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## **Influence of Season on Milk Yield and Milk Composition of Red Sokoto Goats in Mubi Area of Adamawa State, Nigeria**

A. Midau, A. Kibon, S.M. Moruppa and C. Augustine  
Animal Production Adamawa State University Mubi, P.M.B. 25, Nigeria

**Abstract:** The study was conducted to determine the milk yield and composition of goat milk in Mubi area (Mubi North and South local government areas) of Adamawa State, Nigeria. Purposeful, multistage and random sampling techniques were used to select 40 lactating Red Sokoto does in wet and dry season in 2008, within Mubi area for the study. Composition of milk were, 4.84, 17.86, 13.42, 0.17, 0.22, 0.14 and 0.13% for fat, total solid, solid non fat, cholesterol, calcium, magnesium and phosphorus in the dry season respectively. The mean milk yield was 2.08 kg week<sup>-1</sup> in the dry season. The mean values, 5.01, 16.58, 11.79, 0.18, 0.29, 0.15 and 0.14% for fat, total solid, solid non fat, cholesterol, calcium, magnesium and phosphorus obtained in the wet season, respectively. The milk yield was 3.38 kg week<sup>-1</sup> in the wet season, these were determined according to the standard procedures described by AOAC, Pearson's chemical analysis of food and assessment of methodologies for colorimetric cholesterol assay. The results showed that percent, milk yield was significantly ( $p < 0.001$ ) affected by season. Fat, total solid, solid non fat were significantly ( $p < 0.001$ ) affected by parity. There was seasonal variation ( $p < 0.001$ ) on calcium. TS and SNF was significant ( $p < 0.05$ ) as affected by season. Parity and season has no effect on cholesterol, magnesium and phosphorus. The result showed that, the composition of milk studied is comparable to the reported values of exotic breeds found in other countries. Although the milk yield was not comparable to the exotic breeds, its composition was similar. In conclusion, there is need to improve milk production potentials of the local breed through breeding, nutrition, improved management systems as well as creating awareness on nutritional value of goat milk.

**Key words:** Goat milk, production, local breed, wet season, dry season, parity

### **INTRODUCTION**

The Red Sokoto, is the most important goat breed in Nigeria, accounting for about 70% of the estimated 34.5 million goats in Nigeria (Osuhor *et al.*, 1998). The Red Sokoto, is the most widespread and well-known type in Nigeria (Haumesser, 1975). It is the usual village goat in the northern two-thirds of the country.

The importance of goats as providers around the world of essential food in meat and dairy products has been discussed and documented in many recent proceedings of national and international conferences (Gruner and Chabert, 2000; Boyazoglu and Morand-Fehr, 2001; Haenlein and Fahmy, 1999; Haenlein, 1992, 2001; Fehr and Bovazoglu, 1999). This

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**Corresponding Author:** Alexander Midau, Department of Animal Production,  
Adamawa State University P.M.B. 25, Mubi, Nigeria  
Tel: +2348055984585, +2348081081311

importance is also reflected in the largest animal number increase for goats during the last 20 years (FAO, 2001) and the largest increase in goat milk production tonnage compared to other mammalian farm animals. Milk production of goats is likely to be much greater than in these official statistics, because of the large amounts of unreported home consumption, especially in developing countries.

Information was published on the milk yield and composition of Nigerian goats (Red Sokoto) and the result obtained was compared with standard figures for European goats. Milk in yield was obtained at 7 kg per week (Alawa and Oji, 2008), although higher than 1.6 kg per week obtained by Sankey (1991), from does of the same breed (Red Sokoto goats).

It is likely that yields for pastoral goats are lower than the value for station livestock. The Red Sokoto goat was the source of 'Morocco leather' known in Europe from the medieval period onwards. It acquired this name because it was transported across the Sahara by caravans controlled by Moroccan merchants. The Red Sokoto is still known for its suitability for fine leather.

Ruminant livestock in most parts of the tropics graze extensively on naturally growing forages which are poor in quality. These tropical forages compared to those in the temperate, support lower levels of ruminant animal production mainly because they contain less nitrogen and are less digestible (Minson, 1980). The quality and quantity of these grasses become more critical in the dry seasons and thereby imposing more serious constraint to the development and productivity of these animals (Topps, 1992).

Milk composition and quality are important attributes that determine the nutritive value. Malau-Aduli *et al.* (2001) reported goat milk yield and composition are affected by breed, age, stage of lactation, season and plane of nutrition. Mervat-Foda *et al.* (2009) reported that supplementing goat ration will increase milk production and its constituents. 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 B<sub>6</sub> and twice in vitamin B<sub>12</sub> as human milk. They also reported that vitamin A in goat milk exists exclusively in its true form and not as carotenoid pigments. Evaluation of goat milk composition with respect to differences in, season and parity is practically non-existent in literature in the study area. Therefore, this study was designed to investigate the effects of these factors on goat milk composition in Mubi area of Adamawa State, Nigeria.

The objectives of the study are:

- To assess the potential influence of season on milk production and milk composition of goats in Mubi area
- To describe and evaluate the present and potential milk production capacity of the existing local breeds of goats in Mubi area
- To assess the fat, total solid, solid not fat, cholesterol, calcium, phosphorus and magnesium values of the Red Sokoto goats' milk within Mubi area
- To make recommendations for on-farm improvements, policy changes and draw suggestions for further research

## **MATERIALS AND METHODS**

### **Location of the Study**

Mubi area (Mubi north and Mubi south local government areas) lie within Northern Guinea Savannah zone of Nigeria and located at latitude 10°00 North, longitude 13°30 East

and about 305 m above sea level, with an area of 961.39 km<sup>2</sup>. The dry season in this area commences early October and last up to April. The wet season begins from May and attains its peak between July and August and declines in September; the mean annual rainfall is 1050 mm. The relative humidity is extremely low 20-30% between January and March and start increasing as from April and reaches a peak of about 80% in August and September, the relative humidity starts to decline from October following the cessation of rains. The maximum temperature can reach 40°C particularly in April while minimum temperature is about 18°C between December and January. The varieties of livestock include cattle, sheep, goats and pigs. The dwarf goats are the most common breeds (Adebayo and Tukur, 1999).

Mubi area consisting of twenty-one political wards, eleven wards in Mubi North and ten wards in Mubi South, with a population of about 151,072 in Mubi North and 128,937 in Mubi South local government areas (National Population Commission, 2006). Mubi is bounded to the South by Maiha local government area to the West by Hong local government area and to the North by Michika local government area and to the East by Cameroun republic. The people are predominantly farmers. Most households keep various livestock species.

### **Goats Management**

The goats are allowed to range freely in the dry season and confined as soon as the crops are sown in the wet season. They are released as soon as the crops are harvested; they are mostly released out to grazing fields in the morning. In the evening, they are brought back and enclosed in huts made for the goats, no concentrates was given.

### **Sampling Techniques**

Purposeful, multistage and random sampling techniques were used, to select 40 lactating Red Sokoto does, 20 in the dry season (January-April, 2008) and 20 in the wet season (June-September, 2008), was selected within Mubi area to determine the milk yield and its composition.

### **Collection of Milk Samples and Analysis**

Forty Goat milk samples were collected from the two local government areas, in the dry and wet seasons, during the year 2008. During milk collection, the udder and teats of each doe were washed with lukewarm water and cleaned with cotton wool soaked in disinfectant and then they were hand-milked into previously sterilized containers and measured. Milk yield was measured for 12 weeks from each doe after kidding except for the first 3 days postpartum. The entire content was then evaluated for the following; total solid, solid non fat, fat, cholesterol, calcium, phosphorus and magnesium levels, these were determined according to the standard procedures described by AOAC (1990), Pearson's chemical analysis of food, Horold and Kirk (1981) and Bohac *et al.* (1984). The minerals (Phosphorus, Calcium and Magnesium) were determined by Atomic Absorption Spectrophotometer (AAS), (Perkin-Elmer, 1976). Data generated were subjected to analysis of variance using GenStat Release 7.2 (2007).

## **RESULTS**

The results in Table 1 shows that effect of parity was not significant on calcium, cholesterol, milk yield, magnesium, phosphorus and solid non fat, but there was significant effect of parity on fat ( $p < 0.001$ ) and total solid ( $p < 0.005$ ). Table 2 showed parity had

significant effect on fat ( $p < 0.001$ ), solid non fat ( $p < 0.01$ ) and total solid ( $p < 0.001$ ), while there was no significant difference on phosphorus, magnesium, milk yield, cholesterol and calcium. In comparison between wet and dry season, there was significant effect of season on calcium ( $p < 0.01$ ), which shows that the result obtained for calcium was lower in the dry season (Table 2), milk yield was higher in the wet season with significant difference at ( $p < 0.001$ ) as affected by season. Table 3 and 4 show the statistical result of the effect of parity on the milk components in wet season and dry season respectively.

Table 1: Milk yield and composition (Red Sokoto goat milk) in the wet season (n = 20)

Contents (%)	Means	Minimum	Maximum
Milk yield/kg/week	3.38	2.80	4.00
Fat	5.01	3.05	6.40
Total solid	16.58	11.00	21.10
Solid non fat	11.79	6.20	16.21
Cholesterol	0.18	0.13	0.27
Calcium	0.29	0.20	0.40
Magnesium	0.15	0.11	0.17
Phosphorus	0.14	0.11	0.16

Table 2: Milk yield and composition (Red Sokoto goat milk) in the dry season (n = 20)

Contents (%)	Mean	Minimum	Maximum
Milk yield/kg/week	2.08	1.26	2.85
Fat	4.84	3.01	6.20
Total solid	17.86	14.94	20.55
Solid non fat	13.42	11.01	16.76
Cholesterol	0.17	0.13	0.27
Calcium	0.22	0.11	0.30
Magnesium	0.14	0.10	0.16
Phosphorus	0.13	0.11	0.16

Table 3: Mean effect of parity on milk composition (Wet season) (n = 20)

Variations	Treatments				SED
	P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>	P <sub>4</sub>	
Milk yield	3.300	3.522	3.382	3.272	0.2601
Total solid	13.900	15.240	17.930	19.230	1.370
Fat	3.632	4.688	5.126	5.596	0.2361
Solid non fat	10.270	10.550	12.810	13.540	1.332
Cholesterol	0.1901	0.1819	0.1689	0.1658	0.2132
Calcium	0.280	0.302	0.310	0.272	0.0365
Magnesium	0.1380	0.1560	0.1420	0.1520	0.01068
Phosphorus	0.1380	0.1420	0.1320	0.1320	0.00938

P: Parity, SED: Standard error of difference

Table 4: Mean effect of parity on milk composition (Dry season) (n = 20)

Variations	Treatments				SED
	P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>	P <sub>4</sub>	
Milk yield	1.840	1.962	2.340	2.188	0.2381
Total solid	17.340	16.300	18.410	19.380	0.6390
Fat	3.684	4.446	5.164	6.076	0.1886
Solid non fat	13.650	11.860	13.050	14.510	0.7060
Cholesterol	0.1652	0.1602	0.1789	0.1719	0.2352
Calcium	0.2300	0.2120	0.1920	0.2080	0.02777
Magnesium	0.1480	0.1400	0.1220	0.1440	0.01311
Phosphorus	0.1220	0.1360	0.1380	0.1360	0.00894

P: Parity, SED: Standard error of difference

## DISCUSSION

### Milk Yield

Generally the result was better, with higher values obtained during the wet season; this is in line with the findings of El-Hassan *et al.* (2009) that productivity in goats is better during this period. The values obtained in the study were 3.38 and 2.08 kg per week in wet and dry season respectively. It was observed that the milk yield is higher in the wet season, there was a significant difference ( $p < 0.001$ ), this may be due to the availability of forages in the wet season, which was lower in the dry season, the result of Table 3 and 4 show that the effect of parity were not significant in both seasons. This values are comparable to the previously reported values of 3.8 litres per week (Ehoche and Buvanendran, 1983) 3.3 litres per week (Adu *et al.*, 1979) 3.3 litres per week (Akinsoyinu *et al.*, 1981) and lower than 3.7 kg per week (Alawa and Oji, 2008), but higher than 1.6 kg per week obtained by Sankey (1991) from does of the same breed (Red Sokoto goats). The milk yield is low compared to the values reported for European breeds of 1.9 kg per day (Morand-Fehr and Sauvant, 2006) this might be due to breed differences.

### Milk Fat

The milk fat obtained in this study were 5.01 and 4.84% in wet and dry season respectively, the difference was not significant. Fat showed significant difference ( $p < 0.001$ ) with parity effect in both seasons, as shown in Table 3 and 4. The values obtained were similar to the values 5.04 and 4.94 (Zarhraddeen *et al.*, 2007), 5.7 (Alawa and Oji, 2008), 5.32 (Mba *et al.*, 1975), 4.30 (Sankey, 1991) 4.60 (Akinsoyinu *et al.*, 1981) and 4.75 (Ehoche and Buvanendran, 1983) reported for the Red sokoto goat these similarities might be due to similarities in breeds. In comparison to the values for, WAD goat 4.74, Sahel goat 5.16 (Zahradeen *et al.*, 2007), WAD 7.78, Saanen 5.48 (Mba *et al.*, 1975), Previous studies have shown that the WAD goat has high milk fat than the Red Sokoto goat, but the values obtained in this study can be compared to the value obtained for Sahel goat in previous studies. The study (Table 1, 2) have shown that, the mean value of fat was lower in the dry season and higher in the wet season, this might be in relation with nutritional status of the animals during wet season, where feeds are available and richer in minerals and vitamins, the fat content tends to increases as parity increases this might be due to increase in age.

### Total Solid and Solid Non Fat (SNF)

The values of solids-non-fat and total solids in this study, were 11.79 and 16.58%, wet season, 13.42 and 17.86% dry season, respectively, the effect of season is significant ( $p < 0.05$ ) and significant at ( $p < 0.01$ ) with effect of parity in the dry season, these values are similar to the values obtained, 11.4 and 17.1%, respectively (Alawa and Oji, 2008), but also higher than the previously reported lower values of 10.53 and 15.83% by Mba *et al.* (1975), 13.63 and 0.73% by Sankey (1991) The values were higher in the dry season, the effect of parity was significant on total solid ( $p < 0.001$ ).

### The Mineral Content

There were no significant differences in the values of the minerals obtained in this study with parity. The values of calcium found in this study was 0.22 and 0.29% in dry and raining season, respectively, there was a significant difference in calcium at ( $p < 0.001$ ) caused by seasonal effects might not be unrelated to the nutritional level in the raining season. These values are comparable to the value 0.20% obtained by Alawa and Oji (2008). Magnesium

values were 0.14 and 0.15% in dry and wet season respectively, which are also comparable to 0.14% (Alawa and Oji, 2008). The values obtained for phosphorus were 0.13 and 0.14% in the dry and wet season, the influence of season and parity was not significant, 0.13%, (Alawa and Oji, 2008) obtained for same breed in the dry season (Red Sokoto goat ) was in agreement with the value obtained in this study in the dry season.

### **Cholesterol Level**

Cholesterol values obtained in this study were 0.17 and 0.18% in the dry and wet season respectively; research on Red Sokoto goat milk cholesterol level seems unavailable, an average of 0.14% for European goats breed. But in comparison with cow milk the cholesterol level in Red Sokoto goat milk obtained in this study was slightly higher than the average value 0.15% for European breeds of cattle (Chicama, 2009). An average cholesterol level in human milk 0.20% is higher than the values for both goat and cow milk. Low-cholesterol means the food contains 20 mg cholesterol or less per 100 g. The American Heart Association recommended in 2009 that, average daily cholesterol intake of less than 300mg, if you have heart disease, up to 400 mg for healthy persons.

### **CONCLUSION**

There is need to improve milk production potentials of the local breed through breeding, nutrition, improved management systems as well as creating awareness on nutritional value of goat milk.

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