EFFECT OF LOCATION AND RAINY SEASON INTERPHASE ON MILK YIELD AND COMPOSITION OF BUNAJI COWS IN NIGER STATE, SOUTHERN GUINEA SAVANNA

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ABSTRACT
This study investigated the effect of location and rainy season interphase on milk yield and composition of Bunaji cows in Southern Guinea Savanna. The objectives were to determine the milk yield, composition of milk as well as physicochemical properties of milk produced by Bunaji cows under interphase of rainy season. The study was conducted in Niger state between the months of May to October 2023. Three experimental sites: Minna, Lambata and Tafa were selected. Ninety (90) lactating Bunaji (White Fulani) cows were used for the experiment; 30 cows per experimental site. Sample collection was done in three phases: early, mid and late raining seasons which were analyzed for Crude Protein (CP), Ash, Moisture, Fat and physicochemical properties. Results showed that there were significant ($P < 0.05$) differences in milk yield across all observed parameters, namely, early, mid, and late rainy seasons. Also, there was a significant ($P < 0.05$) difference in moisture composition, whereas there were no significant ($P > 0.05$) differences in crude protein, ash, fat, and NFE. The study concluded that milk yield, moisture composition and pH of milk produced by Bunaji cows in the study area are affected by rainy season interphase. It was therefore recommended that selective breeding programs focusing on cows from Lambata and Tafa, which produced higher milk yields across all interphases, should be explored and pH levels in cow milk should be constantly monitored and managed by adjusting feeding practices.
Keywords: Bunaji, Rainy season, Guinea savanna, Milk yield, Milk composition.

INTRODUCTION

The rainy season in Niger state, southern guinea savanna vegetation zone of Nigeria, brings about significant changes in environmental conditions that can impact various aspects of agricultural activities such as dairy farming, particularly the milk yield and composition of Bunaji cows also known as White Fulani (Adama, *et al*., 2016). By monitoring milk composition during different interphases, farmers can tailor their milk processing and storage techniques to ensure optimal quality and safety standards. Ajayi *et al.* (2018) studied the influence of seasonal variation on milk yield and composition of Bunaji cattle in North Central Nigeria, emphasized the need for further research to specifically address the effects of the interphase of the rainy season. The objectives of the study were to determine the milk yield, the milk composition and the physicochemical properties of milk produced by Bunaji cows in Niger state.

Therefore, this study seeks to explore the influence of the interphase of the rainy season on milk yield and composition in Bunaji cows within the Niger state.

Materials and methods

The study was conducted in Niger state which is located in southern guinea savannah region between the months of May to October 2023. Three experimental sites: Minna, Lambata and Tafa were selected. 90 lactating Bunaji (White Fulani) cows were used for the experiment; 30 cows per experimental site. Sample collection was done in three phases: early, mid and late raining seasons. The experimental design was Completely Randomized Design (CRD) with three treatments, three replicates and 10 animals per replicate. 200 Mls of milk samples were collected between 6 and 7 am from each location weekly using hand milking method. They were stored at range temperature of 1-4^{0}C in plastic bottles. The milk samples were analyzed for Crude Protein, Ash, Moisture, Fat, Nitrogen Free Extra (NFE) and physicochemical properties according to the methods of Association of Official Analytical Chemist AOAC (2000).

Data analysis

Data collected were subjected to Analysis of Variance (ANOVA) using Statistical Package for Social Sciences. Means were compared with Duncan's Multiple Range Test (DMRT) analysis at a confidence level of 0.05.

RESULTS AND DISCUSSION

The results of the milk yield of Bunaji cows during the interphases of the rainy season in the study area are presented in Table 1. It is evident that there were significant ($P < 0.05$) differences in milk yield across all observed parameters, namely, early, mid, and late rainy seasons. However, there were no significant ($P > 0.05$) differences in the milk yield of Bunaji cows between Lambata and Tafa for all three interphases of the rainy season. The milk yield of cows in Minna showed a significant difference ($P < 0.05$) compared to those in Lambata and Tafa. Notably, the lowest milk yield was observed among cows in Minna during the early rainy season (2.597 litres), while the highest milk yield was obtained among cows in Tafa during the early rainy season (3.040 litres) and Lambata. Throughout all three interphases of the rainy season, the milk yield of cows in Minna remained the lowest, while those in Tafa and Lambata were consistently the highest. This result is in line with Githinji *et al*. (2020) who reported that monthly rainfall had a significant ($P < 0.001$) and positive correlation with monthly milk yield.

Table 1: Milk yield of Bunaji cows under interphase of rainy season

Parameters	Minna	Lambata	Tafa	SEM	p-Value	LS
Early Rainy Season (litres)	2.597[a]	2.940[b]	3.040[b]	0.0387	0.000	*
Mid Rainy Season (litres)	2.770[a]	2.987[b]	3.010[b]	0.0374	0.014	*
Late Rainy Season (litres)	2.687[a]	2.933[b]	2.943[b]	0.0400	0.011	*

[ab] = means in the same row with different superscript are significantly different ($P < 0.05$),
LS = Level of Significance, * = statistically significant at 0.05

Table 2 presents the impact of the rainy season interphase on the milk composition of Bunaji cows in the study area. The results indicate a significant ($P < 0.05$) difference in moisture composition, whereas there were no significant ($P > 0.05$) differences in crude protein, ash, fat, and NFE. The moisture composition of milk obtained from cows in Lambata (87.25%) was statistically similar to that of Tafa (87.58%) and Minna (87.02%). However, the average moisture composition of milk from cows in Minna was statistically ($P < 0.05$) different and lower than the average moisture composition of milk from cows in Tafa.

Table 2: Effect of interphase of rainy season on the milk composition of Bunaji cows

Parameters	Minna	Lambata	Tafa	SEM	p-Value	LS
Moisture (%)	87.0240[a]	87.2510[ab]	87.5834[b]	0.0921	0.043	*
Crude protein (%)	3.7913[a]	3.4898[a]	3.7184[a]	0.0685	0.174	NS
Ash (%)	1.6035[a]	1.7310[a]	1.6421[a]	0.0537	0.616	NS
Fat (%)	3.1771[a]	3.3150[a]	3.1445[a]	0.0482	0.314	NS
NFE (%)	4.4268[a]	4.2305[a]	3.8867[a]	0.1236	0.197	NS

[ab] = means in the same row with different superscript are significantly ($P < 0.05$) different,
LS = Level of Significance, * = statistically significant at 0.05, NS = Not Significant, NFE = Nitrogen Free Extract

This finding agrees with Ajai *et al.* (2012); nevertheless, the range of moisture composition (84.22% to 89.02%) in this study is higher than what was reported by Ajai *et al*. (2012). The variation could be due to differences in diet, lactation phase of the cows sampled or other climatic conditions like temperature and humidity. According to Isengard (2001), moisture provides important information related to the texture, taste and microbial stability of milk. It is also a key variable used to calculate purity, yield, and /or resulting constituent analysis on a dry basis.

Table 3 presents the results of the effect of the rainy season interphase on the physiochemical properties of milk produced by Bunaji cows in the study area. The result reveals a significant difference in pH ($P < 0.05$), while no significant differences ($P > 0.05$) were observed in Total Solids, Total Titratable Acidity, viscosity, density, and Total Soluble Solids. Additionally, there were no significant differences ($P > 0.05$) between the pH of milk obtained from Lambata (6.3013) and Tafa (6.4537), as well as between Minna (6.5550) and Tafa (6.4537). However, the pH of milk obtained from Minna (6.5550) was significantly ($P < 0.05$) different and higher than the pH of milk obtained from Lambata (6.3013). Therefore, interphase of rainy season resulted in significant ($P < 0.05$) difference in pH of milk produced by cows in the study area. This result is in line with Teshome and Tesfaye (2016). In addition, the authors reported a significant ($P < 0.05$) difference in TTA while in this study, there was no significant ($P > 0.05$) difference in TTA. The variation could be due to differences in study location and breeds of cows. The pH serves as a key indicator of freshness and potential contamination of cow milk which impacts its susceptibility to harmful bacteria and ensuring a longer shelf life.

Table 3: Effect of rainy season interphase on physiochemical properties of milk produced by Bunaji cows

Parameters	Minna	Lambata	Tafa	SEM	p-Value	LS
TS (%)	13.9643[a]	13.4187[a]	13.8233[a]	0.2068	0.540	NS
TTA (%)	0.0603[a]	0.0730a	0.0597[a]	0.0057	0.568	NS
pH	6.5550[b]	6.3013[a]	6.4537[ab]	0.0376	0.020	*
Viscosity (sec)	399.087[a]	475.323[a]	469.687[a]	19.543	0.209	NS
Density (g/mL)	0.9187[a]	0.9210[a]	0.9160[a]	0.0048	0.917	NS
TSS (%)	12.2593	12.1440	12.4210	0.2282	0.886	NS

[ab] = means in the same row with different superscript are significantly ($P < 0.05$) different,
LS = Level of Significance, * = statistically significant at 0.05, NS = Not Significant, TS = Total Solids, TTA = Total Titratable Acidity, TSS = Total Soluble Solids

CONCLUSION

Based on the findings of this research work, the following conclusions were drawn:

i. Milk yield of Bunaji cows in the study area is influenced by rainy season interphase. Also, cows in Lambata and Tafa produced higher milk than those in Minna in all interphases of rainy season.
ii. Moisture composition of milk produced by cows in the study area is influenced by interphase of rainy season. Milk of cows in Tafa had the highest moisture composition.
iii. pH of cow milk differed significantly across the three interphases of rainy season.

RECOMMENDATIONs

i. Selective breeding programs focusing on cows from Lambata and Tafa, which consistently produced higher milk yields across all interphases, should be explored. This targeted approach can lead to the development of more productive and resilient Bunaji cow breeds.
ii. Given that the moisture composition of milk in Tafa was the highest, nutritional interventions aimed at optimizing moisture levels in the diet of cows in other locations will go a long way in improving milk quality.
iii. Constantly monitor and manage pH levels in cow milk, considering the significant differences across rainy season interphases. This may involve adjusting feeding practices or implementing measures to maintain consistent milk acidity.

REFERENCES

Adama, T. Z., Kudu, A. B., Barde, I. A., and Gana, A. S. (2016). Effects of season and parity on milk yield and composition of Bunaji cows in Minna, Nigeria. *Nigerian Journal of Animal Production,* 43(2), 109-117.

Ajai, A. I., Ochigbo, S. S., Ndamitso, M. M., and Olaoluwajuwon, J. (2012). Proximate and Mineral Compositions of Different Raw Cow's Milks in Minna. *European Journal of Applied Engineering and Scientific Research*, 1(1), 23-29.

Ajayi, F. T., Oladele, O. A., and Abdulazeez, S. O. (2018). The Influence of Seasonal Variation on Milk Yield and Composition of Bunaji Cattle in North Central Nigeria. *Nigerian Journal of Animal Science,* 20(1), 186-193.

Githinji, M. G., Ilatsia, E. D., Muasya, T. K., and Bebe, B. O. (2020, December 8-10). *Variability in Monthly Rainfall and Temperature has an Influence on Daily Milk Production in Sahiwal Cows in Kenya* [Paper presentation]. 1st African Conference on Precision Agriculture (AfCPA), Morocco.

Isengard, H. (2001). Water content, one of the most important properties of food. *Food Control*, 12(7), 395-400.

Teshome, G. and Tesfaye, A. (2016). Physicochemical Properties and Microbial Quality of Raw Cow Milk Produced by Smallholders in Bench Maji-Zone, Southwestern Ethiopia. *Food Science and Quality Management*, 54, 47-54.