EFFECTS OF BREEDS ON PROXIMATE COMPOSITION OF RAW MILK OF LOCAL COW AND SHEEP BREEDS

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Abstract

This study evaluated the effects of breeds on the proximate compositions of raw milk from cow and sheep breeds at Fulani settlement in Challawa industrial area of Kano state, Nigeria. Raw milk samples were analysed for proximate composition using a standard method. Moisture, lactose and protein contents ranged from 85.22 – 87.22%, 4.06 – 4.57% and 3.02 – 4.08% respectively, with Red bororo having significant ($p<0.05$) highest content. Total solid, ash and fat contents ranged from 12.78 – 14.78%, 0.49 – 0.68% and 3.09 – 4.89% respectively, with White Fulani having significant ($p<0.05$) highest content, while solid-not-fat ranged from 8.89 – 11.16%, with Sokoto Gudali having significant ($p<0.05$) highest content. Sheep raw milk moisture, protein and fat contents ranged from 82.36 – 84.58%, 4.18 – 5.32% and 4.36 – 5.86% respectively, with Balami having significant ($p<0.05$) highest content. Total solid, ash and solid-not-fat contents ranged from 15.42 – 17.94%, 0.86 – 1.15% and 9.56 – 13.43% respectively, with Yankasa having highest content, while lactose ranged from 3.60 – 3.70% with Uda having highest content. Based on standard requirements, the proximate content of studied cow breeds is within the range for milk composition, while that of sheep breeds is above the range. Cow breeds raw milk is therefore recommended for human consumption compared to sheep.

Key words: breeds, cow, proximate compositions, raw milk, sheep.

Introduction

In Nigeria, milk production from local breeds of cattle and sheep represents an important component of the agribusiness sector with great economic, nutritional, and social implications. Cattle, as the primary source of milk, provide more than 90% of the total animal domestic milk output [1]. However, poor nutrition [2] and low reproductive performance [3] have been highlighted as some of the major factors affecting milk production from these indigenous breeds of cattle and sheep.

Milk, a food of outstanding interest, is designed by nature to be a complete food for every young mammal [4]. According to Ramesh [5], the major components of milk are water (87.40%), milk solid (12.60%), solid-not-fat (9.00%), fat (3.60%), protein (3.40%), milk sugar or lactose (4.90%) and ash or minerals (0.70%). Studies have shown that these nutrients are distributed in milk in appropriate dietary requirements [6]. Variations in the contents can be related to animal breeds, season/weather condition during milking, locality, stage of lactation, age and size of cow, environmental and dietary composition [7]. Milk is produced in urban and rural areas mostly in non-organized way and usually supplied to the consumers in raw form [8]. Milking is usually done in the morning. After the household and calf requirements are met, the remaining milk are taken to the traditional market as fresh or sour milk, cheese, ghee and butter for human consumption. It has been shown that the quality of milk intended for consumption and processing varies subject to cattle and sheep breed [9, 10]. Hence there is a need to assess the local breeds of dairy cattle and sheep in Nigeria to ascertain the best nutritionally enriched milk. This study therefore assessed the proximate composition of raw milk from traditionally managed local cow and sheep breeds raised among Fulani rearers in Challawa industrial area, Kumbotso Local Government Area of Kano State, Nigeria.

Materials and methods

Description of the study area

The study was carried out in the Fulani settlements at Challawa Industrial area of Kumbotso Local Government area, Kano State which is located in North western Nigeria between latitude 10° 33'N and 12° 23'N and longitude7° 45'E and 9° 29'E. The annual mean rainfall is between 800 mm to 900 mm and variations about the mean values are up to ±30%. The mean annual temperature is about 26°C with two distinct seasons of rainy (April—October) and dry seasons (November—March) [11].

Herd management

All the cows and sheep used for this study were owned by pastoralists of the same herd and were reared semi-intensively in a temporary settlement in the study area. Supplementary food was uncommon. The cows were randomly selected from the experimental sites. Routine grazing was carried out twice daily (morning and evening) they were fed on natural pasture comprising mainly guinea grass and other forages. The animals were between the ages of 3-4 years.

Collection of milk samples and analysis

Conventional hand-milking was done by the Fulani herdsmen on the farm between 06.00 h and 07.30 h on daily basis. Milk samples for constituent analysis were collected in hygienic conditions of the same herd milk from each cow and sheep breeds. Raw milk samples (100 cm^3) were collected from 30 lactating cow and sheep breeds comprising 5 from White Fulani (WFC), Red Bororo (RBC) and Sokoto Gudali (SGC) cow breed, and Balami (BS), Uda (US) and Yankasa (YS) sheep breed. Samples were collected before morning grazing. Representative samples of milk obtained from each breeds were bulked separated and collected into clean, white 120 cm^3 plastic containers. Routine veterinary care was given to each cow and their nipples were also sterilized with cotton diluted with ethanol prior to milking. The samples were then transported to the laboratory in an ice-filled box for analysis.

Proximate analysis

Moisture (MC), total solid (TS) and ash contents (AC) was determined by using the method reported by Association of Analytical Chemists [12].

Lactose content analysis

Lactose content (LC) was determined by difference [13]

% Lactose =% total solids - (% fat+ % protein+ % total ash).

Determination of protein content

Protein content (PC) was determined by Kjeldahl method [14].

Determination of fat content

Gerber method was used to determine the milk fat content. The average of triplicate readings was computed and recorded.

Solids- not –fat

The solids not fat (SNF %) was determined by difference [13]. This was done by subtracting the percent fat from percent total solids.

%SNF = %TS – %fat

Statistical analysis

Values represented are the means and standard deviations for three replicates. Statistical analysis was carried out by student t-test using SPSS Version 11.0 software package (SPSS Inc., Chicago Illinois, USA) Significance difference was defined at $P < 0.05$ using Duncan's multiple range tests.

Results and discussions

Moisture content

The level of moisture content of the raw milk sample in the cow breeds were in the range of (85.22 – 87.22%). The lowest value was recorded in WFC (85.22±0.46%) and the highest value in RBC (87.22±0.18%). Moisture content of cow breeds observed in the present study is higher than (84.80 – 85.20%) [15], but lower than 87.42% [16]. Similarly significant difference ($p<0.05$) in moisture content was observed in the sheep breeds and ranged from (82.06 – 84.58%). The lowest value was recorded in YS (82.36±0.13%) and the highest in BS (84.58±0.31%). Moisture content of sheep breeds observed in the present study is lower than 91.33±0.31% [17]. However, 82.06±0.31% moisture content of YS breed in the present study is higher than 80.80% of YS [18]. Moisture content across the breeds was highest in cow breeds in RBC (87.22±0.18%) and lowest in sheep breeds in YS (82.36±0.13%). This finding is similar to the report of Etonihu and Alicho [19], who reported higher moisture content in cow compared to sheep. The variation in moisture content in the raw milk among the breeds may be due to the difference in composition of the milk of individual breeds and ruminants [20]. Moisture contents of cow breeds observed in the present study met the milk composition standard requirement of 84.00 – 88.00%, while that of sheep breeds is lower than the milk composition standard requirement of 84.00 – 88.00% [20].

Total solid content

Total solid content differed significantly ($p<0.05$) among cow and sheep breeds. Lowest value among cow breeds was recorded in RBC (12.78±0.19) and highest in WFC (14.78±0.51). Total solid content in cow breeds in the present study was higher than (12.40 – 12.50%) [21] for Bunaji and Bokoloji cow breeds. The value is also greater than the findings of [16, 22] who reported TS of 12.33%, 12.57% and 12.70% respectively. Sheep breeds total solid content ranged from 15.42 – 17.94% which was significantly ($p<0.05$) highest in YS (17.94±0.16) and

lowest in BS (15.42±0.11). Total solid across the breeds was significantly ($p<0.05$) highest in sheep breeds in YS (17.94±0.16%) and lowest in cow breeds in WFC (14.78±0.51%). Sheep milk contains higher level of total solids and major nutrients than cow milk [23] which is in consistence with the present report. Differences in nutrition and management could influence the variation of percent total solids in milk across study area [24]. The difference in total solid among the breeds might also be due to difference in moisture content as the values are negatively correlated. The range of total solid content of sheep breeds in the present study is higher than the milk composition standard requirement of 12.80– 14.50%, while that of cow breeds is close to the milk composition standard requirement of 12.80– 14.50% [20].

Ash content

No significant difference ($p<0.05$) was observed in ash content in the raw milk sample of cow breeds, but was highest in WFC (0.52±0.02%) and lowest in RBC (0.44±0.03%). Ash content for cow breeds observed in the present study is lower than 0.79 – 0.81% [21] for Bokoloji and Bunaji. Lower ash contents were reported by [23], and higher range of 0.82 - 0.90% and 1.2% [17] for white Fulani cattle. The difference could be as a result of experimental location. Raw milk of YS (1.15±0.02) had significant ($p<0.05$) highest content and lowest in BS (0.81±0.05) among the sheep breeds. The ash content for sheep breeds observed in the present study is higher than 0.75 – 0.84% for WAD, YAN and XBD [18], and 0.33±0.11% [25]. Ash content across the breeds was significantly highest in sheep breeds in YS (1.15±0.02%) and lowest in cow breeds in RBC (0.44±0.03%). The ash content of cow breeds in the present study is lower than 0.82% recommended daily intake, while that of sheep breeds is higher than 0.82% recommended daily intake [20]. Ash content is an empirical measurement of the mineral constituent of foodstuff volatile component which is very essential in nutrition [19]. Difference in ash content among and across the breeds might be due to difference in total solids as the values are positively correlated.

Lactose content

Lactose contents of the raw milk in this study were not affected ($p<0.05$) by breeds. This supports earlier observation [10]. The lactose content in cow breeds was highest in RBC (4.57±0.07) and lowest in WFC (4.06±0.09). The lactose content of cow breeds in the present study is lower than 4.53 – 4.83% [21] for Bunaji and Bokoloji, but it is within the range of 4.20 – 5.40% for red bororo and white Fulani cow breeds [29]. The content is also similar to the values

for Muturu, white Fulani and red bororo cow breeds [15]. Similarly, sheep breeds lactose content in the present study showed no significant difference ($p<0.05$) but was highest in US (3.84±0.08) and lowest in YS (3.60±0.05). The report of the present study is lower than 4.06 – 5.58% and 4.55±0.04% [16] for sheep milk. Lactose content across the breeds was significantly highest ($p<0.05$) in cow breeds with RBC (4.57±0.07%) and lowest in sheep breeds with YS (3.60±0.05 %). The disparity in values of lactose content among the breeds may be due to system of management, environment and period of study [21]. The range of 5.26 – 4.57% lactose content of cow breeds is close to the 4.45% of the milk composition standard requirement, while that of sheep breed is lower than 4.45% of the milk composition standard requirement [25].

Protein content

Protein content was significantly ($p<0.05$) affected by cow breeds and was highest in RBC (4.08±0.11), compared to SGC (3.41±0.07) and WFC (3.12±0.05). This is in conformity with the work of [21], who found significant difference in protein content among Bunaji and Bokoloji cow breeds. The protein content of cow breed in the present study was higher than 3.30±0.22% [16], but lower than (5.80 – 5.90%) [11] for white Fulani and red bororo cow breeds. The protein content for RBC and in the present report is higher than (3.54±0.24%), while WFC is lower than (3.68±0.11%) [28] for red bororo and white Fulani cow breeds. Sheep breeds protein content ranged from 4.18 – 5.32% with BS (5.32±0.01%) having significant ($p<0.05$) highest protein content and YS (4.18±0.07%) had the lowest content. The protein content of sheep breeds in the present study is higher than 3.41±0.01% [25] for sheep milk. The result of protein content across the breeds in the present study was significantly ($p<0.05$) highest in sheep breeds in BS (5.32±0.01%) and lowest in cow breeds in RBC (4.08±0.11%). Difference in protein content within and across the breeds could be attributed to breed differences as well as the metabolic activities of bacteria present in the milk [21]. Protein content of cow breeds in the present study is lower than 3.56% of the milk composition standard requirement, except for RBC (4.08±0.11%) which is higher, while sheep breeds protein content was higher than 3.56% of the milk composition standard requirement [20].

Fat content

Fat content in cow breeds ranges from 3.59 – 4.89% which was significantly highest ($p<0.05$) in WFC (4.89±0.15%) and lowest in SGC (3.59±0.09%). Fat content of cow breeds in the present

study is close to 3.60 – 4.45% [28] for Muturu, red bororo and white Fulani cow breeds, but lower than 4.60 – 4.70% [21] for Bunaji and Bokoloji cow breeds. However, the value was greater than the earlier findings [22], who reported fat content of 4.30, 3.79 and 3.86% respectively for cow milk produced in dairy farms. The range of fat content in sheep breeds was 4.36 – 6.61% with BS (5.86±0.08%) having highest value and YS (4.36±0.04%) had the lowest value. The fat content of sheep breeds in the present study is lower than 6.77 – 7.54% [18], but higher than 4.20±0.02% [25]. Fat content across the breeds was highest in sheep breeds in BS (5.86±0.08%) and lowest in cow breeds in WFC (4.89±0.15%). Protein is required for body building and repair, while fat is widely known as a source of energy. Excess content of fat could constitute to health risk [27]. The proportion of fat and protein in milk are determined primarily by the genetic make-up of the lactating animals, though they can be changed by nutrition and methods that adjust digestive and metabolic process [18]. Fat contents of cow breeds is within the range of fat for milk composition standard requirement of (3.50 – 5.00%), while that of sheep breeds is higher than the range of fat for milk composition standard requirement of (3.50 – 5.00%) [20].

Solid-not-fat

Solid-not-fat differed significantly ($p<0.05$) among cow and sheep breeds. Among cow breeds SNF was significantly ($p<0.05$) highest in SGC (11.16±0.11) and lowest in RBC (8.89±0.09). SNF content of cow breeds in the present study is higher than 8.63 – 8.87 [26] for Muturu and White Fulani, and 9.02 – 9.40% [20] for Sahiwal-Friesian crossbred cow. Sheep breeds had significant highest ($p<0.05$) SNF content in YS (13.43±0.18) and lowest in BS (9.56±0.09). The SNF content across the breeds was highest in sheep breeds in YS (13.43±0.18%) and lowest in cow breeds in WFC (8.89±0.09%). The difference in SNF content of raw milk could be due to difference in the feeding practices, season, milking method and lactation period exerted [30]. The SNF contents of cow and sheep breeds are higher than the range of SNF for milk composition standard requirement of 8.50 – 9.50% [20].

Conclusion

The results of this study demonstrated that raw milk from Red bororo cow breeds contained higher moisture, lactose and protein and lower fat compared to other breeds, and it was within

the milk composition standard requirement. While Balami sheep breed contained higher moisture, fat and protein compared to other breeds, but was above the milk composition standard requirement. In general breeds had effects on some proximate composition of the raw milk of cow and sheep. Red bororo cow and Balami sheep had a higher proximate composition as these local breeds appeared to be better dairy ruminants than other breeds from this present study.

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