
EFFECT OF MANAGEMENT SYSTEMS ON BODY WEIGHT CHANGES AND CHEMICAL COMPOSITION OF MILK OF WEST AFRICAN DWARF GOAT

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ABSTRACT

The essence of goat improvement with respect to milk production is to increase the utilization of milk and milk related products by livestock and human populace. There is evidence that on live weight basis, goat is a much more efficient milk producer than some other ruminant species. If we must attain self-sufficiency in dairy production, then there is a need to explore other sources of milk from species like goats. Therefore, in this study the effect of management systems on weight of does and the chemical composition of West African dwarf goat milk was conducted. Goats were reared in three management systems- namely extensive, semi-intensive and intensive systems. Eighteen West African dwarf does were divided into three treatment groups with six goats per treatment in a Completely Randomized Design. Concentrate diets were formulated as supplement for the goats in the intensive and semi-intensive systems while roughage was fed as a basal diet. The feeding trial lasted 56 days. Ash, total solid and solid-non-fat were positively correlated with protein and lactose. Doe weight ($p < 0.05$) of 13.98 kg was recorded in semi-intensive system and the lowest (11.00 kg) in extensive system. Lactose, solid-non-fat and total solids were significantly higher under semi-intensive system and significantly ($P < 0.05$) lower under intensive system. Protein was highly significant under intensive and extensive system. The study concluded that semi-intensive management system improved the weight gain of does and the chemical composition of West African dwarf goat milk.

Keywords: West African dwarf goat, goat milk, chemical composition, management system, weight

INTRODUCTION

Goats are valuable domestic animals in the tropical livestock production system. They play an important role in economy, nutrition and welfare of the smallholder arable farmer in Nigeria (Khan *et al.*, 2006). Globally, goats produce only about 2% of the world's total annual milk supply (Park *et al.*, 2007). The contribution of goats in supplying milk and milk products is high and it has significant role in rural economy and health (Zenebe *et al.*, 2014). Goat milk differs from cow or human milk by having better digestibility, alkalinity and buffering capacity (Park *et al.*, 2017). Nutrients contained in goat milk are vitamins, minerals, trace elements, electrolytes, enzymes, proteins and fatty acids and are easily assimilated by the body. This ensures their contribution to food security and micronutrients lacking among rural dwellers in developing nations. If we must attain self-sufficiency in dairy production, then there is a need to explore other sources of milk from species like goats. There is evidence that on live weight basis, the goat is a much more efficient milk producer than some other ruminant species (Malau-Aduli and Anlade, 2002).

Globally, goat production yields about 60 percent of its value as milk, 35 percent as meat and 5 percent as skin (Assan, 2020). Milk composition and quality are important attributes that determine the nutritive value and consumer acceptability. Malau-Aduli *et al.* (2001) reported goat milk yield and composition are affected by breed, age, stage of lactation, season and plane of nutrition. Barnet and Frederick (2000) showed that goat milk contains more fat and ash than cow milk. However, as infant food it is nearly as high in vitamin B₆ and twice in vitamin B₁₂ as human milk. Interestingly, indigenous goats are highly adaptive to different production systems ranging from pastoral to agro-pastoral system with traits such as long walking ranges, ability to selectively graze and feed on poor quality forage, efficient utilisation of marginal environments, and low capital investment (Oguoma, 2003; Lebbie, 2004). However, there are limited research that compared management of lactating doe, affecting its composition, performance, quality and cost benefit analysis of goat milk. The objective of

this study was to evaluate the effect of management systems on does' weight and chemical composition of milk of West African dwarf (WAD) goat.

MATERIALS AND METHODS

Experimental Site

The study was carried out in three goat farms located at the Directorate of University Farms of the Federal University of Agriculture, Abeokuta. The climate of the site is humid; rainfall is well distributed during the rainy season with mean annual rainfall of 1037mm. The average temperature is 34.7°C. This area is located in the derived savannah vegetation zone of Southwestern Nigeria with latitude 7°13' 47.14" N, longitude 3°24'4.93" E, altitude 162m above sea level and relative humidity of 82% (Google Earth, 2022).

Experimental Animals and management

Eighteen West African dwarf goats (18 months old) with an average body weight of 11.78 ± 2.05 kg were used for the study and lasted for 56 days for each management system. The animals were quarantined for a period of two weeks to assess their health status before the commencement of experiment. In the first group, six intensively managed West African Dwarf goats were used. Thus, animals reared intensively were kept in permanent housing, with no access to pasture and were fed with roughage and concentrates. The second group of six WAD goats used for this study was reared under semi-intensive system; In semi-intensive systems, animals are not completely confined, were kept indoors during the night and in the evening and were moved to the pasture or simply to exhibit normal behaviours. Goats were fed with roughage and concentrates, in combination grazing. Goats in all farms, participating in this study were purebred animals. The composition of pasture consumed includes grasses like *Panicum maximum*, *Pennisetum purpureum* and animals are allowed to graze between 5 and 6 hours a day before supplementing with forage. The third group is also six WAD goats reared extensively. Animals were allowed to free grazing between the hours of 8hrs to 10hrs, water and salt lick were provided.

RESULTS AND DISCUSSION

Table 1 shows the weight and chemical composition of goat milk of experimental animals kept under different management systems. All the parameters were significantly ($p < 0.05$) affected by management system except fat and ash. Weight of does was significantly ($p < 0.05$) higher under the intensive and semi-intensive systems, while the extensive system had the lower value. Milk protein values were higher in intensive and extensive systems, while the lower value was recorded under the semi-intensive system. Lactose and total solid followed a similar trend with higher values in does kept under semi-intensive system, while does kept under intensive and extensive systems recorded the lower values. The values for fat (ranging from 5.00-5.12%) were higher than the values (3.76-3.89%) reported by Ebegbulem *et al.* (2021) but similar to 4.1% represented by Kumar *et al.*, (2012). This disparity could be attributed to the quality of feeding materials; goats reared extensively and semi-intensively were probably exposed to better quality feed. Based on the observation of this study, the WAD goat milk protein is relatively lower than 4.8% reported by Mahmoud *et al.*, 2021. This report constitutes a rich attraction of toddlers, pregnant and lactating mothers whose protein requirements exceed those of the average healthy adult, if the WAD goats could produce enough milk.

Table 2 shows the correlation between weights of WAD does and their milk chemical composition. Positive and negative values were recorded for WAD does and their chemical composition. The result showed that doe's weight was negatively and significantly correlated ($p < 0.05$) with lactose. Fat was negatively and significantly correlated ($p < 0.05$) with lactose and solid-non-fat while fat was positively and significantly correlated ($p < 0.05$) with total solid. It also recorded that lactose was positively and significantly ($p < 0.05$) correlated with total solid and was also positively and significantly ($p < 0.05$) correlated with solid-non-fat. The observed negative significant correlation between weight of doe versus protein ($r = -0.12$, $p < 0.05$), fat ($r = -0.14$) was not in line with the report of Tona *et al.* (2015) which observed a non-significant correlation between weight of does and lactose in milk. On the contrary, fat was negatively correlated to the milk lactose content and thus implies that the lactose content in West African dwarf goat milk was very low. Total solids content had highly significant positive correlation with solid-non-fat. The milk ash content was positively correlated with total solids, milk lactose versus total solids.

Table 1: Effect of management systems on doe's weight and chemical composition of West African dwarf goat milk

Parameters	Management system			SEM	p-value
	Intensive	Semi intensive	Extensive		
Doe body wt (kg)	13.20 ^a	13.98 ^a	11.00 ^b	0.18	0
Protein (%)	3.34 ^a	2.87 ^b	3.43 ^a	0.07	0.002
Fat (%)	5	5.09	5.12	0.09	0.856
Lactose (%)	5.01 ^b	8.52 ^a	4.96 ^b	0.21	0
Ash (%)	0.66	0.7	0.69	0.02	0.742
Total solid (%)	14.01 ^b	15.89 ^a	14.17 ^b	0.17	0
Solid-non-fat	9.02 ^b	10.60 ^a	9.91 ^{ab}	0.18	0.002

^{ab} Means on the same row having different superscripts are significantly ($p < 0.05$) different
SEM – Standard error of the mean

Table 2: The correlation between weights of West African dwarf does and their milk chemical composition

Indices (%)	Doe weight	Protein	Fat	Lactose	Ash	Total solid
Doe body wt	1					
Protein	-0.12	1				
Fat	-0.14	0.13	1			
Lactose	0.13	-0.38***	-0.26***	1		
Ash	-0.14	0.02	-0.04	-0.12	1	
Total solid	-0.07	0.06	0.27***	0.71***	0.02	1
Solid-non-fat	-0.08	0.05	-0.24***	0.75***	-0.05	0.73***

Mean values are the major numbers, $p < 0.05$ * $p < 0.01$ ** $p < 0.001$ ***

CONCLUSION

The study showed that semi-intensive management system improved the chemical composition of West African dwarf goat milk as well as the total weight gain of does and kids.

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