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Comparative Proximate and Minerals (Calcium and Phosphorus) Analysis of Milk from Different Breeds of Cow (Red Bororo, Friensian, White Fulani and Crossed Breed) in Sokoto

Yusuf Musa
Department of Science Laboratory Technology (Biochemistry Unit), Adamawa State Polytechnic, Yola, Nigeria

* Corresponding Author: **Yusuf Musa**

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Abstract
This research work was performed to investigate the proximate composition/ constituents of four dairy cow milk. Moisture, ash, crude protein, crude lipid Lactose, calcium and phosphorous of samples were carefully analyzed.
All constituents with the exception of ash were found to have no significant difference when the individual results were compared using ANOVA (least significance difference).
The Moisture content analyzed (Red Bororo 83.00 ± 1.000, Friensian 82.67 ± 1.5811, White Fulani 81.67 ± 1.5811 and Cross Breed 81.33 ± 1.5280) shows no significant differences among the different breeds of cow under investigation while the results of their crude protein analyzed (Red Bororo 5.9 ± 0.4062, Friensian 5.7 ± 0.4527, White Fulani 5.8 ± 0.36205 and Cross Breed 6.4 ± 0.2645) shows that cross breed between Friesian and White Fulani has higher amount of crude protein and hence can serve as a very good source of dietary protein which is a source of essential amino acids.
The minerals quantitatively determined Calcium was found to be insignificance (Red Bororo 0.067 ± 0.0251, Friensian 0.047 ± 0.0212, White Fulani 0.05 ± 0.0200 and Cross Breed 0.06 ± 0.0100) and phoshosphorus (Red Bororo 8.2 ± 0.100, Friensian 8.1 7 ± 0.2549, White Fulani 7.73 ± 0.2236 and Cross Breed 8.30 ± 0.2645) was found to be significant between White Fulani and other breeds.
The ash content which was found to be significant, therefore indicates a variation in the inorganic constituents of the various breed of cow milk.

Keywords: proximate composition, dairy cow milk, moisture content, crude protein, crude lipid

Introduction

The need to provide food is crucial because it plays a very important role biologically in human and animal population, this begins early in life (infancy via breast feeding) which serve in providing the essential chemical constituents that are necessary for growth and maintenance of life.

Man has evolved in close contact with nature, and the first food nature provided for man was milk, it is the most unique and ideal class of food for nursing mammals, because it provides all of the nutrients that a neonate needs It's long been thought of as evolution's perfect feast; it also contains a wealth of defensive managers, enzymes, and development hormones

Cow milk is a comprehensive diet that meets the nutritional requirements of the body Specifically, it contains proteins, lactose, lipids, phosphate, calcium, and vitamins (Gasmalla, M. *et al*., 2017) [9].

It has a lot of calcium and the amino acid lysine, which is frequently absent from plant proteins. The minerals are dominated by calcium and phosphorus, which facilitate the body's absorption of the mineral (Khaskheli, M. *et al*., 2005) [14].

Milk is often characterized as a colloidal solution comprising emulsified fat globules, a diverse family of major and minor proteins, the carbohydrate lactose, minerals, vitamins, and enzymes.

While the classifications of components in milk from most species are similar, there are significant qualitative and quantitative variations across species (i.e. the amount of each constituent per litre) (F. B. Ahtesh, 2018) [3].
Different cow breeds have been chosen based on their intended purpose (milk or meat) and environmental factors (such as climate, diet, and topography), resulting in a broad range in milk composition (Harinder, *et tal.*, 2019) [10]. However, during the past 50 years, vigorous selection of cow breeds has significantly decreased this kind of diversity. The variations in milk composition that occur throughout a cow's lactation cycle are extensively documented (Teja *et tal.*,2020) [22].
Colostrum, the first breast secretion following parturition, has a higher protein content, especially serum protein. This high protein level is mainly due to high levels of immunoglobulin.
The health of the cow has a great impact on milk availability and quality.
The milk proteins contain more essential amino acids than any other natural food, thus it is primarily the protein content of milk that allows one to say that "milk is nature's most nearly perfect food" (Foley *et al*; 1972) [8]. Milk is a complex mixture of fat, proteins and other constituents dispersed in water, it is one of the oldest food known to man (Nickerson, 1999) [18]. Cow milk is widely used for the commercial production of milk products and hence helps in the provision of essential chemical components required for growth. milk was found similar in chemical composition and apparent biological value (ABV) to the milk of humans, this is a pointer to the nutritional contribution of cow milk in a country like Nigeria where the preceding undernourishment are accompanied by low intake of some nutrients among the populace especially the vulnerable (pregnant, lactating mothers, infants).
The constituents of milk are water, proteins (mostly casein), carbohydrate (principally Lactose), lipid (fats), mineral (calcium, phosphorus, sodium etc) and vitamins (Satyanarayana *et al*, 2006 and McDonald *et al*; 1991) [20, 16].
All or most of the major milk constituents are synthesized in the mammary gland from various precursors which have selectively filtering actions on certain proteins, minerals, vitamins which are not elaborated by it but are simply transferred directly from the blood to the milk (McDonald *et al*'., 1991) [16].
The exogenous supply of proteins in the diet of human is required because of their biological significance. Protein is the principal constituent of organs, tissues and continuous dietary supply is required for growth, repair of tissues, production of alternative source of energy (in the absence of glucose and lipid) when the total intake is low. Some proteins have catalytic activity and function as enzymes, others serve as signal receptors or transporters that carry specific substances into or out of cells. Proteins are perhaps the most versatile of all biomolecules, they are complex organic compounds of high molecular weight made-up of amino acids (David *et al*., 2004) [7].

Milk Proteins

About 95 percent of the nitrogen in milk is present as protein, the remainder being present in substances such as urea, creatine and ammonia, which filter from the blood into the milk. In this respect milk functions as an alternative excretory outlet to urine (McDonald *et al*; 1991) [16]. There are two types of proteins in milk, they are the casein and whey or serum proteins. The casein is the major protein focus in milk, in cow milk there are five of these alpha S_1, alpha S_2, casein Kappa casein and gamma casein. Casein is a phosphor protein meaning that a phosphate group is attached to the side chains of their amino acid.
Amino acids are absorbed by the mammary gland in quantities sufficient to account for the protein synthesized within it. Considerable Inter conversion of amino acids occurs before synthesis. And certain amino acids are important as sources of others, thus ornithine which does not appear in milk protein, is absorbed a lid retained in large quantities by the mammary gland and has been shown to be a precursor of protein, glutamate and aspartate. Synthesis of the carbohydrate moieties of the proteins takes place in the mammary gland as does phosphorylation of serine and threonine before their incorporation into the caseins (McDonald *et al*., 1991) [16].
Casein constitutes about 80 percent of the protein in milk, it is insoluble in water but soluble in base and strong acid solution because like all proteins, it has both acid and basic properties and can therefore form soluble salt with both.
The whey or serum proteins are much less abundant the caseins, they include, ß-lactoglobulin, α-lactalbumin, immunoglobulin.

Carbohydrate in Milk

With the exception of traces of glucose and galactose, lactose (milk sugar) is the only carbohydrate found in milk, lactose occurs only as a product of the mammary gland, it is not as soluble as sucrose and is less sweet, compacting only a faint sweet to milk. Lactose consist of one molecule of glucose joined to one molecule of galactose in a β-(1→4) Linkage.

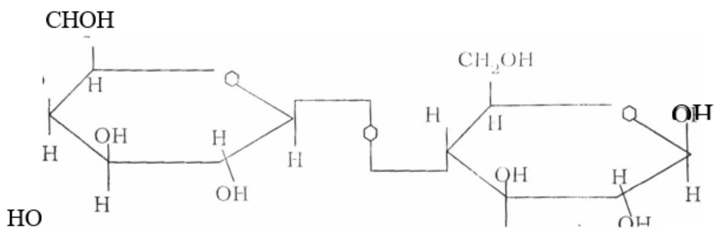

Fig 1: Showing biochemical structure of milk sugar (Lactose (Mc Donald; 1991)

The exclusiveness of lactose in mammalian milk strongly suggests a specific function, a review of literature shows that calcium absorption is enhanced by the presence of lactose (Steven *et al*., 2002) [21] and may play a part in the prevention of rickets. It is metabolized in the infant's body to galactose, a constituent of membrane lipid (galactolipid) such as cerebroside, which is needed for the development of the central nervous system.

Milk Fat

Milk fat is a mixture of triglycerides, saturated acids with four to twenty carbon atoms, and a range of unsaturated fatty acids in addition there is small amounts of the more unsaturated linoleic and linolenic acids. The amounts of the fatty acid present vary with species.

All the acids of milk fat originate in the product of digestion, but not all do so directly, some come from endogenous acetate and fatty acids after storage in the body. Milk fat yield is influenced by the balance of fat synthesis and mobilization. This is under hormonal control but depends upon the balance of glucogenic substances in (he products of digestion, thus a high proportion of propionate, glucose and amino acids stimulate fat deposition in adipose tissue and a reduced supply of fat precursors to the mammary gland (McDonald *et al*., 1991) [16].

Milk fat are oxidized to provide energy for perpetuation of biological processes, they also serve as vehicles upon which fat soluble vitamins (Vitamin A, D, E, K) are carried. The main constituents of milk fat are broken down to monoglycerides and diglycerides, it has been shown that free fatty acid are important sources of energy for young mammals. (Adams *et al*., 1995) [1].

Minerals

Inorganic element of milk may be divided conveniently into two groups. The first comprises the major elements calcium, phosphorus, sodium, potassium, magnesium and chlorine. The second group, are the trace constituents; these include metals such as Aluminium and Tin, the metalloids Boron, Silicon, and the halogens Fluorine, Bromine, and Iodine.

Such substances are present in very small amounts, and their presence in milk is coincidental with their presence in blood; nevertheless, they may have an important bearing on the nutritive value of milk and on the health and well-being of the sucking animal.

The inorganic constituents of milk are rarely absorbed directly from the blood by the mammary gland, which shows considerable selectivity; the gland is able to block the entry of some elements such as selenium and fluorine while allowing the passage of others such as zinc and molybdenum. This selectivity may be a considerable disadvantage when it acts against elements whose presence at increased levels in the milk may be desirable. Copper and iron, for example are both elements important in haemoglobin formation and therefore for the nutrition of the young animal.

Vitamins

Vitamins are another class of food found in milk, vitamins are not synthesized in the mammary gland and those present in milk are absorbed from the blood.

Milk has considerable vitamin A potency owing to the presence of both vitamins A and B- Carotene, the amounts of vitamin C. and D present are very small, while vitamins E and K occur only as traces. There is a large range of B- vitamins ill milk, including thinking, riboflavin, nicotinic acid, biotin, pantothenic acid (McDonald *et al*., 1991) [16].

Vitamin A is necessary for proper growth, reproduction, maintenance of epithelial cells and vision, therefore the deficiency of this vitamin may result to night blindness and in extreme cases (severe deficiency) xerothalmia. The B-vitamins in milk are necessary for growth, prevention of beriberi and some function as coenzymes (Satyanarayana *et al*., 2006) [20].

Material and Method

Samples Collection

Four types of cow (mammalian) milk were used in this work, the cow milks were obtained from Sidi Mamman Tsalha Asarkawa (S.M.T.A) farm and in Runjin Sambo in Sokoto, State Nigeria.

The breed names of the cow were Friesian, White Fulani, Red Bororo and Cross Breed between Friesian and White Fulani. The samples were collected fresh and determinations were carried immediately.

Table 1: Equipment's/ Instruments

S/n	Equipment	Specification	Manufacturer
1	Weighing balance	N Pc440	Mettler, Switzerland
2	Spectrophotometer	sp 2900	Pye-unicam
3	Oven		Lee Nottingham, UK.
4	Muffle furnace		Gallenkamp, UK.
5	Round bottom flask	250 ml 100	Pyrex glass, England
6	Volumetric flask	ml 100 ml	Pyrex glass, England
7	Burette	250m1	Pyrex glass, England
8	Reflux flask		Pyrex glass, England

Table 2: Chemicals

S/n	Chemicals	Grade	Manufacturer
1	Concentrated HCI	Analar	BDH Chemical Pooled England
2	98% Concentrated H_2SO_4	Analar	BDH Chemical Pooled England.
3.	Ammonium molybdate	Analar	Hopkins and William
4	3 ml. 10 % Sodium tungstate	Analar	Chemical Pooled England
5.	25 ml Boric acid	GPR	Hopkins and William
6.	10ml 60% Sodium Hydroxide	Analar	BDH Chemical Pooled England.
7.	5 ml 0.33 M Sulphuric acid	Analar	BDH Chemical Pooled England
8.	Petroleum ether	Analar	BDH Chemical Pooled England.
9.	Copper (Il) Sulphate	Harries Reagent	Shenstone, England
10	Potassium hydroxide	Analar	BDH Chemical Pooled England

Reagents Preparation

The reagents used in this experiment were prepared as follows:

Kjeldahl catalyst: - I .0g of cupric sulphate was mixed with a special Kjeldahtable in kjeldahl flask.

60% (w/ v) Sodium Hydroxide, NaOH: - 60g of sodium hydroxide pellets were dissolved in 100ml of distilled water.

- 0.5N sodium hydroxide: - 2g of sodium hydroxide pelletes were dissolved in 100ml of distilled water.
- Boric acid indicator: - 2.5g of boric acid dissolved in 250ml of distilled water, this is 1% (w/ v) boric acid.
- 0. 1% (w/ v) alcoholic methyl red: - 0. lg of methyl red was dissolved in 100ml ethanol, the solution was then mixed with some drops of solution prepared above. The resulting mixture was boric acid indicator.
- 10% sodium tungstate: - 10g of sodium tungstate pellete was dissolved in 100ml distilled water.

Methods

Determination of Moisture Content

A food might have a different level of moisture content depending on the storage factors, variety, method of analysis. The moisture content refers to the percentage loss in weight which results from drying a known weight of food at 105 ^{0}C to constant weight.

Principle

This is based on heating the sample to Eliminate all the water content in it, this is achieved by placing the same in an oven at 105 ^{0}C for 24 hours, however, the amount (quantity) of sample used would determine the time of drying. High temperature is not needed to avoid decomposition of some organic compounds.

Procedure (Oven Drying Method)

Clean dry crucibles (empty) were obtained weighed (W_1) 2gram of no of the samples each was then placed into the empty crucibles and weighed (w_2) the crucibles and contents were then placed in hot air oven at 105^{0}c for 6hrs. The crucibles were then placed dissicator, the crucibles would be cooled in a dissicator and weighed (w_3).

The above process was repeated drying until a constant value was obtained out of which the percentage moisture was then calculated using the following formular

Calculation:

$$\%Moisture = \frac{\text{loss of weight due to drying}}{\text{Weight of sample (g)}} \text{ X } 100$$

$$\frac{W_2 - W_3}{W_2 - W_1} \text{ x } 100$$

Determination of Ash Content

The ash content of biological material is an analytical term which refers to the inorganic residues left after the organic matter has been burnt this is a measure of the total mineral content.

Principle

When foodstuffs are ashed in a muffle furnace at a high temperature of 600 ^{0}c for 3hours, all the organic matter in the sample would be burned, leaving the inorganic substances in the form of ash.

Procedure (Furnance Method)

Here the samples were oven dried, the oven dried samples were then used for this analysis. A clean crucible was ignited in a hot furnace for 1 minute at 80 ^{0}c, cooled in dessicator, and weighed (W_1). 2g of the samples were placed into the crucibles and weighed (W_2), crucibles containing the samples would be heated in a muffle furnace at 600 ^{0}C for 3 hours to burn all the organic matter. The heating was stopped and the crucibles removed from the furnace and allowed to cool in a dessicator, the crucibles were then re-weighed with the residue (ash).

Calculation

$$\% Ash = \frac{\text{weight of ash}}{\text{Weight of sample (g)}} \text{ X } 100$$

$$\frac{W_2 - W_3}{W_2 - W_1} \text{ x } 100$$

Crude Protein Determination

Most of food nitrogen is present as protein, and it is convenient_ and almost universal for the nitrogen requirement of animals and the nitrogen status of foods to be stated in terms of protein. Chemically the protein of a food is calculated from its nitrogen content, determined by micro Kjeldahl techniques.

Principle

The Kjeldahl digestion involves oxidation of organic matter with concentrated H_2S04 which converts all forms of nitrogen to ammonium sulphate, subsequent addition of excess amount of sodium hydroxide (60%) would neutralize the acid and reduce the ammonia which is distilled into boric acid solution and treated against 0.01 N H_2SO_4 to end point. By titration with standard acid, the percentage of crude protein is calculated.

Reagent / Apparatus

Reagents

20ml concentrated H_2S0_4,10g K_2S0_4, 0.5 $CUSO_4$, 10ml boric acid, 20ml of 4N NaOH, 0.01 N H_2S0_4.

Apparatus

Kjeldahl flask, conical flask, beaker.

Procedure (Micro Kjeldalh Method)

The procedure involved three step, these are as followed; Digestion 0.5g of a sample each of cow milk's were weighed, transferred into dried clean 100ml kjeldalh flask containing tablet of selenium catalyst, 20ml of concentrated H_2S04 was added to accelerate the oxidation of organic matter. 1.0g of K_2S0_4 was used to enhance the speed and completeness of reaction process 0.5g of $CuS0_4$ was added to raise the boiling point so that the oxidation proceeds without excessive loss of acid. The flask was then heated in a fume cupboard until a clear solution was obtained .When the digest get cleared it is an indication that carbon had been oxidized and the reduction of nitrogen to NH_4SO_4 must had been completed. The content was cooled and transferred into a conical flask for distillation.

Distillation

The digested material was diluted to 50ml with distilled water, 10ml of aliquot was taken in a receiver distillation flask and 20ml of 4N NaOH was added to extract ammonia out of the samples which would then be evaporated into boric acid indicator in a receiver distillation flask, the ammonia liberated into boric acid was then heated until the volume made up to 40mls of the conical flask. The colour of the solution would change from reddish brown to green.

Titration

The collected samples with ammonia was titrated against 0.01N H_2S0_4 to end point, this would gave the actual amount of protein content in the samples, the colour change from green to dark red and the titre value was noted.

Calculation

The percentage nitrogen can be calculated using the following formula

$$\%Nitrogen = \frac{Tv\ X\ NA\ X\ 0.014\ X\ 50}{Weight\ of\ sample\ (g) x\ ml\ of\ aliquot} \text{ x } 100$$

% crude protein = % nitrogen x 6.25

Where

T_V= Titre value

N_A = normality of the acid

50 = volume of acid or dilution factor.

Determination of Crude Lipid

Lipids are a group of energy including nutrients which comprise of fats and oil, fats at room temperature are solid while oils are liquid above that temperature. All the substances contained lipid are usually insoluble in water, soluble in organic solvent. It provides more energy than carbohydrate and protein lg of fat provide about 9kcal which is equivalent to 377 KJ.

Apparatus/ Reagent

Apparatus

Condenser -soxhlet extraction unit, dessicator, balance, dry porous thimble, water bath, filter paper, cotton wool, hot air drying oven.

Reagent

Petroleum ether (40 — 60 ^{0}C boiling point)

Principle

The non-polar components of the food sample will easily be extracted into organic solvent, the continuous extraction of fat content with suitable solvent (petroleum ether) would dissolves it easily. It has a low boiling point and highly volatile when treated temperature (40-6^{0}C) in a flask fixed to soxhlet apparatus using reflux condenser.

Procedure (Soxhlet Extraction Method)

About 2g each of samples were accurately weighed and placed into the thimbles which has been dried and weighed (W_1), the thimbles and sample were weighed (w2) a clean dry extraction flasks (250ml) were oven-dried at 105-110^{0}C cooled in a dessicator and weighed (W_3), the mouth of the porous thimbles were covered with clean cotton wool, 200ml each of petroleum ether were added into the dried 250ml extraction flasks, the covered porous thimbles were placed into condenser (soxhlet extraction unit) the apparatus were assemble, this quos then heated for about 4-5hrs.

The porous thimbles were removed with care and the petroleum ether in the top container tube were collected, the extraction flask were removed from the water bath when it was almost free of petroleum ether.

The extraction flask containing the oils were oven dried at 105^0 C for an hour, the content were cooled in a dessicator and weighed (W_4).

Calculation

$$\% \text{ Fat} = \frac{W_4 - W_3}{W_2 - W_1} \text{ x } 100$$

Where

W_1 = weight of empty porous thimble

W_2 = weight of sample and empty porous thimble

W_3= weight of empty flask

W_4 = weight of extraction flask with oil

Preparation of Sample Stock Solution

The ash residue was dissolved using 5ml hydrochloric acid and was heated carefully to dryness at low temperature over a hot plate, hydrochloric acid was then added and heating was continued until the solution boiled..

The contents were then cooled and filtered in io a volumetric flask, the flask was then filled up to the mark wit distilled water, this was the sample stock solution.

Determination of Calcium (Titrimetric Method)

1ml of diluted samples each were diluted with 19ml of distilled water to make it 20ml, 1ml of 10% NaOH. 3 drop solution, 3 drop potassium cyanide solution, 3 drop hydroxylamine hydrochloride, 3 drop triethanolamine and a tip of murexide indicator were added. The solution was shaken and the colour of solution changes from colourless to pink solution it was then titrated against EDTA to the end point at which the colour changed to purple, concentration of calcium can be calculated using the following formula.

Calculation

$$\%Nitrogen = \frac{Tv\ X\ NA}{ml\ of\ aliquot} \text{ x } 100$$

Where

Tv = Titre value

N_A = Normality of EDTA

Determination of Phosphorus (Spectrophotometry Method)

2ml of the stock solution each were into 50ml volumetric flask, 2ml of phosphorus extraction solution and 2ml of ammonium molybdate each were added into the volumetric flask distilled water were added. 1ml of stannous chloride solution were added blue colour was develop, distilled water were added to make it to the mark. The colour intensity were measured spectrophotometrically at 660mm.

Calculation

$$\text{Phosphorous mg/l} = \frac{Absorbance \times CF \times DF_1 \times DF_2}{Atomic\ weight\ of\ phosphorus}$$

Where CF = conversion factor 0.61 DF_1 first dilution factor

=25 DF_2 second dilution factor = 25.

Determination of Lactose (Titration Method)

About 10ml of milk was introduced in to a I volumetric flask, 3ml of sodium tungstate (10 w/ v), and 5ml of KOH (0.5N) were added and the volume made to the mark with distilled water. The mixture was shaken and filtered using 12.5cm What man filter paper.

3g of sodium carbonate and 25ml of benedicts solution were put into a 100ml conical flask, the mixture was boiled few pieces of porcelain were added to reduced bumping. 5ml of Sulphuric acid (0.33N) was added, few drops of starch indicator were then added. The milk filtrate were titrated against boiling solution at time will the formation white precipitate the blue colour gradually disappeared after running the milk filtrate in the solution, the disappearance of the last trace of blue colour was obtained on running in more of the milk filtrate to the boiling mixture at a time the end point were recorded.

Calculation

25ml benedict's solution = 67mg of lactose weight of lactose in

$$10\text{ml milk} = \frac{number\ of\ time\ milk\ was\ dilute}{Volume\ required\ for\ titration} \times \frac{67 \times 100}{1000}$$

Results and Discussion

Results

The determinations of the major constituents of milks were carried out as explained earlier and the results were recorded below:

Table 3: Showing Proximate Composition of Cow Milk, in percentage.

Parameter	Red Bororo	Friesian	White Fulani	Cross breed
Moisture %	83.00 ± 0.1000a	82.33 ± 1.5811a	81.67 ± 1.5811a	81.33 ± 1.5280a
Ash Content %	0.73 ± 0.0100a	0.81 ± 0.0200b	0.90 ± 0.0100c	0.97 ± 0.0300d
Crude Protein %	5.9 ± 0.4062a	5.7 ± 0.4527a	5.8 ± 0.3605a	6.4 ± 0.2645a
Lipid Content %	6.17 ± 0.9082a	5.96 ± 0.2121a	6.23 ± 0.1581a	6.8 ± 0.6244a
Lactose %	4.2 ± 0.2549a	5.2 ± 0.3082a	5.4 ± 0.1000a	4.5 ± 0.8803a

Values are presented in mean + standard deviation. Same letters means there is no any significant difference between the individual samples results. While different letters means is a significance difference between the individual results when compared with least significant difference (LSD) at 5%.

Table 4: Showing the amount of Calcium and Phosphorus in the four samples of milk.

Breeds of Cow	Calcium %	Phosphorus mg/l
Red Bororo	0.067 ± 0.0251 a	8.2 ± 0.100a
Friesian	0.047 ± 0.0212a	8.1 7 ± 0.2549a
White Fulani	0.05 ± 0.0200a	7.73 ± 0.2236b
Cross Breed	0.06 ± 0.0100a	8.30 ± 0.2645a

Values are presented in mean + standard deviation. Same letters means there is no any significant difference between the individual samples results, while different letters means there is a significance difference between the individual results when compared with least significant difference (LSD) at 5%.

The variation in milk composition and milk yield within a species depends on so many factors; some of these factors are genetics, stage of lactation, type of diet, age, udder health and season. Nutrition can be regarded as one of the most important source of variation in the yield and composition of milk, but climatic conditions and seasonal variation and regional differences can also play an important role (Adams *et al*., 1995) [1].

3.2. Discussion

Moisture (Water): water is the most abundant substance in living systems, making up 70% or more of the weight of organism (David *et al*., 2004) [7]. life and water are inextricably connected, it serves as a medium in which most cells are constantly bathed and the major components of cells themselves, not only do most biochemical reactions occur in water, but water itself participates in biochemical reactions (Jain *et al*., 2004). The results of moisture analysis are shown in table 3.1, it can be seen that the red Bororo has the highest amount (%) of water 83.00 ± 1.0000 followed by Friesian 82.33 ± 1.5811 while white Fulani and cross breed between Friesian and White Fulani 81.67 ± 1.5811 and 81.33 ± 1.5280 respectively. These results were not in agreement with those reported by Ahmed and El-Zubeir (2007) [2] 87.42 ± 1.13.

Ash: The ash content of biological material is an analytical term which refers to the inorganic residues left after samples were, oven dried, the ash content is a measure of the total mineral content of the food substance in question. Table 3.1 showed the ash content of the four samples after analysis it can be deduced from the table that the cross breed between Friesian and White Fulani has the highest ash content of 0.97 ± 0.03 followed by white Fulani with 0.90 these results (0.97 ± 0.03 and 0.90 ± 0.01) were found to be higher than that reported by Bosworth 0.71% it should be noted however that the two remaining ash were found to be almost the same with the results reported by Bosworth.

Crude protein: proteins are the most abundant biological macromolecules occurring in all cells (David *et al*, 2004) [7]. Dietary proteins are the major sources of nutritionally essential amino acids, review of literature has shown that milk proteins are very rich in essential amino acids. Determination of percentage protein (crude protein) therefore might not be an index of how rich ill the supply of essential amino acids the four types of milk arc this can only be ascertained after the amino acid determination (analysis) of the four types of milk is carried out. As a working assumption however, because milk proteins are animal proteins, it will be accepted that the crude protein content is directly proportional to the extent to which the milk can supply essential amino acids. The results of crude protein analysis are shown in table 3.1 it can be seen that Cross breed between Friesian and White Fulani has the highest crude protein of 6.4 ± 0.2645 followed by Red Bororo with of 5.9 ± 0.4062 and the crude protein content of White Fulani and Friesian were found to be 5.8 ± 0.3605 and 5.7±0.4527. These results are higher than the reported by Bosworth 3.58%.

Lipids: Lipids are also a class of biomolecules in milk, milk fat is highly digestible and review of literature has shown that it contains considerable amount of essential fatty acids and has been shown that free fatty acids are the most important source energy for young animals.

The results of the crude lipid analysis are shown in table 3.1 it can also be seen that Cross breed between Friesian and White Fulani has the highest lipid content of 6.8 ± 0.6244 while White Fulani, Red Bororo and Friesian have the crude lipids of 6.23 ± 0.1581, 6.17 ± 0.9082 and 5.96 ± 0.2121 respectively.

The fat content during the present research experiment was higher than the value reported by Pape-Zambito *et al.*, (2007) [19].

Lactose: carbohydrates are energy giving compounds, and the main carbohydrate found in milk is lactose (milk sugar) which is a dissacharide (Jeremy *et al.*, 2002) [13].

The results of lactose determination are shown in table 3.1 from this table it can be seen that the White Fulani has the highest amount of milk sugar of 5.4 1000g% followed by Friesian which has 5.2 ± 0.3082 while Red Bororo and Cross breed between Friesian and While Fulani has lactose of 4.2 ± 0.2549g% and 4.5 ± 0.8803g% respectively. Two of the results (4.5±0.8803 and 4.2 ± 0.2549) were found to be lower while the remaining two results (5.4± 0.1000 and 5.2±0.382) were found to be higher than that reported by Bosworth and 4.96%.

The White Fulani and Friesian are good source of milk sugar considering the amount of lactose in them.

Minerals: calcium is the most abundant the minerals in the body it is required for the development of strong bone and teeth and it is required also in several reactions in the cascade of blood clotting process (Satyanarayana *et al.*, 2006) [20].

The results of calcium in the samples were shown ill table 3.2 from this table it can be seen that red bororo has the highest percentage of calcium of 0.067% ± 0.0251 followed by Friesian 0.047% ± 0.02121 while White Fulani and cross breed between Friesian and white Fulani has 0.05% + 0.0200 and 0.06% + 0.0100 respectively. Because red Bororo has the highest amount of calcium one can conclude that red bororo is the best source of calcium among the four samples.

Phosphorus also forms the essential component of several nucleotides, coenzyme e.g. NAD^+, AMP (Satyanarayana el al, 2006) [20].

Results of phosphorus determination were shown in table 3.2 and it can be noticed from this table that cross breed between Friesian and white Fulani has the highest amount of phosphorous of 8.301mg/l ± 0.2645 followed by red bororo with the value of 0.1000mg/l while Friesian and while Fulani has 8.17± 0.2549mg/l and 7.73 ± 0.2236mg/1. From these results it can be seen that cross breed between Friesian and white Fulani can be a good source of phosphorus and red bororo too than the other samples.

Conclusion

In conclusion, from the study conducted the major constituents of milk were found to have no significant difference from one another when compared with the different breeds of cow however, the ash content which is a measure of mineral content was found to vary with the breed of the cow' and hence only the ash content was found to be different in the constituents of milk study.

Recommendations for Further Research

For proper and better interpretation of results, the following are suggested for further investigation:

1. The high water activity, moderate pH (6.4- 6.6) and ample supply of nutrients make milk an excellent medium microbial growth there is need to study this class of organism and their effect.
2. Milk is a rich source of minerals and vitamins further research should be done to determine other quantitatively other minerals and vitamins contents since it was found that there is a significant difference in their ash contents.
3. Milk contain all the essential amino acid required for growth, hence there is need to determine the amount of these amino acids found in milk.

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