods, particularly during winter season (89.9%). Housing was made (90%) to provide shelter and protection from predators and theft. Mean live weights of SR were comparable with breed average. Animals were highly prolific with 1.43 services per conception showing 60% conception rate. The mortality rate was high in goat kids (28.73%) than that of lambs (19.22%). The major hindrances in SR productivity enhancementidentified were feed shortage, inadequate animal health care and lack of proper marketing system.

Key words: Potohar, sheep, goat, production systems and small ruminants.

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INTRODUCTION

Small ruminants (SR) especially goat and sheep have been used for centuries by mankind for milk, meat, fibre, skin and even for work under different managemental conditions. In subsistence agriculture, common in arid regions of the world, small holders and landless farmers keep SR for sale, consumption and personal use. Pakistan has 68.4 million goats and 29.4 million sheep (GOP, 2015) belonging to thirty-four and twenty eight different breeds, respectively (Isani and Baloch, 1996, andFAO 1999). Small ruminants production systems are common in all provinces ofPakistan. The majority of the SR owners are either landless or having a small piece of land (less than 5 acres). Goats and sheep contribute significantly to the income of the small scale farmers. Dairy goats are commonly kept by the farmers belonging to the poor socio-economic group. Majority of the farmers have mixed flocks of sheep and goats. However, limited number of separate flocks of either specie can also be seen. The nomadic, transhumant and sedentary production systems of keeping SR are common in the country (Ishaque, 1993). However, in each production system the productive efficiency of animals depends on the type of feeding system, level of feeding, management and availability of nutrients for high production. In Pakistan, a mix of different feeding and management systems has been in practice in different areas. The choice of feeding system depends on various factors including availability of rangelands, grazing areas, and season of the year (Ahmad *et. al.*, 2010 andDuku*et. al.*, 2010)

The arid land constitutes about 88 percent of the country's total geographic area of 79.61 million hectares.The rainfed or Barani region extends over Potohar plateau and lower Himalayan piedmont plains stretching over Rawalpindi division and northern strip of Gujrat and Sailkotdistricts. In baraniregion, the natural vegetation is xerophytic comprises of semi evergreen woode shrub land. The region provides grazing opportunities for a large number of sheep and goats whole year and seasonally in winter for transhumant livestock in the northern mountains, besides the local livestock. This shows the great potential of range areas for vegetation supply to small ruminants (Khan and Ashfaq, 2003).

The sporadic information available on the production systems in the country reported by Ahmad *et. al.*,(2010) indicates that despite different problems, the Potoharplateau is best suited for SR production. Keeping in view the productive potential of the Potohar plateau for SR production and non-availability of data on production systems as well as factors affecting SR productive potential in the area, the present study has been planned to determine the current status of SR production systems in terms of SR feeding and managementand toidentify the areas for future development.

MATERIALS AND METHODS

Present study was conducted in the adjoining villages of Rawalpindi and Islamabad (commonly called twin cities; Latitude 338N and Longitude 738E), in the province of Punjab, Pakistan. These cities are located in the Potohar Plateau in the northwest of the country.

Small ruminants farmers (n=50) having a flock of more than 5 heads were randomly selected from twelve villages in the specified radius of 50 Km. Maximum numbers of farmers from each village were interviewed to gather detailed information. The farmers having a history of keeping SR for more than 18 months were selected for data collection. However, the data of famers having common production system and residing in one village were pooled to a single unit. The data of only ≤5 farmers from each village was used for statistical analysis. This strategy enabled addition of maximum number of villages in the data pool of the study area.

A questionnaire was used to collect information and to assess the production parameters including age at first kidding/lambing (months), kidding/lambing rate (%), prolificacy, mortality rate (%), weight of mature breeder males and females (kg); and animal off-take rate (%), milk off-take per lactation. The data of live weight of breeder females and mature breeding males was collected on first visit by using portable weighing scale. Each farmer's lambs/kids were individually weighed and recorded. Thereafter, kids/lambs were marked and weighed again on second visit after about two months of the first visit. The lambs/kids were divided into three age groups i.e. Group-I, birth to 60 days; Group-II, 61 to 90 days and Group-III, 91 to 120 days for the calculation of average growth rate of each group. The data was analyzed for the differences in live weight gain of kids/lambs by using descriptive statistics and T-test was used to compare the differences among density groups and live weight difference between first and second visit (SPSS, 2006).

RESULTS AND DISCUSSION

The small ruminants owners were males and majority of them wereilliterate. The data on land holding status indicated that 17.02% of the farmers were either landless or had land holding between 5.1 to 10 acres. The land was primarily used for the cultivation of cash crops including wheat, maize, millet and sorghum. Very limited land area was used for fodder production.On overall basis, a famer owned 4.22 sheep, 11.11 goats, 4.10 cattle, 1.99 buffalo, 3.48 poultry and 2.14 others like donkeys and dogs. The number of goats was significantly higher ($P<0.05$) in both goat dominant and mixed flocks

The percent distribution of different breeds of small ruminants, on individual farmer basis, indicated that Teddy goat (86%) was dominant. The same findings of higher ownership (94.56%) of Teddy goat in Punjab were reported by Teufel*et. al.,* (1998). The overall data showed that Desi (non-descript; 68%) and Beetal (66%) goats were among the second largest breeds owned by the small farmers in the area. The Teddy goat was highly prolific and gave birth to twins and tripplets. The Beetal is knownas poor's man cow and raised for both milk and mutton. The overall age distribution data indicated higher proportion of breeding females (57.17%) of sheep and goats in the flocks. The kids/lambs (< 3 month of age) constituted the second largest (18.84%) age group followed by young females (9.75%) and males (7.45%) from 3-6 months of age. The higher proportion of breeding females, followed by suckling age group in the present study was in agreement with the reported by Tsedeke (2007) and CACC (2008) which showed higher proportion of females than males in Ethiopian small ruminant structure due to demand for breeding and milking animals.

Three types of feeding systems (grazing, partial grazing and stall feeding) were identified in the study area. The majority (86%) of the farmers used grazing system (GS) as the common source of SR feeding. However, partial grazing (PG; 10%) and stall feeding (SF; 4%) systems were practiced by limited number of farmers. Different types of feed sources in the area are categorized as grazing, dry roughages (crop residues), green fodder/forage (cut and carry; CC), concentrates (feed supplements) and non-conventional feed sources (NCFS; kitchen waste, fruit leftovers, vegetables, leftover bread, weeds). Among different feed sources, grazing was the major contributor (64.08%) of small ruminants feeds due to free of cost availability of grazing areas. The share of dry roughages, CC, concentrates and NCFS was 14.28, 6.50, 10.20 and 4.94%, respectively.

Livestock farmers in the study area were following sedentary-household system. This system was actually a settled farming in which animals were allowed to graze early in the morning and in the evening in close proximity of the villages on marginal lands or fallow lands, followed by their arrival back in the evening at the same destination. This system was commonly found in the Punjab province of Pakistan (Iqbal *et. al.,* 2008 andIshaque, 1993). The SR farmers who opted grazing system (GS) also feed their animals with other types of feeds. The use of other types of feed sources depended on availability of pasture/range vegetation in the grazing areas. Free range grazing (72.09%), tethered grazing (6.98%), free range cum tethered grazing (11.63%) and fodder/forage (cut and carry; 9.30%) were the different ways of feeding in a GS for goats and sheep (Table 1). Tethered grazing was practiced to avoid damage to crops and vegetation, to save labor and to reduce aggressiveness in case of male animals. The importance of tethering animals was mainly to avoid crop damage

and to save labor has already been reported by Tadesse*et.al.,* 2015; Gemeda, 2009 andTsedeke, 2007. Cut and carry system was followed when harsh environment or zero vegetation did not permit to graze rangelands. Communal/free land, crop residues, crop aftermath and roadsides were the different types of land/areas commonly used for grazing by small ruminants (Table 1). The communal/free lands (76.74%) were the natural rangelands and were owned partially by the government in the study area. Natural pastures were the main feed sources for small ruminants and cattle in Ethiopia (Fikru and Gebeyew, 2015; Tsedeke, 2007). The majority of communal/free lands in the study area were privately owned and left unattended. A major proportion of grazing areas were available free of cost to famers (65.12%). Only 4.65% farmers were paying grazing charges as an annual contract or leasing. Personally owned land was used by 30.23% of the farmers for their own animal grazing.

In GS, majority of the small ruminants (51-79%) daily travelled 2 to 4 kms (one way) in search of feed (Table 1). The 41.86% of goats and sheep grazing roadsides travelled up to 6 kms to get their bellies fed. The time spent on grazing varied with the season. In most of the cases animals spent 6 to 8 and 8 to 12 hrs in the grazing area during winter and spring season, respectively. However, the time spent on grazing was limited to the cool hours of the day during summer season. The farmers restrict travelling during winter season to avoid nutrient loss and preferred to keep animals on stall feeding with crop residues, NCFS and feed supplements. However, there was no difference in allowable grazing time between goats and sheep. The high percentage of farmers (90.70%) grazed their flocks by themselves (Table 2). The male individuals including children were involved in the grazing of flocks. Children, even alone, were taking care of some individual small grazing flocks of goats and sheep. However, family women also took the responsibility to care of the SR flock after arrival from grazing.

The farmers were aware of the feed supplementation and its importance in the growth and development of SR. This fact was substantiated by the observations that both regular feed supplementation (97.67%) and additional feeding before and after parturition were practiced by the farmers (Table 2). Generally female animals were preferred for supplementation. Breeding females received salt, wheat, corn grains, wheat bran and cotton seed cake supplementation. The feed supplementation was practiced mainly during winter and summer seasons, owing to forage shortage and harsh environment. However, the proportion of farmers supplementing SR was higher during winter (89.90%) than summer season (46.94%). The farmers avoided supplementation during summer season as it was believed that concentrate feeding produces extra heat within the body which reduce the performance of animals already suffering from heat stress caused by high environmental temperature.

Water was one of the major concerns in the grazing area. The area was rainfed and both crop and animal production were dependent on rain water. All farmers used to offer water to their animals at home/farmstead in addition to water consumed in the grazing area. The rain water was the only source of water in the grazing area available through natural water points (67.35%), water ponds and reservoirs (18.37%) meant for both animal and human uses. Usually water was offered twice a day in buckets during summer and winter season by 63.27 and 12.24% of small holders, respectively. The frequency of offering water manually once a day was highest during winter (55.10%) and lowest in summer (4.08%). However,the farmers with large flocks had properly built water troughs for *ad libitum* watering (32.65%) round the year.

The housing facility for SR was made available by 90% of the farmers. The majority of goats and sheep were kept in separately constructed houses (60%) whereas, limited number of farmers were keeping animals in their main (12%) or adjoined house (18%). Some of the farmers (10%) kept animals in the backyard throughout the year. However, woolen cloths were used over the animals during severe winter season. The loose housing system (68.89%) was commonly adopted by farmers who had separately constructed houses. The conventional barns (20%) were constructed by few farmers in the area.

The data on in-house facilities (Table 2) indicated non-provision of separate housing for mature males and females as well as for young stock and matures. However, pregnant females were provided with separate space for about one week pre and post parturition. Feed manger and watering facility was common in almost all types of houses. The low priced and easily movable wooden feed mangers were in common use in loose housing and conventional cum loose housing systems. Some of the farmers made temporary arrangements for heating during the winter season. However, ceiling fans or other house cooling facilities during severe summer season were not seen in any type of housing system. Proper drainage channels were provided in only in conventional houses. In loose housing system with mud construction, drainage was based on floor slope rather than special provision for drainage. In house facilities varied with the socio-economic status of farmers of Asia and Africa (Fikru and Gebeyew, 2015 and Ahmad *et. al.,* 2010).

Family members including males, females and children were all taking care of SR at home in the area. Generally management of small ruminants was not considered as a fix responsibility of any single person in the house. Therefore, the proportion of random

management (46%) by male, female and children was higher than that of both male and female (36%). Only 10% of the farmers with large flocks hired staff for farm management. The hiring was common only in mix flock owners.

Majority of the goats were milked once a day (87.88%) by women (51.52%) only. Twice a day milking was done only in Beetal goats. Sheep were not milked in the area due to poor milk yield. Breeding management parameters revealed that small flock owners commonly used other farmer's breeding males (54%) for mating purpose. A small proportion of farmers either used their own breeding male (26%) at the house/farm or paid charges for mating (20%). Artificial insemination of goat and sheep was not practiced in the studied areas. Production and reproductive management varied with animal types and farmer's personal choices in the different countries.(Getahun, 2008).

The mean live body weight of animals was comparable to breed average. The weaning age ranged between 2 to 4 months. The body weight gain up to 3 months of age ranged between 2.9 to 4.2 kg per month in both goats and sheep. The live weight of kid was significantly higher after two months of age. However, the gain in body weight was non- significant from birth to 3 months of age in kids whereas, the weight gain differed significantly between 0 to 1 and 1 to 2 months of age in lambs (Ahmad *et. al.,* 2010). This might be due to the specie difference and variations in animal feeding.The mortality rate up to 6 months of age was high in kids (28.73%) than in lambs (19.22%). This might be due to the poor management of kids by the goat owners. The respondents indicated that sheep lambs were harder than goat young ones. Pneumonia was commonly noted among kids than lambs. Therefore, overall survivability of sheep was higher than that of goat in the area. The growth and reproductive performance of SR were the important factors influencing overall flock productivity. All forms of small ruminants output like milk, meat, hair, wool and skin depended on these factors which varied mostly between breeds and even within flocks in a given population (Getahun, 2008; ILCA, 1990). The efficiency of milk and meat production, genetic progress rate and size of the crop for replacement was all directly linked to the reproductive parameters (Mukasa*et. al.,* 2002 andKiwuwa, *et. al.*, 1983).

The native small ruminants were known to be strong enough to withstand infection, harsh environmental conditions and scarcity of feeds. This made the farmer to be careless in maintaining conditions necessary for optimum health and performance of small ruminants. Therefore, only 28 and 18% of goat and sheep farmers, respectively, were following the regular vaccination program. Parasitism was one of the major (97.67%) health problems in the grazing small ruminants (Table 2). The occurrence of nutritional disorders and sickness or deaths wereassociated with consumption of poisonous plants which was 20.93 and 18.60%, respectively. The farmers relied on traditional methods of treatment andwere least concerned with parasitism. The poverty was the major factor that restricted famers from animal treatment. The main reasons, for improper vaccination, were identified as lack of funds to the farmers, high priced medicines and veterinary services, poor government veterinary health cover, and non-availability of veterinarian and para-veterinary staff.

Table 1.Characteristics of small ruminants grazing system, water sources and health problems.

Descriptor	Farmers percentage
Grazing system types	
Free range grazing	72.09
Tethered grazing	6.98
Free range cum Tethered grazing	11.63
Fodder/forage (cut and carry)	9.30
Grazing area/land types	
Communal land/Free land	76.74
Grazing crop residues	11.63
Grazing aftermath	6.98
Grazing roadside	4.65
Distance travelled (one way) for grazing (km)	
Communal land/free land	
< 2.0	16.28
2.0-4.0	79.07
4.0-6.0	4.65
Grazing crop residues and aftermath	
< 2.0	23.26
2.0-4.0	69.77
4.0-6.0	6.98
Grazing roadside	
< 2.0	6.98
2.0-4.0	51.16
4.0-6.0	41.86
Water sources	
Range water points/natural ponds/reservoirs	100
Manual (by farmer at home/farm)	100
Grazing by	
Self	90.70
Shepherd	9.30
Grazing charges	
Free of cost	65.12
Annual contract/Lease	4.65
Own land	30.23
Additional feeding	97.67
Supplementary feeding	
Special feeding (Flushing)	100
Feeding for fattening	23.26
Health problems related to grazing	
Cases of nutritional disorders	20.93
Cases of poisonous plants	18.60
Parasitism (Internal/External)	97.67

Table 2. Housing facilities for small ruminants categorized by housing systems.

Type of facilities	Housing systems			Overall
	Conventional barns	Loose housing	Conventional cum loose housing	
	---------- % ----------			
Separate housing for adult male and females	66.67	29.03	40.00	37.78
Separate housing for young and adults	66.67	9.68	20.00	22.22
Separate housing for pregnant females	100.00	58.06	80.00	68.89
Feeding manager availability	100.00	96.77	100.00	97.78
Type of feeding manger				
Wooden manger*	0.00	70.00	60.00	54.55
Cemented manger*	100.00	30.00	40.00	45.45
Watering trough	100.00	87.10	80.00	88.89
Heating facility during winter season	33.33	29.03	60.00	33.33
Drainage facility inside the house	100.00	70.97	80.00	77.78

*Values are out of total number of farmers having feeding manger facility under each housing system category

Conclusions: The farmers raised small ruminants with minimal care for animal feeding and management. Small ruminants in the area are highly prolific having productive and reproductive parameters comparable to reported breed mean values. This suggests possibilities of improvement in SR production though adoption of proper feeding and management practices.

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