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Milk Composition of Yankasa Sheep Raised Under Small-Holder Husbandry System in Zaria, Nigeria

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Target audience: Researchers, farmers, teachers, policy makers and students

Abstract

This study was conducted to investigate milk compositional parameters in Yankasa sheep raised under small-holder husbandry system in Zaria, Nigeria. A total of eighty lactating ewes were used and classified on the basis of age, body condition score (BCS), parity and season. The results showed that there were significant differences (P<0.05) in milk compositional parameters with respect to total solid, lactose, crude protein (CP) and fat contents pH and ash contents were influenced by BCS of the ewes studied. Age of ewes significantly (P<0.05) affected all the milk composition parameters investigated. However, parity effect showed significant differences (P<0.05) in terms of total solid, lactose, CP, fat pH and ash contents of ewes milked. The results also shows seasonal significant (p<0.05) effects on milk composition with respect to four parameters (lactose, CP, fat and ash contents). Total solid and pH content of ewe milked did not differ significantly (P>0.05) in the two seasons (wet and dry). There were many significant (P<0.05) and positive correlations among the milk composition parameters. For instance BCS vs season, fat vs CP and pH vs parity, CP vs BCS, BCS vs fat; values being r= 0.31, 0.76, 0.31, 0.27, 0.82 (P<0.05), respectively. This study on milk composition of ewes showed great variability in the values of the milk composition investigated and attributed it to the differences in the feeding and management of these animals. It is therefore suggested that enhanced management in terms of feeding and housing be given to these ewes in order to achieve the purpose to which they are kept.

Key Words: Yankasa; ewes; milk composition; small-holder

Description of Problems

In Nigeria, Yankasa is the most predominant and widely spread breed of sheep. There are few other breeds such as Uda, Balami and West African Dwarf which are found at specific locations across the country. The breed is an intermediate between the long legged (Balami) and short legged West African Dwarf sheep. The description of Yankasa breed has been reported by (1).

Milk composition and quality are important attributes that determine the nutritive value and consumer acceptability of fresh milk and milk products (2). The indigenous cattle have been the major source of domestic milk

supply in the country. Milk supply from other livestock such as sheep, goats and camels is negligible and rarely used for domestic purposes (3; 4). The dairy industry in the country is rural and traditional with Fulani pastoralists controlling more than 95 % of the national herd. It has been reported that the annual collectable milk from the national herd was approximately 555,000 tonnes (5), and this might not have changed much. However, there is a growing awareness of the importance of sheep as a source of milk for human consumption in the country (6). Sheep and goat production in Nigeria have been characterized by low productivity in some indices such as growth and lactation performance, with very low kid/lamb survival rate (6). This reduced productivity has been attributed to several factors such as poor nutrition (7), heat stress and diseases (8; 9), management practices (6).

It has been reported that in traditional husbandry, no special care is given to the breeding stock and this has resulted in reduced lactation performance (4). Local sheep breeds in the country have the potential to supply a significant portion of the milk deficit because of their numerical numbers far exceeding cattle in both rural and urban communities (10). Sheep are also more affordable to resource poor families and produce more milk in relation to body size than cattle (11). Also, knowing the quality parameters of the milk will aid in determining the use to which it can be put in terms of processing (12). Therefore, this study was designed to investigate the variation and quality of milk from Yankasa sheep raised under small holder husbandry system in Zaria, a part of Northern Guinea Savanna ecological zone of Nigeria.

Materials and Methods

Study area

Zaria is situated on latitude 112° 12′ N and longitude 07° 37′ E, at an altitude of 550-700 meters (13). Located on the high plains of Northern Nigeria, 652.6 meters above the sea level, possesses a tropical continental climate with a pronounced dry season, lasting up to seven months (October - May). During the dry season, cold period is usually experienced between November and February.' This emanates from the influence of the North-easterly (NE) winds (the Harmattan) which control the tropical continental air mass coming from the Sahara. The harmattan prevails over most parts of the country. The NE wind is characterized by hazy to dusty conditions and low temperatures, as low as 10°C at night. In the afternoons, up to 42°C is sometimes recorded. The humidity also drops to less than 15 % in December/January (13).

The rainy season lasts from early May to early October with long-term annual rainfall of 1040mm in about 90 rain days (13). The relatively deep tropical ferruginous soils and climate conditions of Zaria are suitable for and sustain a good cover of savanna woodland (Northern Guinea Savanna) with a variety of grasses, woody shrubs and short trees (13).

Experimental Sheep

The breed of sheep used for the study is

the Yankasa ewes. The detailed description of this breed has been reported by (1). A total of 40 ewes of various ages, parity and body conditions score (BCS) were used. These ewes were aged using the dentition method described by (14) and BCS was taken as per the procedure laid down by (14).

These ewes were those raised by small holders under husbandry system and were of various parity ranging from 1 to 6. The husbandry system is mostly traditional and ranges from free range grazing with little or no supplementary feeding during the non cropping period to tethering with zero grazing during the cropping season (15).There is provision of little or rudimentary medical care for the animals.

Milk samples collection

Milk samples were collected using hygienic method to ensure minimal contamination. The data was collected in both dry (October-March) and wet (April-September) seasons. The milk samples collected were classified based on the BCS, parity, and age of the animals.

Milk samples analyses

Milk quantity of 5mls was collected from each animal using hand milking. The milk samples were put into a 10mls sterile plain sample bottles. The samples were then packed in ice coolers and transported to the laboratory and refrigerated to avoid quality deterioration before analyses. The (16) methods were followed in the determination of milk composition parameters with respect to total solid, fat, crude protein, pH and ash. The lactose percentage was calculated as: Total solids – (Protein+ fats +ash).

Data analyses

The data from this study were subjected to analyses of variance and correlation using the general linear model (GLM) of (17). Means were subsequently compared using Duncans Multiple Range Test (DMRT).

Results and Discussion

The effects of body condition score on milk composition in Yankasa sheep is shown (Table 1). There were significant differences ($P<0.05$) in terms of the total solid, lactose, crude protein and fat contents. Total solid was significantly ($P<0.05$) higher in animals with body condition score 1 and decreased at body condition score 3. Percent lactose was significantly ($P<0.05$) higher in animals with body condition score 1 and was decreased at body condition score 2. Crude protein was higher at body condition score 4 and decreased at body condition score 2. Fat was higher at body condition score 5 and lower at body condition score 1. BCS may be used as an indicator of milk composition in dairy animals as reported by (18). The present study obtained better milk compositional parameters (total solids, lactose, CP and fats) in ewes at higher body condition score. Animals with higher body condition score tend to have higher total solid, protein and fat contents in their milk (18; 19).

Table 1 Effects of Body Condition Score on Milk Composition (%) in Yankasa sheep

Parameter	BCS					SEM	LOS
	1	2	3	4	5		
Total Solid	5.57^{a}	5.34^{ab}	5.17^{b}	5.23^{ab}	5.51^{a}	0.18	*
Lactose	5.26^{a}	4.66^{b}	4.84^{ab}	4.86^{ab}	5.01^{ab}	0.12	*
CP	12.89^{ab}	12.27^{b}	12.65^{b}	13.37^{a}	13.24^{a}	0.35	*
Fats	8.02^{c}	8.35^{bc}	8.64^{ab}	9.04^{a}	9.19^{a}	0.32	*
pH	6.82	6.92	6.79	10.41	6.81	0.04	NS
Ash	0.28	0.27	0.30	0.33	0.31	0.03	NS

a,b means having different significance superscripts across rows differ significantly SEM: standard error means, LOS = level of significance difference. NS = no significant difference at 5%. CP=Crude Protein.

The effect of age on milk composition of ewes is depicted in Table 2. There were significant differences (P<0.05) across all the parameters investigated. Total solid was higher in ewes in their first year and lower values were obtained in ewes aged four years, though the value was not different from the values obtained from ewes in their 2nd, 3rd, 5th and 6th year. Higher value of lactose was obtained from ewes aged one year. However, crude protein and fat were higher in ewes in their first year and those aged four years had the lower value of lactose However, pH and ash were higher in ewes aged six years and lower in ewes aged one year. This result is contrary to the report of (20) except for the fat, that the chemical components of milk were not significantly affected by ewe's age, except fat. Fat content was lower in older ewes compared with that of younger ewes (20). Similarly, (21) reported that no significant differences were observed with respect to age on percentages of total solid, lactose, protein, pH and ash of sheep milk. The result on CP content is in agreement with the reports of (22) that age of ewe had a significant effect on the percentages of protein, where it was the highest at the age of 3 to 4 years. As dairy animals grow older, fat content of their milk decreases and the fall in solids not fat is much greater (23).

Table 2: Effects of Age on Milk Composition (%) in Yankasa sheep

Parameter	Age (years)						SEM	LOS
	1	2	3	4	5	6		
Total Solid	5.53^{a}	5.38^{ab}	5.36^{ab}	5.11^{b}	5.32^{ab}	5.31^{ab}	0.20	*
Lactose	5.03^{a}	4.88^{ab}	4.88^{ab}	4.71^{b}	4.87^{ab}	5.00^{a}	0.13	*
CP	13.98^{a}	13.49^{ab}	13.00^{bc}	12.55^{c}	12.63^{c}	13.05^{ab}	0.39	*
Fat	10.65^{a}	9.28^{b}	8.70^{bc}	8.47^{c}	8.64^{bc}	8.81^{bc}	0.35	*
pH	6.75^{b}	7.01^{b}	6.65^{b}	6.78^{b}	6.81^{b}	8.60^{a}	2.59	*
Ash	0.26^{b}	0.31^{ab}	0.30^{ab}	0.29^{ab}	0.31^{ab}	0.33^{a}	0.03	*

* P 0.05, LOS = level of significance. ab means with the same superscript along the rows are not significantly different. CP= Crude Protein.

The effect of parity on milk composition in Yankasa sheep is shown in Table 3. All the parameters investigated showed significant differences (P<0.05) across the treatments. The total solids, crude protein and fat contents were high and low in ewes at their first and third parities, respectively. Ewes at fifth

parity had higher lactose content, where as lower lactose was obtained from ewes in their first parity. However higher pH and ash contents were obtained in ewes in their sixth parity. Ewes at first parity, however, had lower milk pH and ash contents. The results of this study are contrary to the findings of (24) who stated that fat, crude protein and lactose of milk decrease with increasing parity. Similarly, (25) reported that total solid, protein, fat and lactose of milk decrease at third parity, which is in disagreement with the findings of this study. (26) However reported that protein lactose, pH and ash of an animal's milk are not affected by parity.

. **Table 3: Effects of Parity on Milk Composition (%) in Yankasa sheep**

	Parity							
Parameter	1st	2nd	3rd	4th	5th	6th	SEM	LOS
Total Solid	5.68^{a}	5.45^{abc}	5.10^{c}	5.22^{bc}	5.29^{bc}	5.59^{a}	0.20	*
Lactose	4.38^{b}	4.77^{ab}	4.93^{ab}	4.92^{ab}	5.04^{a}	4.67^{ab}	0.13	*
CP	14.44^{a}	12.89^{ab}	12.59^{b}	12.87^{ab}	12.99^{ab}	14.19^{ab}	0.38	*
Fat	9.88^{a}	8.95^{bc}	8.38^{d}	8.58^{cd}	8.96^{bc}	9.51^{ab}	0.35	*
pH	7.16^{ab}	6.75^{b}	6.82^{ab}	6.73^{b}	6.94^{ab}	8.52^{a}	0.72	*
Ash	0.30^{bc}	0.27^{c}	0.29^{bc}	0.33^{b}	0.33^{b}	0.39^{a}	0.03	*

a,b,c means difference significance superscripts across rows differ significantly SEM: standard error means, LOS = level of significance difference. CP= Crude Protein.

The effect of season on milk composition of Yankasa sheep is presented in Table 4. There were significant differences ($P<0.05$) with respect to lactose, crude protein, fats and ash contents. Higher values of lactose, crude protein, fat and ash were obtained during the rainy season. Malau Aduli *et al* (2) reported that within each species of farm animals, there are significant differences in compositional values of milk between seasons. The result obtained in terms of per cent fat in this study is contrary to the reports of (28) that high level of nutrition of dairy ewes will reduce milk fat percentage. The result of this study in terms of milk fat percentage is also contrary to the report of (21) that milk from ewes that lambed in the dry season tend to have higher milk fat, but in agreement with their report on pH; that acidity of ewe milk of ewes that lambed in dry season was higher than those lambed during the rainy season. The results obtained in the present study is also in agreement with (29) that fat, protein and total solids rates in the milk increased in the rainy season mainly changes in the animal's diet. However, under feeding reduces both fat, protein and lactose contents of an animal's milk as reported by (23).

Table 4: Effects of Season on Milk Composition (%) of Yankasa sheep

Parameter	Season		SEM	LOS
	Dry	Rainy		
Total Solid	5.26	5.32	0.12	NS
Lactose	4.77[b]	4.97[a]	0.07	*
CP	11.91[b]	13.93[a]	0.13	*
Fat	7.88[b]	9.72[a]	0.12	*
pH	6.71	9.00	1.49	NS
Ash	0.25[b]	0.36[a]	0.01	*

NS = not significant at 5%, * P < 0.05, LOS = level of significance.

The correlation coefficients of milk compositional parameters are depicted in Table 5. There were many positive and significant (P<0.05) correlations between BCS and season, age and parity, pH and parity, crude protein vs season, crude protein vs BCS, fat vs season, fat vs BCS, fats vs crude protein. However, ash had significantly (P>0.05) positive correlation with season, parity, lactose, crude protein and fat. While a significantly (P>0.05) negative correlation was obtained between and total solid. BCS correlated positively with fat and protein and negatively with milk yield as similarly observed by (18). In a study carried out by (19) a positive high correlation was observed between total solids and protein of ewe's milk. Also, lower BCS has negative significant influence on the milk fat synthesis for dams having low fat depots. This is an indication of the amount of nutrition available to these animals in the former studies. However these traits can be used to select or develop a local breed with potential milk compositional parameters for improved milk production of the local stock. For instance, milk yield and fat content have been shown to be negatively correlated.

Table 5: Correlation matrix of Milk Compositional Parameters in Yankasa sheep

Parameters	1	2	3	4	5	6	7	8	9	10
1. Season	1.00									
2. BCS	0.31*	1.00								
3. Parity	0.06	0.19	1.00							
4. Age	-0.12	0.15	0.83*	1.00						
5. Total Solid	0.05	0.06	-0.08	-0.06	1.00					
6. pH	0.14	0.06	0.31*	0.18	0.17	1.00				
7. Lactose	0.25	0.13	0.20	0.05	-0.13	-0.10	1.00			
8. Crude Protein	0.83*	0.27*	0.03	-0.17	0.11	0.13	0.10	1.00		
9. Fat	0.82*	0.28*	-0.04	-0.21	0.24	0.18	0.21	0.76*	1.00	
10. Ash	0.60*	0.16	0.31*	0.11	-0.26*	0.08	0.37*	0.53*	0.42*	1.00

BCS = Body Condition Score; * = P<0.05

Conclusions and Applications

This study on milk composition of ewes characterized by small-holder farmers in Zaria:

1. Showed great variability in the values of the milk parameters investigated and attributed it to the variations in the feeding of these animals.
2. It is therefore suggested that animals, especially ewes subjected to this rearing

system be given enhanced management in terms of feeding and housing in order to achieve the purpose to which they are kept.

References

1. Osinowo, O.A (1990). Breed selection, reproduction and breed management in the local Small ruminant breeds. In: the Nigeria sheep and goat production Manual. O.A Osinowo and A.A Abatan (Eds) NAPRI, ABU, Zaria, pp 7-18.
2. Malau-Aduli, B.S., Eduvie, I.O., Lakpini, C.A.M and Malau-Aduli, A.E.O (2001). Effects of Supplementation on the milk yield of Red Sokoto does. Proceedings of the 26th Animal Conference of Nigerian Society for Animal Production, March, 2001, ABU Zaria, Nigeria, Pp 353-355.
3. Ibeawuchi, J.A and Daylop, D.M (1995). Composition and quality of fresh cow milk offered for sale in parts of Plateau State of Nigeria. *Nigerian Journal of Animal Production*, 22 (1): 81-84.
4. Zahraddeen, D (2006). Studies on reproductive performance and milk productivity of goats in Bauchi. An unpublished Ph.D. Thesis, Animal Production Programme, Abubakar Tafawa Balewa University, Bauchi, Nigeria, pp210.
5. Anon (1990). The history of dairy development in Nigeria. National Seminar on dairy Production. Hill Station, jos, 9-19th August, 1990, pp 1- 11.
6. Sanusi, M., Zahraddeen, D and Mahmood, A.J (2010). Characteristics of Small-Holder Sheep and Goat Farming in Bauchi, North Eastern Nigeria. *Animal Production Research Advances,* 6(2): 133-138.
7. Osinowo, O. A and Adu, I.F (1985). Intensive Sheep Production. National Animal Production Research Institute (NAPRI), ABU, Zaria, Nigeria.
8. Butswat, I.S., Mbap, S.T and Ayibatonye, G.A (2000). Heat tolerance of sheep in Bauchi, Nigeria. *Tropical Agriculture* (Trinidad), 77 (4): 265-268.
9. Butswat, I. S.R., Zahraddeen, D and Hussaini, A.S (2005). Prevalence of Peste des pestits ruminant (PPR) and helminthiasis in sheep and goats. Bulletin *for Animal Health and Production in Africa*, 53:131-134.
10. Adewumi. O. O (2005). Sheep milk: The most important but neglected source of protein. *Proceedings of the 10th Annual Conference of Animal Science Association of Nigeria,* University of Ado-Ekiti, Nigeria September 12-15, 2005, pp237-239.
11. Nuru, S (1990). Prospects and Challenges of viable Dairy Industry in Nigeria. In: the monthly public lecture series of the Federal Ministry of Science and Technology, 19th December, pp 16-17.
12. Pellegrini O., Remeuf F., Rivemale M and Barillet F (1997). Renneting properties of milk from individual ewes: influence of

genetic and non-genetic variables, and the relationship with physicochemical characteristics. *Journal of Dairy Researcg*, 64: 355-366.

13. ABU (2015). Ahmadu Bello University, Zaria. www.abu.edu.ng. Retrieved 9th December, 2015.
14. Gatenby, R. M (1991). *Sheep- The Tropical Agricultural* Series. Macmillan Education Limited. Pp 152.
15. Butswat, I. S. R. and Bello, M. (2002). Contributions of different livestock species as sources of meat in Bauchi. *Nigerian Journal of Animal Production*, **29** (2): 207 –216.
16. AOAC (1995). Official Methods of Analysis AOAC, 16th edition, Volume II, AOAC International Suite 500 Maryland, USA, pp 12-14. Association of Official Analytical Chemists. Official Methods of Analysis.16th Edn.,Washington, DC, 1: 600-792.
17. SPSS (2001) Statistical Package for Social Sciences. SPSS Inc., 444 Michigan Avenue, Chicago, IL60611.
18. Jílek, F., P., Pytloun, M., Kubešová, M., Štípková, J., Bouška, J., Volek, J., Frelich, J and Rajmon, R (2008). Relationships among body condition score, milk yield and reproduction in Czech Fleckvieh cows. *Czech Journal of Animal Science*, 53: 357–367.
19. Cimen, M. and Topcu, H (2013). Effect of body condition score on biochemical milk parameters having economic importance in dairy goat during the first month of postpartum period. *International Journal of Agricultural Biology*, 15: 395?397
20. Abdallah, M., Abass, S.F. and Allam, F.M (2011) Factors affecting the milk yield and composition of Rahmani and Chios sheep *International Journal of Livestock Production*, 2(3): 024-030. Available online at http://www.academicjournals.org/IJLP
21. Lateif, M.G.A., Abedsalam, M.M and Haider A.A (1989). Factors affecting the milk yield and composition of Rahmani and Barki sheep and their cross. Proc. of 3rd Egyptain British Conf. Anim. Fish and Poultry Production, Alex. Univ. Egypt
22. Hassan, H.A (1995). Effects of crossing and environmental factors on production and some constituents of milk in Ossimi and Saidi sheep and their crosses with Chios. *Small Ruminant Research*, 18: 165-172.
23. Mahony, F.O (1988). *Rural Dairy Technology*- Experiences in Ethiopia. ILCA International Livestock centre for Africa Manual No. 4
24. Mustafa, A.B., Mohamed, E.H.A., Haroun, E., Attia, K.A., Nikhala, M.A (2014). Effect of Parity On Camel Milk Composition Under traditional Pastoral And Farmed Systems In Sudan**.** *International Journal of Advances In Pharmacy,*

Biology And Chemistry. IJAPBC – Vol. 3(2),

25. Novotna, L., Kuchtíkl, J., Šustová, K., Zapletal, D and Filipčíkl, R (2009). Effects of Lactation Stage and Parity on Milk Yield, Composition and Properties of Organic Sheep Milk. *Journal of Applied Animal Research*, 36: 71-76.
26. Jemila, G. and Achenef, M (2012) Effect of Lactation Stage, Pregnancy, Parity and Age on Yield and Major Components of Raw Milk in Bred Cross Holstein Friesian Cows. *World Journal of Dairy & Food Sciences,* 7 (2): 146-149.
27. Kanwal, R., Ahmed, T and Mirza , B (2004). Comparative Analysis of Quality of Milk Collected from Buffalo, Cow, Goat and Sheep of Rawalpindi/Islamabad Region in Pakistan. *Asian Journal of Plant sciences,* 3: 300-305. DOI10.3923/ajps.2004.300.305 URL: http://scialert.net/abstract/?doi=ajps.2004.300.305.
28. Bocquier F and Caja, G (1993). Recent advances on nutrition and feeding of dairy sheep, Proceed. 5th Int. Symp. on Machine Milking of Small Ruminants, Budapest, May 14-20. *Hungarian Journal of Animal Production,* 1 (Suppl.): 580-607.
29. Nóbrega, D. B and Langoni, H (2011). Breed and season influence on milk quality parameters and in mastitis occurrence. *Pesquisa Veterinária Brasileira*, *31*(12), 1045-1052. https://dx.doi.org/10.1590/S0100-736X2011001200002