

Factors Affecting Animal Welfare of Goats under Different Production Systems in Pakistan

Farooq MZ^{1,2*}, Sumiyya Sattar⁵, Hafiz IA¹, Yaqoob M³, Bhatti JA², Ahmad W², Hayat Z², Farmanullah⁴, Ahmad N², Saleem AH²

¹ Key Laboratory of Agricultural Animal Genetics, Breeding and Reproduction of Ministry of Education, College of Animal Science and Technology, Huazhong Agricultural University, Wuhan PR China.

² Department of Animal Sciences, College of Veterinary & Animal Sciences, Jhang, Sub Campus UVAS, Lahore, Pakistan.

³ Department of Livestock Production, University of Agriculture Faisalabad.

⁴ Faculty of Veterinary and Animal Sciences, Lasbella University of Agriculture, Water and Marine Sciences, Uthal, Balochistan, Pakistan.

⁵ Veterinary Research Institute, Lahore, Pakistan.

*Corresponding Author:

Muhammad Zahid Farooq,
Lecturer, Department of Animal Sciences, College of Veterinary and Animal Sciences, Jhang
University of Veterinary and Animal Sciences, Lahore, Pakistan.
Tel: +92 301 7175369
Email: zahid.farooq@uvas.edu.pk

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Abstract

The animal welfare and well-being have got less consideration for longer time, resulting research works and information on this segment are in scarce. However, in recent years, scenario has been starting to change due to a gradual diffusion of intensive and extensive systems. The various factors that affect the goats well-being and their state of harmony in extensive/grazing system and intensive systems, have been highlighted by many researchers and scientists. Most important factors relating to extensive system are nutritional stress, water shortage, parasite infestation and climatic extremes. The goats although get shelter in intensive systems but ventilation problems, space requirement, stocking density, disease transmission and noxious gasses are the crucial factors which reduce well-being and production. The objective of this review is to compile all factors related to goats in extensive and intensive systems in such way that it may provide guidelines to stakeholders, farmers and researchers to plan or design a new strategic management schemes or measures in order to overcome these factors.

Keywords: Animal welfare, goats, production systems, stocking density, Ventilation, Nutritional Stress.

Introduction

Animal welfare has got much attention in recent years and an amassing awareness round the globe. The questions are being asked about prevailing conditions through which food comes to consumer's table from animal farm. The state of affairs about raising the animals are catching public attention [1]. Animal welfare includes not only physical health but also psychological well-being. It is a function of many environmental variables, including physical surroundings, nutritional intake, and social & biological interactions [76]. (Désiré et al., 2002) [21] stated that the well-being of animals is a harmony and a state of mind between the animal and its surroundings. How individuals perceive their environment is called welfare [12, 21]. Focus on positive emotions when evaluating animal welfare and animal well-being [73]. In-general, welfare may be defined as conditions or circumstances where a person or an animal live healthy, feel happiness [23]. According to (Fraser, 2003; McGlone, 2001) [26, 41] animal welfare are the con-

ditions where animal can live with complete mental and physical health without any sufferings. More over the animals can show all their natural behaviors. Significance of animal welfare is different among the regions and countries with respect to their economic situation and education level [20]. Animal welfare may encounter the profit margin and sustainability in animal production [20, 38].

The welfare of the goats is very important because goats play vital role in the economy of the any country especially the Asian and African countries where goat's population is more than any other continent. According to (Speedy, 2003) [67], global goat meat production is above than 5 million tonnes. While most of the goat meat was produced in (Speedy, 2003) [67] Asia and Africa, accounting jointly for 93.6 percent of the world's goat population and 94.5 percent of meat production. Pakistan is among the leaders with Bangladesh, China, India in both meat and milk production from goats [14]. In the year 2000, there are around 1790 million sheep and goats in the world [37]. India and China pos-

ness the largest goat population, each of these having more than 120 million goats. The goat population of Pakistan stands next to these countries, the number being about 68.4 million [18]. They are important source of quality animal protein (meat and milk); wool and skins [37]. Goat rearing is an enterprise that has been practiced by a large section of population in rural areas. This is especially true for arid regions where crop production and dairy farming is not possible. They are also important component of a mixed farming system of irrigated agriculture practiced by about four million farmers. However, in spite of their evident importance to Pakistan's economy, goats have received scant attention and poor support.

Mainly two production systems exist for goats i.e. extensive or grazing and intensive system. Both have own importance, benefits in their perspective and somehow limiting factors which reduce welfare and production of the animals. The objective of this review is to investigate these problems and limiting factors related to different production systems of goats.

Factors Affecting Welfare in Grazing Goats

The welfare of grazing goats is not based on scientific line and assessment [70]. Goats in extensive system have various limiting factors which affect animal health and production. These factors include nutritional stress, inadequate water supply, climatic extremes, parasitological diseases and lameness.

Nutritional Stress

In grazing system, the animals move freely so they have better physiological and behavioral function. However, there are many factors which affect animal welfare and production and the most important among which is the nutritional stress. Animals in poor rangeland may graze the forage with high fiber contents and low energy due to seasonal variation and not timely grazing. Nutritional stress affects the fertility in sheep and goats [13]. In late summer and late spring not only the grasses are scarce and less palatable, but also the protein contents are low in the forage [53]. Grazing animal have nutritional imbalance during this season, which affects rumen fermentation and protein synthesis. It also alters the fat and protein content of milk. Goats show decreased milk production in poor meadows which has more fibrous forage [25]. Experiment showed that feed restriction for short time resulted in low milk production and high milk fat in Sandra dairy ewes [61]. Under-nutrition affects the milk fatty acid profile, as a consequence of body fat mobilization. Underfed ewes showed higher somatic cell count (SCC) in milk, as resulted by metabolic disorder of the animal and its mammary gland. Plant height close to 60 mm and a green leaf mass of 1500 to 2000 kg/ha can improve feed intake, welfare and performance of sheep [56].

Inadequate Water Supply

Water is very vital component of life, as it is a major constitution of both animal and plant cell. Many pastures are deficient in water that limit the animal welfare and affect their production performance. Water restriction results in high rectal temperature, increased breathing rate, increased amount of urea in blood and milk, low glucose level in blood and low feed intake [7]. In sheep and goat, water stress causes a more or less marked alteration in the metabolic profile but more reduction in live weight [29]. Water restriction results in 50 % decrease in milk production [60]. (Lynch et al., 1972) [45] observed increased abortion and high mortality rate in new born lambs due to inadequate water supply. Water deprivation during the season has been reported to affect respiratory and pulse rates in Tswana [1], West African Dwarf and

Red Sokoto goats [2], and Sudanese desert sheep [13]. When animals were subjected to water restriction, they progressively lowered feed consumption which consequently affected their growth [1].

Parasitic Infestation

Natural pastures are main source of internal and external parasites. The animals graze freely in the rangeland and their feces carry eggs of parasites. These eggs enter into healthy animals during grazing and change into parasite. The parasites affect the feeding efficiency of sheep and goats, as a result there is considerable decline in weight gain, milk yield and wool growth. They also affect reproduction performance in sheep and goats [27]. (Schnittger et al., 2003) [59] External parasites are usually arthropods. Their infestation site is the outer surface of animal such as skin, hair, wool causing ulcers. Most of the external parasites are carrier (Hoste et al., 2005; Kaplan et al., 2004) [31, 36] of disease causing agents and can affect the health and productivity of sheep and goats [31, 71]. Affected animals spend less time in grazing, are less active and their feed intake is reduced [33]. Early stages of internal parasite infestation show restlessness, abnormal lying behavioral pattern, (Hoste et al., 2005) [31] scratching of fleece area and biting at the flanks. In the later stage, animal become highly disturbed and show agnostic behavior due to the allergies caused by parasite [70]. Lameness is a more important challenge factor that reduces animal welfare to sheep and goat in extensive systems [28]. (Ley et al., 1992) [40] found that plasma adrenaline and noradrenalin levels are elevated by the mild or severe foot rot in sheep and goats. Severe foot rot reduces the threshold for nociceptive stimuli [41].

Climatic Extreme

Pakistan is subtropical country situated above line of equator with long periods of summer and therefore harsh climate tends to effect goats performance especially in extensive system. Sheep and goats are considered as more resistant animals to high temperature, environmental stress and climatic extreme [46, 50]. However, milk production decreases in summer season due to less feed intake [66]. The energy is used to dissipate heat from body to environment that result in low production [50]. (SEVI et al., 2002) [60] observed increased rectal temperature, metabolism alteration and low milk yield when ewes were subjected to average daily temperatures of 35°C and 30°C for short and long period respectively. (Bernabucci et al., 2010; Lu, 1989; Silanikove, 2000) [8, 17, 66] found that mineral imbalance occurred with loss of water by perspiration during heat stress. Milk coagulating properties got worsen due to presence of higher concentrations of neutrophil and somatic cell in the milk (Marai et al., 2007) [46] during hot summer season. The calcium and phosphorous (Todini, 2007) [69] content are decreased and plasmin levels are increased in milk when animal is under heat stress [60]. To minimize the effect of heat stress it is necessary to provide shade to animal in hot hours and provide feed during cold hours such as in morning and evening time. As compared to moderate and higher temperature [66, 76], goats spent less time in lying and more active and eat more in cold conditions which shows that goats are using behavioral responses and strategies to compete with low temperature similar to sheep [4, 24] and cattle.

(Andersen and Bøe, 2007; Arieli et al., 2005; Bøe et al., 2007; Loretz et al., 2004) [4, 6, 11, 42] recommended that air temperature should be in range of 6 to 27°C with optimal temperature 18°C in sheds. There is not much research work (Vas et al., 2013) [72] on effect of temperature on goat performance, just a few studies are

available on kids [57]. (Mejdell and Bøe, 2005) [48] reported that the thyroid hormones will speed up the mobilization of metabolic fuel such as free fatty acid and glucose in winter season. These will produce the higher amount of heat product ions which adjust the (Andersen et al., 2000) [72] body's long time adaptation to lower temperature. The higher level of thyroid hormones was found in sheep, cattle and sows in low temperature [19, 58, 72].

Factors Affecting Welfare in Housed Goats

Some housing systems can be a source of stress for goats and other domestic animals in general [9, 39]. Intensive system has many factors which reduces animal welfare and health especially in sheep and goats. These factors include high stocking density [15, 61]. (Caroprese, 2008; Sevi et al., 2009) and prolonged feces accumulation in houses. The feces and litter material are main source of disease causing agent. Coccidiosis is main issue in intensive system for kids and lambs kept in confined area [74, 75]. Therefore, for maximum production and animal health it is necessary to give more attention in litter management practices, proper space requirement and controlling the micro-climatic factors such as temperature, relative humidity and air quality. The animals housed permanent are in minority. Mostly the animals are housed during night time and in such condition when grazing is not feasible [47]. Unfortunately goats often have shelters which are not appropriate by the material, size and design [37]. So there is need to design building and house of goats in such pattern where animal feel comfortable and maintain its health. Some aspects and factors related to housing are reviewed as following [3, 64].

Stocking Density

(Loynes, 1983) [43] recommended different space requirements for small ruminant in different type of floor systems. He advised that animals kept on straw litter should be given minimum space 0.7m²/head and for slatted (Nardone et al., 2010) [51] floor it should be 1m²/head for sheep and goats when weight is not more than 60kg. Increase 30% space allowances when sheep have gained weight about 60-90kg and provide more 30% space if suckling lambs are available [64]. Spaces also differ for sheared and horned animals [64]. Reduce 10% space allowance for sheared and increase 17% for horned sheep [22]. (Sevi et al., 2009) [61] suggests slightly higher values, i.e. on straw litter it should be 0.9-1.2m²/head and on slatted floor space may be 0.8-1m²/head and 2m² paddock area per sheep [43]. In general, sheep and goats should not be housed alone in intensive environment, instead they should be kept in group so that they may feel comfortable by visual contact with other animals [35, 49]. The stocking density and space allowance has impact on health and production of the animals. It was observed that milk yield, (Kannan et al., 2000) [35] fat and casein yield were increased when animals were kept in least crowded room. Milk has 3-4 time lower somatic count cell in such ewes which were given space 2m²/head than (Brandano et al., 2004) [13] those animals which were kept in room that has area of 1-1.5m²/head [62]. Proper space requirement has minimum chance of sub-clinical mastitis in the animals. But animals in crowded area have problems of clinical and sub-clinical mastitis [39]. Feeding behavior was also changed in goats when space was reduced (Loynes, 1983) [43] from 2m²/head to 1m²/head. 5% and 13% was reduction in feeding intake and resting time respectively in horned goats and in polled goats these parameters were reduced about 8% and 6% respectively [62].

Litter Material and Floor Type

Goat's houses are provided with straw as bedding material to feel calm and remain safe from any injury due to concrete floor [43]. The slatted floor pens are more economical and beneficial for the farmers because animals remain clean (Khan et al., 2003) [37], no need of any bedding material, low space required and less labors needed [4]. The pen flooring for farm animals is considered as very important site to maintain animal welfare by its unique characteristics such as thermal conductivity, (Caroprese, 2008) [15] softness and cleanliness. The insulated soft floor will (Caroprese et al., 2016) [16] correlate the thermal conductivity and softness of floor with each other [54]. The animal usually like such type of floor such as straw bedding and mattresses that has low thermal conductivity and reduces the heat loss (pigs: 36, 48, cattle: 49, 50). Sheared sheep like solid wood and straw bedding at temperature 8-10°C but in coated sheep there is no any preference of such type of floor at this temperature [24]. Softness floor is very important for physical fitness and activeness of the animals. The animals in soft floor are more active, healthy and calm as compared to harder or concrete floor [43]. So their preference to soft floor such as straw bedding, sawdust and rubber mattresses is more than concrete floor (cattle: 47, 50, 51, sheep: 52). (Shackleton and Shank, 1984) [65] concluded that goats not prefer soft floor because in natural environment such as steep cliff they are often found resting on the rocks which is not soft place. Now days, the bare concrete is replaced by mattress of rubber or plastic materials for dairy cows. (Natzke et al., 1982; Nilsson, 1988) [52, 54] also verified these results when they observed preference of animals to straw and soft bedding as compared to bared concrete bedding. The individual preference depends on previous experience, objections may also determine by animal through previous experience [55]. In dairy cows it was examined that animals on sawdust bedded floor preferred sawdust to sand and mattress but some change their preference from other floor after forced experienced. (Panagakis et al., 2004) [55] summarized that animal likeliness and preference are influenced by the cleanliness of floor because degree of absorption is not same for different types of floor. (Herlin, 1997; Stefanowska et al., 2002) [30, 68] quoted that the animal on wet and dirtier floor are less comfortable. On wet floor animal not rest properly not feel comfortable as long [34].

Ventilation

Ventilation is very important aspect for maintaining the performance and welfare of goats kept in house and in farming systems. It controls the animal body temperature by conduction. Noxious gases and airborne particles are controlled by ventilation. Rate of ventilation depends on speed of air and length of ventilation cycle. Air speed has pivotal role for ventilation because when air velocity increases more than 1 m/s, the cooling efficiency of ventilation not increases. Turbulent air currents of ventilation may cause the entry of higher concentration of dust particles into animal house suspended in air for long time [63]. ventilation rate should be 65 m³/h per head to keep animal comfortable. Summer ventilation less than 40 m³/h per head has many behavioral and hormonal changes in sheep and goats. Milk yield is also decreased about 10% at the ventilation rate. (Albenzio et al., 2005) [64] suggest that more chance of bacterial load in milk, alteration of milk cheese-making quality, losses of casein and lipid during cheese making process and delay in ripening of cheese processes.

In given Table recommended values of some spatial and micro-environment parameters in sheep and goat housing are reported by [61].

Conclusion

Sheep and goats are considered to be very rustic, they can greatly benefit from careful flock management, which can markedly improve their well-being and biological efficiency. Climatic extremes, seasonal fluctuations of herbage quality and quantity, and parasitism can threaten the welfare of extensively reared flocks. Although it has limitations but one advantage of this system is free grazing and browsing the animal in rangeland and natural vegetation. The intensive forming ensures shelter, proper care and feeding to animals in better way but ventilation problems, overcrowding, noxious gasses production and diseases occurrences are very important factors which are needed to be overcome by managemental strategies.

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