

Review Article

Grazing Behavior and Forage Selection of Goats (*Capra hircus*)

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ABSTRACT

The normal feeding approach of goats might be due to their precise anatomical and physiological characteristics of entity, which permit them to be highly selective, to eat legume silages and wild green grass. This review has been designed to consider the grazing behavior, fodder selection, and feed composition of goats. Various herbs and corns consumed by goats have numerous nutritive resources. Based on the general herbaceous intake activities and behavior of goats, they prefer wild grass such as grass grown in the steep hills than soft grass. Because the digestion capacity of cellulose feed has higher digestion level compared to other non-ruminants within rumen and it is advantageous to use wild forest or mountain grass which comprises high proportion of cellulose feed for goat. In South Korea, there are abundant feed resources for goats because of occupying large areas of mountains. Thus, goat production and feeding costs could be reduced if plants are used from the wild forest as a feed for goats relative to grassland grazing. Also, it is expected to contribute in improvement of goat farming with harmonious relationship between the grassland and wild forest while satisfying animal welfare and physiological desires of livestock.

(Key words: Grazing, Grassland, Forage, Goat)

I. INTRODUCTION

Goats exhibits a distinguished grazing behavior compared to other domestic compound stomached animal such as cattle and sheep. Although they are not distinctive grazers, goats are well-thought-out as selective browsers due to their distinctive feeding activities (Sanon et al., 2007). The anatomical characteristics of goats having moveable upper lip and tongue would allow them to be extremely choosy regarding feed selection (Decandia et al., 2008). It is also recounted that goats are capable to proceeds the bipedal posture and eat leaves in the plant canopy, however they occasionally climb the trees if the branch structure permit them (Narjisse, 1991). Moreover, goats are efficiently traveled to graze in long distances on the basis of feed availability (Lu, 1988). Goats like to eat more the leaves of woody plant in comparison to herbaceous grasses, and therefore, their feeds consist mainly of liguminous species (Aharon et al., 2007). Goats are able to eat plants with spikes and thorns (Decandia et al., 2008) even though these plant species could

negatively distress their preferences (Belovsky et al., 1991) and reduce their feed intake level (Basha et al., 2012). Additionally, they have extraordinary digestibility due to the availability of special rumen microbes (Molina Alcaide et al., 1997), and also have the capability to utilize fiber-rich grasses. Furthermore, goats are able to consume lignified and tannin-rich fodder (Silanikove, 2000). Goats has peculiar characteristics which are distinguishable compared to other livestock. Goats can search for pasture and wild grass, and thus survive in wild fields where the feed amounts and value is not enough.

Goats had been used successfully to improve the status of weeds and grazing capacity range due to their peculiar grazing behavior and feed selection (Davis et al., 1975). As goats can survive and prosper in the area where cows and sheep cannot survive, some scholars assume that goats can have lower metabolic change and higher digestion efficiency. Goats particularly have longer staying time of feed within the ruminant stomach and have more volatility fatty acid production, cellulose dissolving microbe and saliva production thus having more effective digestion

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rate than sheep and cows (Gihad et al., 1980). On the contrary, the contrasting research results also had been reported that sheep and goats have similar digestion capacity (Gihad et al., 1980; Brown and Johnson, 1985).

Goats require poorer metabolic desires compared to other ruminants like cattle and sheep, and they are able to convert the inferior-quality plants into superior metabolic end-products (Landau et al., 2000). Furthermore, goats have the ability to acclimate their feed according to the fodder unavailability (Osoro et al., 2013), although the extraordinary variety of the plant arrangement of their feed has been previously described (Decandia et al., 2008). There are various factors which affect to feed, laboratory animals, environment, digestion and required nutrition amounts. However, the improved adaptability of goats has been assessed in many parts of bio networks besides of the evaluation of this distinctive physiology of goats. Therefore, the aim of the present review was to explore grazing behavior and forage selection of goats and also the research status of goats in South Korea.

II. GRAZING AND BROWSING

In grazing pattern under various environmental conditions, the goats are categorized into either grazers who eat the grass or browsers which eat young leaves; however, the interpretation can be confusing. The patience on the bitter taste of goats has a significant character in feeding maximum dimensions and observing the prominence of biological wild plant. Weather and ingestion behavior (Tixier et al. 1997), climate and delivery of movement hours (Backer et al., 1992; Goniez-castro et al. 1991; Solanki 1994) on most of investigation conducted on grazed animals and their behavioral aspects were related and grazing interactions with other area had been studied by Bohra et al. (1992) and Solanki and Naik (1998). Fodder choice influenced the diet conformation of goats. It is commonly acknowledged that goats choose forested plant species compared to herbaceous ones (Aharon et al., 2007). The present investigation point out that, wild plant species conquered against other forage grasses and hence chose by of goats throughout the periods. Predominantly, the total bites percentage of wild grass species extended nearly 99% of the entire predilections throughout the summer period. The forage selection pattern of wild plants is

generally lower. It was predictable, particularly throughout the availability of herbaceous grass species besides remarkably higher levels of temperature and rainfall (Manousidis et al., 2016) that produced newly growth of herbaceous grass species. Goats are accustomed to forage availability and also has the ability to adapt with the predilections (Osoro et al., 2013), and therefore they favored herbaceous grasses if it remained plentiful.

III. FODDER SELECTION CHARACTERISTICS OF GOATS

Feed consumption and rumination take up most of goats' daily routine. This study has indicated that grazed goats have the resting hours mostly and eating activities take up 30.5% (Askins and Turner, 1972). Although goats' eating speed is faster than that of sheep (Geoffroy, 1974), goats spend most of their time on selecting feeds, moving a long distance and frequent eating.

Malechek and Provenza (1981) reported that goats eat 60% shrub, 30% grass and 10% big leaves. In contrast, sheep eat 20% shrub, 50% grass and 30% big leaves. A wild and herbaceous plant comprises about 34% and 66% of the total plant, respectively. Goats have peculiar lip and tongue which is well-developed thus having capacity to eat grass from short grass and big leaves to wild shrub. Also, goats can move upper lip like sheep; they can graze grass near the ground. It is ideal for goats to move upper lip for selecting high quality feeds. Goats prefer leaves on stem and fresh grass on dry grass. However, although goats are known to like selecting grass, there are no sufficient research results or scientific information on their selection amounts.

IV. ACCLIMATIZATION WITH THE AVAILABILITY OF FORAGE AND PASTURE

The feed selection of herbivore animals is subjected by the pertinent pasture convenience throughout the year (Dumont et al., 2002). Goats represented the ability to select plant leaves from the upper surface layer, due to their bipedal posture, that subsidized to ingesting forage (Decandia et al., 2008). Nevertheless, in dissimilar environmental circumstances, such as humid and

tropical grassland in South Korea, herbaceous grasses were not designated by goats in the various plot area corresponding to their availability. During spring the levels of selectivity index for the herbaceous grass species might have a relevant affinity to be greater than the other climatic seasons, however they were always deleterious with the exception of legumes and herbs during spring season. Pisani et al. (2000) reported that the feed selection of goats on a semi-arid circumventing grass land that point out the higher level of grass selectivity during spring can be explained by their higher quality and quantity in this season.

V. ENERGY CONSUMPTION TO GRAZE GRASS

Goats usually ruminate for one-third of a day. According to the research of Bell and Lawn (1957), healthy goats spend from about 3 hours to 13 hours daily and Askins and Turner (1972) assumed that rumination takes 10.6% of 24 hours. The major factors which affect rumination are the length of grass particle, grass consumption amounts and heat stress, while the length of grass particle and grass intake amounts have positive correlation (Lu, 1987), it has negative correlation with environment temperature (Appleman and Delouche, 1958; Lu 1984). The goats are known to move relatively a long distance compared to other ruminants (Huston, 1978). The energy consumed while the goats eat grass take up significant parts of total energy required amounts. The energy consumption to graze grass lowers the accuracy as it assumes the intake of livestock on grazed status. It is impossible to assume the accurate energy consumption of grazing animals with current technology. The energy consumption of grazing livestock has been examined by derelict intake equation (Reid et al., 1958), indirect calorie measurement (Young and Corbett, 1972; Holmes et al., 1978), measurement of carbon dioxide entering rate (Corbett et al., 1971) and etc.

VI. DRY MATTER INTAKE WHILE GRAZING OF GOATS

As there are no methods to measure accurate grass intake amounts of livestock, there are still problems in explaining the

correlation between animals and grassland. As the components and quality of grass type within grassland are different and the digestion indicators are insufficient, it is difficult situation to estimate them accurately. Dry matter intake of a grazed goat is not influenced by chemical components and physical form. As goats have peculiar eating habits of selectively consuming feeds, when judging intake, digestion rate and nutrition required amounts, grass components within grass land would be important. Earlier research on dry matter intake (DMI) of a goat had been examined in various methods. The goat is examined to eat nearly equal amount of grass which sheep eats (Geoffroy, 1974). According to type of goats and parts of grass, DMI is different (Malechek and Leinweber, 1972). DMI of a goat is assumed to be 3.14% of weight (Rajpoot, 1981) and depending on grazing place when grazing the goat, it has been reported that DMI can be from 1.47% to 3.65% of weight (Ranjhan, 1980). In the case of dairy goat like Alpine, at the early stage of pregnancy, it takes up 3% of weight, during late pregnancy, it has been reported to decrease to 2% (Sauvant, 1981). Particularly, in the case of dairy goats, DMI is influenced by feeding, energy density of feed, milk production, feeding stage and the size of an animal (Lu et al., 1984). Consequently, there is a significant difference in DMI, digestion rates, and feed selection characteristics of goat breed in various environmental factors and particularly, according to the situation of grazing pasture and grass feed capacity is influenced (Arnold and Dudzinski, 1967).

VII. CURRENT RESEARCH STATUS OF GOAT INDUSTRY IN KOREA

Although goats had been bred for a long time in South Korea, there is not much research conducted on traditional black goats compared to other livestock. For research on phenotype survey on traditional black goats before 1970s and research of reproduction of big livestock as laboratory animals of ruminants since 1980s, it had been partially used. Capacity improvements of traditional black goats and conservational research as genetic resources are extremely rare, these days pure traditional black goats have confronted extinction crisis. Although the portion of the goat industry within stock breeding is low, however the number of breeding is a growing scale and getting popular day

Table 1. The current status of major research of South Korea regarding goats

Research topic	Research contents	References
Analysis of genetic diversity	Establishment of population identification MS marker set of goats	Suh et al (2014)
	Analysis of genetic diversity and pliable relationship of traditional goat group by using MS cover	Suh et al (2012)
	Analysis of a system genetics of traditional goats	Kim et al (2012)
	Discernment of traditional black goat meat	Chung (2002)
Monitoring breeding	Analysis of physical growth and characteristics of meat according to grazing and breeding	Hwangbo (2014)
	Assumption of growth curve parameter of a goat's weight	Lee et al (2016)
	The effects of controlling tannin content on intake rate of traditional goats	Heo et al (2004)
	Research on grazing at mountainous district grassland	Yun et al (2018)
	Effects of feed salary system on nutrition usage rate, nitrogen accumulation and blood	Jung et al (2008)
	Evaluation of feed value on forest by-product and grass	Jo et al (1997)
Analysis of meat	Comparison of quality characteristics of castrated and non-castrated goat meat	Kang et al (2013)
	Analysis of characteristics of goat meat according to castration period	Kim et al (2010a)
	Analysis of characteristics of goat meat	Kim et al (2010b)
Research on disease	Research on the disease of traditional goats	Kim et al (2016)
	Survey on infection status of <i>Coxiella burnetii</i>	Gang et al (2016)
	Survey on antibody possession rate of <i>Coxiella burnetii</i>	Kim et al (2014)

by day. Also, the consumption type of goat meat is changing from medicinal use to edible meat. The trend indicates that import amounts are increasing consistently. However, there are various problems which must be solved accordingly. Among those, systematized researches on systematized breeding, reproduction, specifications, retail and etc. are urgently needed. For research on goats of South Korea, research on specifications, disease, goat meat, genetic analysis of South Korea goats had been partially reported (Table 1).

VIII. CONCLUSION

In conclusion, goats preferred mostly wild plant species and therefore their feed selection patterned principally leguminous plant species. Also, the meat consumption trends are changing from medicinal use to edible meat and the trend indicates that the number of butchery is import amounts and consistently increasing. However, there are diversified problems which must be solved accordingly and among those, genetic improvement of goats and retail system is urgently needed. Moreover, as

meat import from the abroad is consistently increasing compared to Korean domestic goat meats and are impossible to distinguish, however it is expected that imported meats will be replaced by the domestic meats. Consequently, for convenient marketing of the domestic goat meat, reproduction of a goat should be improved. Finally, monitoring of the genetic diversity of Korean domestic goat population and also the production traits need to be amended and executed by the updated feeding approaches to discriminate the goat population with advance genetic techniques in addition to obtain the maximum economic benefit from commercial goat farm.

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