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Evaluation of raw milk quality from multipurpose cow in Jos, Nigeria

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Abstract

This study aimed to access the milk yield and quality of White Fulani and Sokoto Gudali cows in Jos North and South Local Government Areas of Plateau State Nigeria. A total of one hundred (100) respondents were interviewed and subsequently milk samples were collected for laboratory analysis, microbial quality assessment and milk composition. The results showed majority of the respondent were males of varying ages with 34% attaining secondary education. Moisture content, fat and nitrogen-free extracts were significant ($P<0.05$) between the two breeds while the other parameters were not significant ($P>0.05$). Total bacterial count (TBC) and Total coliform count (TCC) of White Fulani were higher in Jos North than south (3.8x 105 and 2.9x105) while Sokoto Gudali breeds had higher values of total bacterial counts in Jos North than Jos South. *Bacillus spp, Escherichia* and *Webseilla aerogenes* are the most dominant bacteria in White Fulani and Sokoto Gudali cows' milk. This study concludes that poor quality of cow milk results from unhygienic practices and animal husbandry at farm level which predispose famers, consumers and the public to the risk of contracting milk borne zoonotic infection and associated bacterial resistance.

Keywords: Cows; Milk quality; Yield; bacteria; Coliform count

1. Introduction

Cattle are raised as livestock for meat (beef), as dairy animal for milk and other dairy products, and as draft animals (Adegbola 1999). Cattle in the tropics especially Nigeria are bred for multipurpose (meat and milk) use and have not been specialize for milk production due to lack of organize breeding programmes (Akinsola, 2017). The breeds of cattle raised in Nigeria include: Red bororo,Wadara, Kuri, Keteku,Muturu, N'dama with Fulani and Sokoto Gudali as the most common dairy breeds of cattle (FAO, 2018). The importance of dairy products cannot be over emphasize as they are becoming increasingly important for improving human health. Exotic breeds such as Holstein Friesian, Brown Swiss, Jersey and their crosses are common in more intensive specialized dairy systems in the country. Milk is known as ideal food with unique quality for nourishment of human being long before recorded history. It is recognized as complete meal because of its wholesome nutrients for all mammals, including human beings (Hossain et al., 2010). It meets the nutritional requirement of the body more perfectly than any other single food as it carries each of the absolutely necessary nutritional components to perform physiological activities of the body system. Phersson (2000) reported that milk has around 87.8% water, 3.2% protein, 3.5% fat, 4.8% lactose, 0.7%, minerals and 100gm milk supplies around 66 kg of energy. It has been evidently established that people who derive daily energy requirement from milk and milk products were more prosperous and capable of effective governance and such community possesses the benefit of having complete freedom from many nutritional diseases (Barham et al., 2015).On the other hand, the world's poor or under developed countries or regions have an inadequate opportunity in drinking milk which results to a large number of nutritionally deficient inhabitants (Hoppe et al., 2006). However, milk is a highly perishable food because of higher moisture content with a shelf- life of normally three to five hours as well as a great growing medium for microorganism. Though, the milk is considered sterile before milking, the quality start deteriorating during handling, processing and

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storage (De, 2005). In addition, microbial contamination generally occurred from different sources and the common pathogenic microbes in milk, include *Salmonella sp*, *Listeria, monocytogenes, Yersinia enterocolitica, Campylobacter jejuni*, *Staphylococcus aureus* and *Escherichia coli* among others that are responsible for food-borne diseases (Anderson et al, 2011). Milk is made hygienic by pasteurization to destroy or inactivate all the harmful or pathologenic microorganisms by using heat treatment (De, 2005). Although at pasteurization most of the bacteria are destroyed but few heat resistant enzymes tends to remain alive and result in vital deformity of milk throughout the time of storage (Valcro et al., 2001). The objective of this study is to evaluate the quality and composition of marketed milk, milk yield of breeds and the variation of microbial counts of raw milk.

2. Material and methods

2.1. Location and climate

The research was carried out in Jos North and South Local Government areas of Plateau state. Plateau state is part of the northern Guinea savannah between longitude 8^0 20 and latitude 90 30, with an elevation of about 1, 250m above sea level and stands at a height of above 600m above the surrounding plains and average temperature of between 21^0C and 25^0C. Thought situated in the tropical zone, a higher altitude means plateau state has a near temprat6e climates with an average temperature between 18 and 22^oC. Harmattan winds cause the coldest weather from November to March. The warmest temperatures usually occur in the dry season months of April and May. The mean annual rainfall varies from 131.75 cm in the southern part to 146 cm on the upper Plateau. Agriculture is a major occupation of the people in addition to mining activities (Climate-data, 2022)

2.2. Data Collection

One hundred questionnaires were distributed using a random sampling techniques in the two Local Governments with each receiving fifty that all were retrieved. Raw milk samples from the two study areas were aseptically collected from the pooled storage containers used by the respondents visited in their households. Raw milk were coded with random numbers for identification, stored in a cool box with ice packs during field work, transported to Biochemistry and Microbiology laboratory of National Veterinary Research Institute (NVRI), Vom. They were then stored at -20^0C until required for analysis. Total coliform count (TCC) and total bacterial counts (TBC) using direct culture methods. Moisture, protein, fat yield, nitrogen free extract, lactose, calcium and phosphorus were analysed using calibrated milk analyser (Lactoscan). Primary data was done by means of administering well structured questionnaires where information on the socio-economic characteristics of milk yield and composition of the respondents were collected and secondary data obtained from the Fulani herdsmen and researchers from previous authors.

2.3. Statistical Analysis

Percentages and descriptive statistics were used for the questionnaires and One way analysis of variance (ANOVA) test used to obtain the results of the laboratory analysis. Significant differences in means were compared using Tukey test.

3. Results and discussion

3.1. Socio-economic characteristics of respondents.

The results showed that all the respondents were males (100%). It also showed that all the respondents were in their active age across the five groups (15-50years) and had obtained one form of education or the other ranging from primary (11%), secondary (34%) and tertiary (27%), while 23% had none. In the present study, the fact that majority of the respondents were males is consistent with that reported (Yitaye et al., 2007). The respondents engaged in dairy farming who were likely the youths due to resource limitations. Women were as well missing in dairy farming activities also suggesting resource limitations as men tend to have the primary decision power in Nigerian households. Belay et al. (2011) reported an average of 51.26 +10.99years for small holder dairy producers in Jimma town, Ethiopia which is higher than the ages reported in this study. The fact that majority of the respondents had higher than primary school education corroborates the earlier findings (Gillah et al., 2013).

Table 1 Socio-economic characteristics of respondents

Characteristics of respondents	Number of respondents	Percentage (%)
Sex		
Male	100	100
Female	00	-
Total		100
Age		
15-20	11	11
21-30	29	29
31-40	24	24
41-50	22	22
51 and above	14	14
Total	100	100
Education level		
None	23	23
Primary	11	11
Secondary	34	34
Tertiary	27	27
Other	5	5
Total	100	100

Source: Field survey, 2021

Table 3 Effect of breed on milk quality traits

Parameters	Sokoto Gudali	White Fulani	SEM	P.value
Milk yield				
Moisture	86.68[a]	70.03[b]	11.73	0.049*
Protein yield	4.77	5.31	0.23	0.242
Fat yield	3.96[a]	3.41[b]	0.05	0.017*
Ash	1.61	1.22	0.14	0.185
NFE	2.99[b]	14.02[a]	1.6	0.04*
Lactose	3.45	3.35	0.14	0.26
Calcium	0.33	0.27	0.02	0.168
Phosphorus	0.14	0.32	0.06	0.172

NFE- Nitrogen free extract, NS- not significant,* Significant at 5%, SEM- stand error of mean.

Table 2 shows the effect of breed on milk quality traits of white Fulani and Sokoto Gudali. Among all the parameters moisture, fat yield, nitrogen free- extracts were significant ($P<0.05$) while protein yield, ash, calcium and phosphorus were not significant ($P>0.05$).The amount of ash in the milk samples were in conformity with the findings of Hosain et al., (2011) at 0.70-0.80% but higher than those obtained by El-Magli and El-Zubair (2006) as it ranged 0.33-0.69% which might be due to feeding strategies. From this study, the percentage 3.96% in Sokoto Gudali and 3.4% in white Fulani fat content found in raw milk samples meet the recommended standards of not less than 3.25% milk fat by food and drug

administration. The values obtained for calcium and phosphorus were lower than those reported by El-magli and El-Zubair (2006) for bovine milk ranging from 10 to 14% and 12 to 21%, respectively. The variations in the estimated values might be due to breed and feeding strategies adopted by different researchers.

Breed and location effect on total bacterial and coliform count is presented in Table 3. White Fulani cows in Jos north had higher total bacterial count (3.8 x 10^6cfu/ml) than white Fulani cows in Jos south (1.8 x 105cfu/ml). Sokoto Gudali in Jos south had higher bacterial total count (3.0x10^5cfu/ml) than Sokoto Gudali in Jos north (2x10^5cfu/ml).Total coliform counts were higher among Sokoto Gudali in Jos south (3.1x 10^5) and white Fulani in Jos north (2.9 x10^5) According to Asaminew and Eyasu (2011) the overall mean total bacterial count of cow's milk produced in Bahirder Zuria and Mecha district was 7.58 log/10cfu/ml which is higher as compared to the acceptable level of 1.x10^5 bacteria/ml of raw milk (Connor, 1994) while coliform count of milk produced in the same place was 4.49 log10cfu/ml. The highest coliform count obtained in the current study 3.1 log10cfu/ml is lower than that reported by Banik et al., (2014) who found coliform count of 3.8 log10cfu/ml. Grade A milk supply must meet a standard of not more than 1x10^6 bacteria per ml and mixed milk in the plant must not contain more than 3x10^6 bacteria per ml (Fraizer and Wasthoff, 1995). Poor hygienic conditions during milking are the most noticeable reason of high microbial count. Others are contamination from dirty udder, utensils, and environment thus increasing bacterial, coliform count and acidity (CDFA, 2008). Also, unhygienic hands, milking system, use of contaminated water and equipment.

Table 3 Breed and location effect on total bacterial and coliform count

Breed/location	**Total bacterial counts (TBC) (Cfu/Ml)**	**Total coliform count (TCC) (Cfu/ml/M/)**	**SEM**	**Bacteria identified**
White Fulani Jos north	3.8 x 10^5	2.9 x 10^5	2.5 x 10^5	*Escherichia coli, klebsiella arrogances*
White Fulani Jos south	1.8 x 10^5	1.0 x 10^5	1.4 x 10^5	*Escherichia coli, bacillus spp*
Sokoto Gudali Jos south	2x 10^5	1.9 x 10^5	1.8 x 10^5	*Websiella corogenes*
Sokoto Gudali Jos south	3.1 x 10^5	3 x 10^5	3 x 10^5	*Escherichia coli*

SEM- standard error of mean

4. Conclusion

Poor making producers milk handing including the surrounding environment and treatment practices have a greater influence on the microbial contamination of raw milk and contributes to zoonotic pathogens. Consumption of raw milk and milk products made from raw milk could result into health problems. There is therefore the need to avoid the consumption of raw milk which sources are not confirm to be hygienic or treated and made wholesome for human consumption.

Recommendation

There is need for genetic improvement of our indigenous breeds to dairy animal through research for better milk yield. Mandatory assessment of milk quality as produce by small scale livestock keepers from milk borne zoonotic infection which may radiate through consumption of unsafe milk and milk products.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest.

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