Original Research Article

COMPARATIVE ANALYSIS OF BREAST MILK AND COMMERCIAL INFANT MILK

ABSTRACT

The aim of this study is the comparative analysis of breast milk and commercial infant milk sold in Aguata LGA. Breast milk and four infant milk (SME GOLD, Peak milk, MY BOY and Lactogen) were purchased from different sellers within Aguata metropolies .The proximate analysis were determined using standard AOAC method. The results of this study showed that the milk contained the following nutrients : in terms of moisture content, breast milk contain 11.40% ,Peak milk 22.40%, Lactogen milk 11.60, My boy milk 17.40% and SME Gold milk 19.20% .Fat content were breast 12.50% ,Peak milk 13.50, Lactogen milk 20.10, My boy milk 21.00% and SME Gold milk 12.80% . Crude fiber were breast milk 27.60% ,Peak milk 32.00% , Lactogen milk 31.00% ,My boy milk 30.00% and SME Gold milk 33.00% ,Ash content were breast milk 22.20% ,Peak milk 30.00%, Lactogen milk 40.00% ,My boy milk 43.00% and SME Gold milk 34.00% ,Protein content were breast milk 0.29% ,Peak milk 0.29% ,Lactogen milk 0.28% ,My boy milk 0.31% and SME Gold milk 0.29% .Carbohydrate content were breast milk 22.00% ,Peak milk 2.00%, Lactogen milk 16.91%, My boy milk 6.99% and SME Gold milk 0.70% .The Breast milk is the best nutrition for infant growth and development ,and is also rich in antibodies that provide the first source of adaptive immunity in a newborn's intestinal tract .For healthy newborns whose mothers are unable to provide sufficient breast milk ,the current option of choice is infant formula.

Keywords: Breastmilk, Commercial milk, proximate, Vitamins analysis.

Comment [a1]: Please check the punctuations of this abstract again

Comment [a2]: Please mention the state and country.

Comment [a3]: Please check these stated results again, they are so wrong and not in accordance with the results given in the body of the article

Introduction

Mothers' own milk is considered to be the best source of infant nutrition (Lessen and Kavanagh, 2015). Extensive evidence has shown that breast milk contains a variety of bioactive agents that modify the function of the gastrointestinal tract and the immune system, as well as in brain development. Thus, breast milk is widely recognized as a biological fluid required for optimal infant growth and development. Recently, studies have further suggested that breast milk mitigates infant programming of late metabolic diseases, particularly protecting against obesity and type 2 diabetes (Weseler *et al.*, 2018).

Comment [a4]: Please provide a reference

Breastfeeding is universal and the most appropriate form of nourishing the infants for the first 6 months postpartum. When breastfeeding is not possible, alternate sources of nutrients are required. Human milk is markedly different from cows' milk, both in terms of macronutrients and micronutrients (Savino *et al.*, 2013). Cow milk contains high concentrations of proteins and minerals which impedes digestion. In addition, cow milk lacks the iron, vitamin C and some fats important for growing babies. For this reason, cow milk should not be used as the main drink before 12 months of age, although small volumes may be added to complementary foods (Del Prado *et al.*, 2011).

Commercial infant formulas are commonly used either as baby diet supplements or as complete breast milk substitutes. The infant milk substitutes should be properly formulated so that nutritional requirements for optimal growth are met adequately. Most infant formulas are made with cow milk which has been altered to resemble human milk. The other types of formulas are soy-based and protein hydrolysate formulas. Milk substitute from plant sources does not contain all the nutrients in a healthy balance for infants (Stevens *et al.*, 2019).

The physicochemical characteristics such as refractive index, surface tension, pH, conductivity, viscosity and titratable acidity are important parameters in studying quality and nutritional aspects of milk and milk products, because the physical and rheological properties strongly depend on chemical composition. The aim of this work was to investigate and compare the physicochemical parameters of breast milk and infant milk.

1.2 Statement of the Problem

Comment [a5]: This subheading is not necessary, summarize this part under "introduction"

Infant formular manufacturers have made changes to formulas in order to match either human milk composition or breastfeeding performance (Zhang et al., 2013). The term "breastfeeding performance" is used because, with the exception of one study of preterm infants all other studies comparing human milk with formulas involved breastfeeding—not providing human milk from a bottle. Several factors may contribute to change, its physical and chemical properties of liquid milk which reduce its nutritional value, shelf life and thus its commercial value (Weseler *et al.*, 2018).

To our knowledge, not many studies on the chemical composition of various kinds of milk market in Nigeria have been reported. Therefore, in the present study, we investigated various physical parameters and chemical components of commercially available liquid milk samples. We also compared the findings with the reported data from various regions of the world and with World Health Organization (WHO) standards.

1.3 Aims of the Study

In view of the nutritional benefits of breast milk, the aim of this study is to determine and compare the nutritional composition of breast milk and Nigeria made infant milksold in Nigeria.

The specific aims is to:

- Assess the nutritional composition of breast milk and infant milk sold in Nigeria in terms of its moisture, fat, crude fibre, protein and carbohydrate content.
- To assess the mineral composition of breast milk and infant milk sold in Nigeria in terms of calcium, magnesium, sodium, potassium and phosphorus.

1.4 Significance of study

- The research will bring to light the magnitude of the significance of breast milk and infant milk products as a healthy and nutritious food that is capable of minimizing if not to eliminate the rising disease and malnutrition problems of our society in recent times.
- The result of nutritional composition of milk obtain from this study will provide useful information for agriculturists, industry and health agencies in both the private and public sector in making decision bordering on production and processing, health, and nutrition development.
- The result of nutritional composition of milk obtain from this study will also serve as a manual for marketers who may wish to promote the development of a niche market for milk and its products.
- Finally, this study will reveal that a better view and focus on the intensification of milk production and subsequent promotion, will not only help improve the food crop sub-sector but also help boost the livestock and poultry sectors' which are currently faced with huge demand deficits of milk meal and the resulting high protein demand deficit facing the nation as a whole.

MATERIALS AND METHODS

3.1 Apparatus

Dessicator -A laboratory desiccators is around shaped closed vessel made of heavy glass which is a common laboratory glassware item and has multiple uses, such as :Storage of standards under dry environment .Storage of materials for weighing to constant weight .Prolonged storage of hygroscopic materials.

Comment [a6]: These sections are completely irrelevant, please summarize these section in a paragraph. Meanwhile, the subsection "Aim of the study is a repetition of the aim stated under "introduction"

Please read on how to section a scientific research article. The subsections "Introduction" "statement of the problem" "Aim of the study" "specific aim" and significance of study" should be summarize under a section known as "Introduction"

Comment [a7]: Where is "3.1" coming from? Please discard all the section numbering

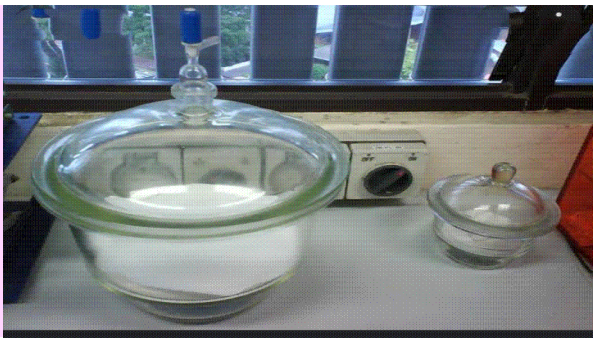

Fig. 1 Dessicator

Muffle furnace : Muffle furnaces isolate the samples from the fuel and the combustion to eliminate contamination of the samples .they are durable ,reliable ,and work well for extensive use, muffle furnaces are ideal for research and development ,materials testing and quality control ,heat treatment ,ceramics glass and so much more.

Fig.2 : Muffle furnace

Kjeldahl flask : Kjeldahl flasks are round bottom flasks with long wide necks that are used in Kjeldahl method for quantitative determination of sample nitrogen content. Kjeldahl flasks are typically

manufactured from borosilicate glass, which is resist antto heat and chemicals.

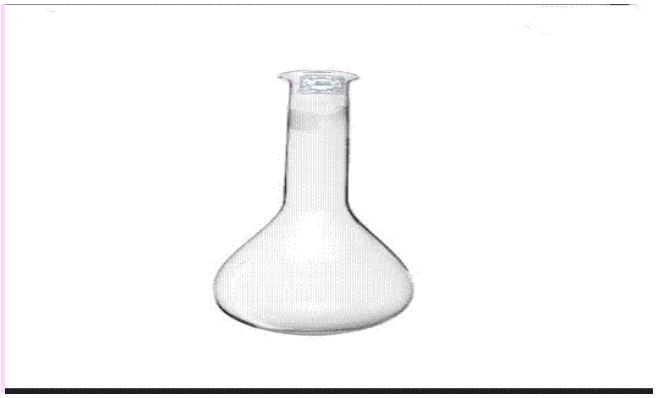

Fig.3 : Kjeldahl flask

Funnel : Laboratory funnels are used to channel liquids or fine-grained chemicals (powders) into lab ware with a narrow neck or opening .Often they are made of plastic such as polypropylene .Reusable products can be sterilized in an autoclave.

Soxhlet apparatus : A soxhlet extractor is a laboratory apparatus for the extraction of lipids and other molecules from a solid sample. A soxhlet extraction apparatus is composed of a condenser ,a soxhlet extractor ,and round bottomed flask.

Filter paper – Filter paper is a semi-permeable paper membrane that is use for the separation of solid particles from liquids or gases.

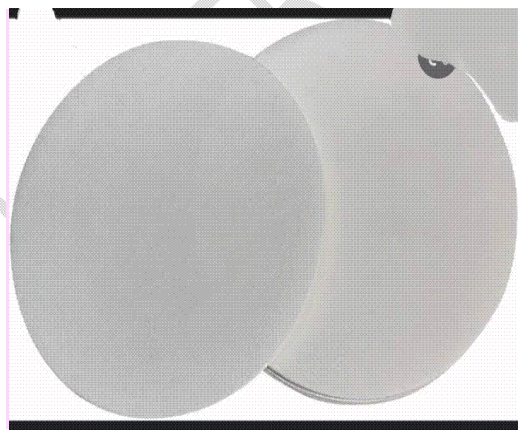

Fig.4 : Filter paper

Thimble - Extraction thimbles are often used for solid material to extract certain substances with a solvent .They are often used in air and exhaust gas analysis for separation of solid particle.

Electric oven: also referred to as laboratory furnaces ,are used to sterilize biohazard waste, dissecting instruments or media/ reagents for aseptic assays They are also used for drying ,heating ,testing environmental stresses ,such as changes in temperature ,light and humidity.

fig. 5: Electric oven

Grinder - Grinders are used to grind or homogenize rigid ,soft ,wet ,dry ,flexible ,fragile ,and fibrous samples .A variety of mill types can be used to produce coarse ,mid-range ,and fine results ,down to the nanometer scale.

Retort stand - also called a clamp stand ,a ring stand ,or a support stand ,is a piece of scientific equipment intended to support other pieces of equipment and glassware—for instance ,burettes ,test tubes and flasks.

Test tube -widely used by chemists to handle chemicals ,especially for qualitative experiments and assays.

Crucible -used to burn ,melt or mix solid chemical compounds over a burner .It can hold all kinds of substances ,materials and fluid.

Fig.6 : Crucible

Weighing balance -is an instrument that is used to determine the weight or mass of an object.

Fig.7: Weighing balance

Petri dish -is ash allow cylindrical , round glass that is used in laboratories to culture different microorganisms and cells.

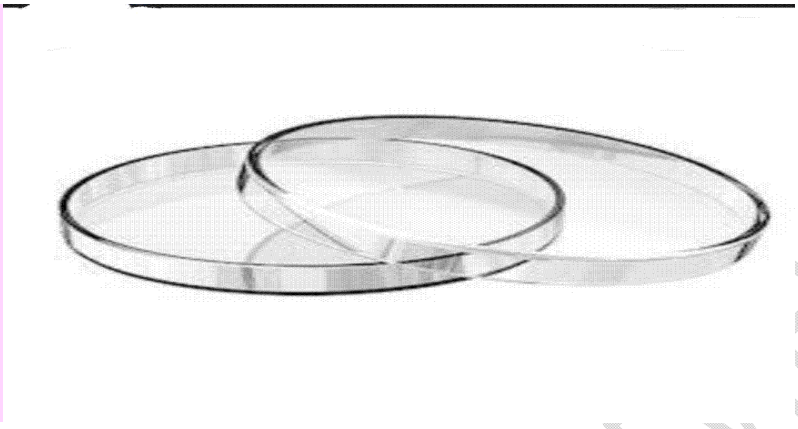

Fig. 8: Petri dish

Comment [a8]: Please discard all the explanation and diagrams of the apparatus, they are highly irrelevant, you can kindly just list out the apparatus

3.2 Reagents

- Tetraoxo-sulphate (vi) acid
- Boric acid indicator solution,
- Sodium hydroxide
- Hydrochloric acid,
- Petroleum ether,
- Potassium hydroxide,
- Phenolphthalein indicator,

Comment [a9]: Make this listing continuous with commas and not this way, same as above

3.3 Sampling

The Nigerian made liquid milk used in the study were-

A = Breast milk 1 (Age of infant 4 months).= Breast milk 2 (Environmental exposure: exposure to early morning sun which gives vitamin D).=Breast milk 3 (foremilk enriched with carbohydrates for baby thirst).=Breast milk 4(Maternal diet enriched with minerals)

Comment [a10]: How was the breast milk obtained?

B = Peak milk

C= Lactogen milk

D = My boy sample

E = SME Gold milk

3.4 Sample Treatment

Prior to analysis, the liquid milk samples (breast, Peak milk, Lactogen milk, Myboy milk and SME Goldmilk) were properly labeled A, B, C, D and E and 500ml from each tin were poured into a 500ml beaker. The 500ml of each sample was used for the proximate analysis

3.5 Standard solution

All the solution used were prepared from analytical grade chemical using AOAC, 2002 standard procedure.

3.6 Procedure

3.6.1 Moisture content determination

The AOAC (2002) method no. 945.38 will be used. 5g of the sample will be weigh into clean, dry and pre weighed crucibles. The crucibles and their contents will be dry in the moisture extraction oven at 110^0C for 4 hours. The samples will be cool in desiccators and reweighed. The samples will be dried in the oven until a constant weight is obtained.

Comment [a11]: Will be or was used?

$$\% \text{ Moisture content} = \frac{\text{Initial weight} - \text{weight of oven sample} \times 100}{\text{Initial weight of sample}}$$

3.6.2 Crude fat determination

Method no. 920.39A (AOAC, 2002) will be used. 5g of the air dried ground sample will be weighed into a filter paper, wrapped carefully and put in the sample holder of the soxhlet extraction apparatus. A clean dry and weighed soxhlet extraction flask will be half filled with N-hexane and the whole apparatus will be assembled together, and the flask placed on the heating mantle and heated at 60^0C.

Comment [a12]: Not in the reference section

The fat was extracted for three hours. Then, the sample holder will be disconnected and the extraction flask removed. The percentage fat contained will be determined thus:

$$\% \text{ Crude fat} = \frac{\text{weight of flask + oil} - \text{weight of empty flask X100}}{\text{Initial weight of sample}}$$

3.6.3 Crude fiber determination

Method No. 942.05 (AOAC, 2002) will be used. 2g of defatted sample will be weighed into 250 ml beaker containing 200 ml of 0.125M tetraoxosulphateiv acid (Sulphuric acid). The mixture will be heated in a steam bath at 70^0C for 2 hours, and then allowed to cool. The cooled mixture will be filtered using a muslin cloth over a Buckner funnel. The residue will be washed three times with hot water to remove the

acid and then put in a beaker containing 200 ml of potassium hydroxide. The mixture will be heated as before over a steam bath for 2 hours. The solution will be filtered and the residue washed three times with hot water. The final residue obtained will be put in clean preweighed crucible and dried at 120^0C to a constant weight. The crucible with the dry sample will be put in a muffle furnace and ashed at 550^0C for 30 minutes such that the sample became ash white. Percentage fibre will be calculated as followed:

% Crude fibre =

$$\frac{\text{weight of oven dried sample – weight of ash X 100}}{\text{Initial weight of sample}}$$

3.6.4 Crude protein determination

Method no. 955.04C called the Kjeldahl method will be used (AOAC, 2002). This method will be divided into three namely, digestion, distillation and titration.

Digestion: Approximately 0.1g of ground sample will be weighed into clean dried Kjeldahl flask for digestion, and 0.1g copper tetraoxosulphate iv crystals, 0.5g sodium tetraoxosulphate iv crystal and 25ml of concentrated H2SO4 acid will be added into the flask and some glass beads will be added into the flask content as anti-bumping agents. The Kjeldahl flask and its content will be transferred to the digesting chamber in a fume cupboard and digested. Digestion continued with constant rotation of the digestion flask until the sample changed colour (that is from black to light blue). The digestion flask will be remove from the digesting chamber and allow cooling. The digest was made up to 100ml using distilled water and shaken vigorously to a homogenous solution.

Distillation: Out of the homogenous solution of the digest, 20ml will be transferred into a distillation flask using a pipette. Then 20ml of 40% sodium hydroxide solution will be added carefully down the side of the flask through a funnel.

Then 50ml of 2% boric acid solution will be pipetted into a receiving flask and two drops of methyl red indicator added. The distillation unit will be fitted such that the condenser is connected to the receiving flask with a glass tube, and the condenser cooled with constant supply of cold water from tap. Also, the tip of the glass tube will be immersed in the boric acid. The distillation unit is heated on a heating mantle for 35 minutes until the pink solution of the boric acid turned blue and the volume increased to about 100ml by the distillate.

Titration: Ten millilitres of the distillate will be titrated against 0.1N hydrochloric acid to a colourless end point. A blank solution will also be titrated to get any trace of nitrogen in the blank. All the titre volumes were recorded. The percentage crude protein will be calculated as follows:

%Crude protein = % Nitrogen X 6.25

3.6.5 Ash content determination

The AOAC (2002) method No 942.05 will be used. Clean dried crucibles will be weighed on an electronic balance and 5g of sample weighed into the crucibles. The samples will be dry in the oven until constant weights are obtained.

Then, the samples will be transferred into the muffle furnace with a pair of tongs and ashed at 550^0C 4 hours until ash was obtained. The sample will be removed from the furnace and cooled in desiccators, and reweighed. The percentage ash will be calculated as followed:

$$\% \text{ Ash Content: } \frac{\text{Weight of Ash X } 100}{\text{Weight of sample (after oven drying)}}$$

3.6.6 Carbohydrate content determination

The carbohydrate content of the sample will be obtained by difference, that is, as the difference between the total summations of percentage moisture, fat, fibre, protein, ash and 100

% Carbohydrate= 100 – (% moisture + % fat + % protein + % fibre + % ash).

Procedure for mineral element analysis

3.3.1 Digestion of sample

The mineral contents of the test samples will be determined by the dry ashextraction method following each specific mineral element as described by AOAC (2005). Twenty (20) grams of the samples will be burnt to ash (as in ash determination and the resulting ash will be dissolved in 100ml of dilute hydrochloric acid (1MHCL) and then diluted to 100ml volumetric flask using distilled water. The solution will be used for the various analysis of mineral.

Calcium Determination:

Calcium contents of the test sample will be determined by the EDTA complex isometric titration. Twenty (20) ml of each extract will be dispersed into a conical flask and panels of the masking agents, hydroxytannin, hydrochlorate, and potassium cyanide will be added followed by 20ml of ammonia buffer (pH 10.0). A pinch of the indicator-Ferrochrome black will be added and the mixture will be shaken very well. It will be titrated against 0.02N EDTA solution. The calcium contents will be calculated using the formulae below.

$$\textbf{Calcium (mg/100g)} = \frac{(Tv \times 0.4008 \times 1000)}{\text{Vol of sample used}}$$

3.3.3 Determination of Magnesium Exactly 10ml of the sample filtrate will be pipetted into 250ml conical flask after which 25ml of ammonia buffer solution will be added into the conical flask and will be properly mixed. Then a pinch of Erichrome black T indicator will be added and titrated with 0.02N of EDTA until the colour of the solution change.

Magnessium (mg/100g) = (Tv x 0.2432 x 1000)

Vol of sample used

3.3.4 Determination of Potassium (K)

The concentrations of potassium (ppm) will be analysed using UV- spectrophotometer at a wavelength of 766.5 nm, and the concentration in mg/100 g will be calculated using the following equation:

Potassium (**mg/100g**)=Concentration (ppm) x Dilution factor X 1000
Wt of Sample

Comment [a13]: Please report these section as past events, "will be" should be "was" or "were" as the case may be. And all citation like AOAC should be at the reference section.

3.3.5 Determination of Sodium (Na)

The concentrations of chromium (ppm) was analysed using atomic absorption spectrophotometer at a wavelength of 243nm and the concentration in mg/100 g was calculated using the following equation:

Sodium (**mg/100g**)=Concentration (ppm) x Dilution factor x 1000
Wt.of Sample

Determination of Phosphorus (P)

A 20 ml sample solution was put in a 100 ml volumetric flask. The solution was neutralized with ammonia and nitric acid solution (1:2). Twenty (20) ml of vanadate molybdate reagent was added and diluted to the mark. It was allowed to stand for ten minutes and absorbance read at 470nm in the ultra violet region and the mineral concentration in mg/100 g was calculated using the following equation:

Phosphorus (**mg/100g**)=Concentration (ppm) x Dilution factor x 100
Wt.of Sample

Table 1 : PROXIMATE COMPOSITION (%)

Comment [a14]: A section titled "results" should be added before presenting the results

SAMPLE	MOISTURE	ASH	FIBER	PROTEIN	FATS	CARBOHYDRATE
Breast milk1	51.40	7.50	0.60	22.2	0.29	18.01
Breast milk 2	62.00	4.70	0.33	18.02	0.17	14.78
Breast milk 3	53.10	6.80	0.45	20.27	0. 90	18.48
Breast milk 4	55.60	6.00	0.53	19.82	0.36	17.69

Peak	12.40	5.50	1.52	15.00	0.29	55.29
Lactogen	11.60	5.10	1.81	15.70	0.28	55.51
My boy	11.40	5.11	1.00	18.00	0.31	64.18
SME Gold	11.20	5.80	1.30	19.50	0.29	61.91

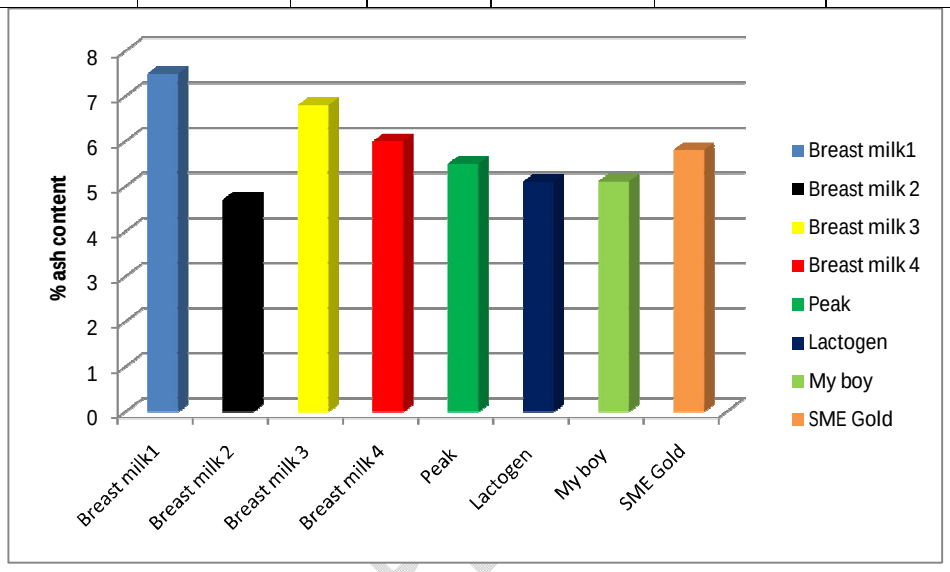

Fig.9 ASH content in different milk

Comment [a15]: The result figures are too much and irrelevant since the tables already show a summary of the results. But as a suggestion, tables of the same result can be merge into a single figure, so the number of result figures won't be more than 4 or the figures should be removed totally.

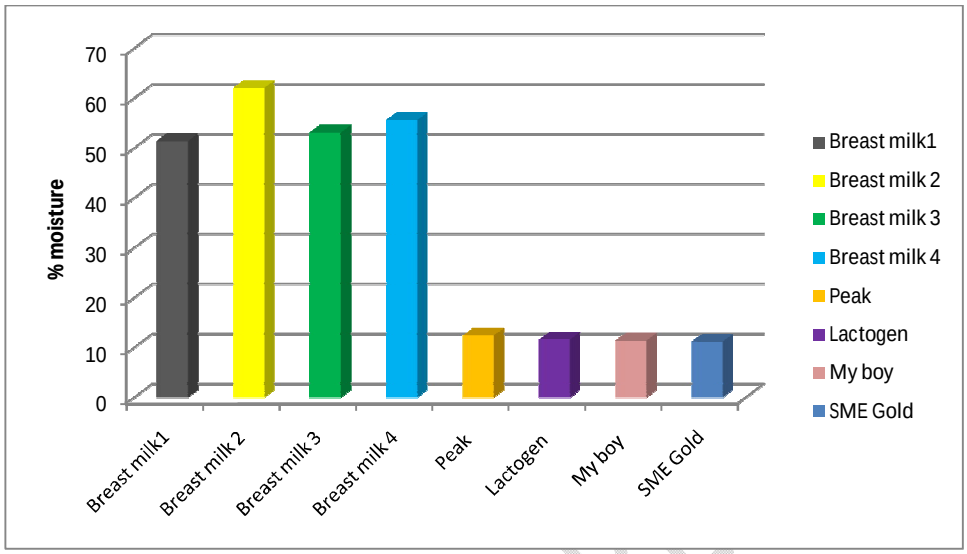

Fig.10 Moisture content in different milk

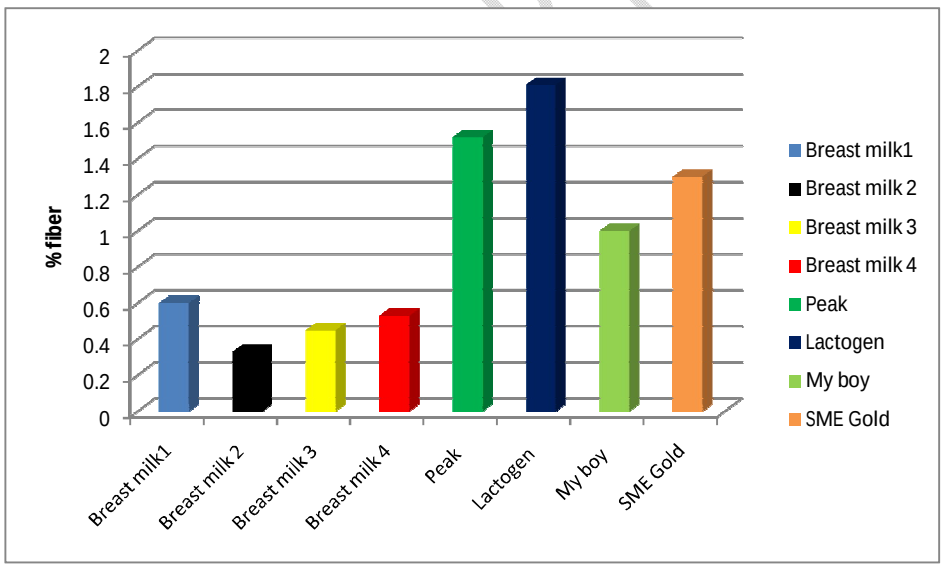

Fig.11 Fibre content in different milk

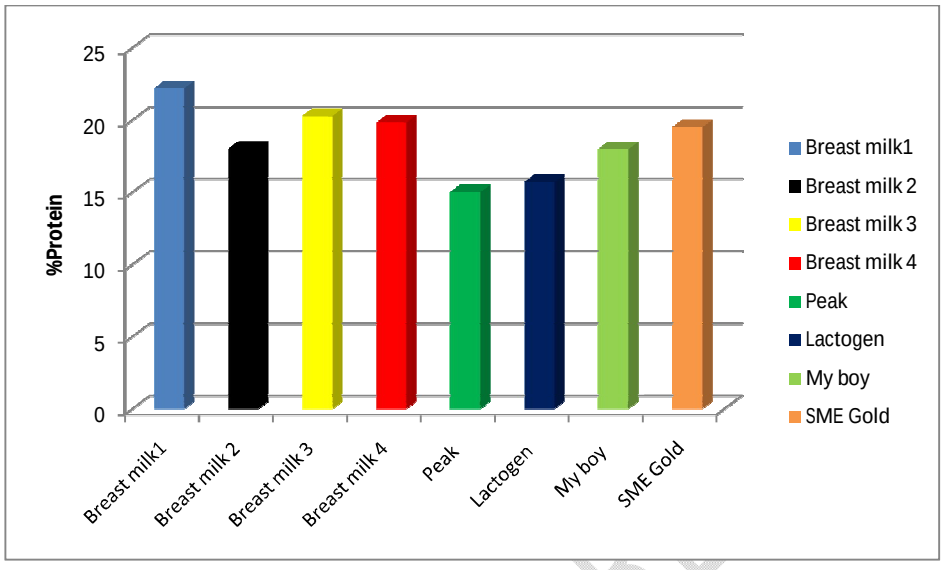

Fig.12 Protein content in different milk

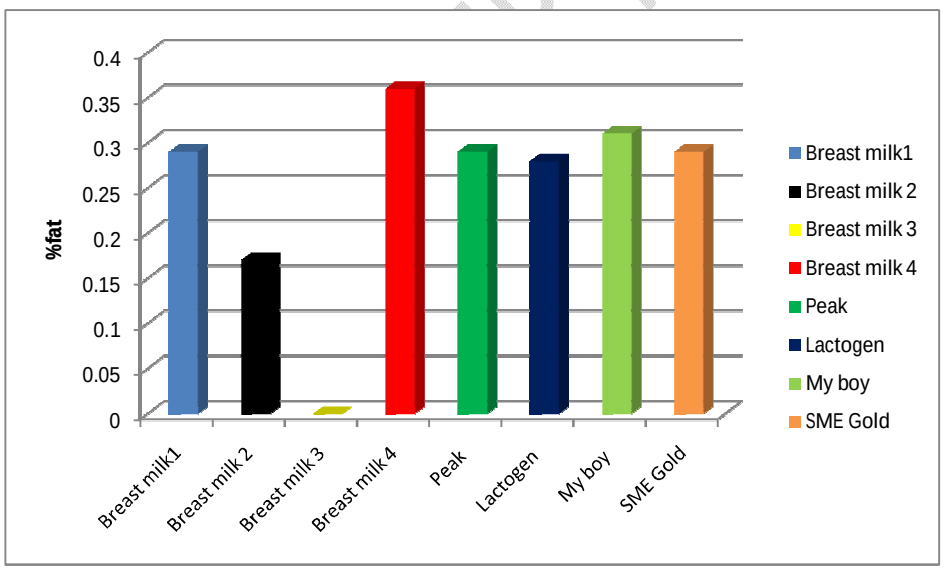

Fig.13 Fat content in different milk

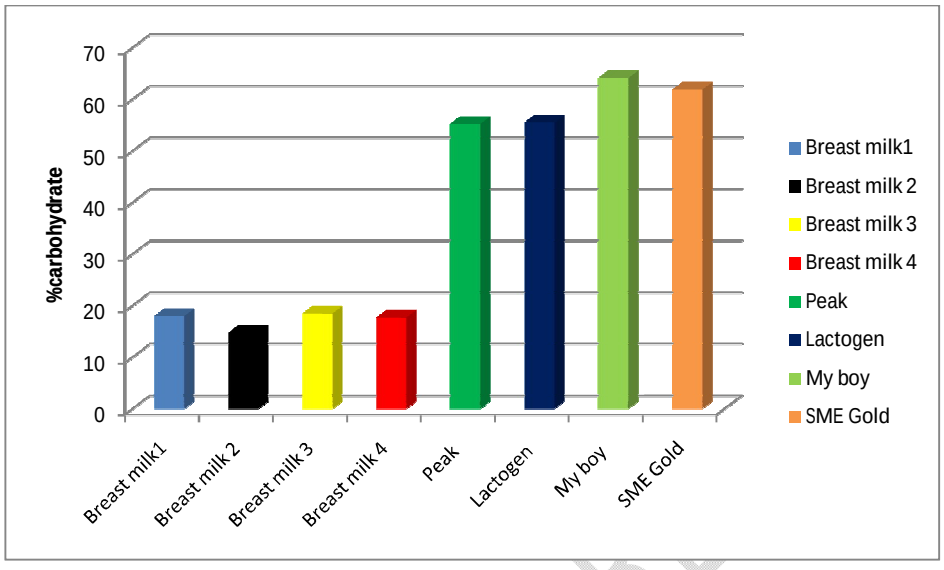

Fig.14 Carbohydrate content in different milk

Table 2 : MINERAL COMPOSITION (Mg/100g)

SAMPLE	CALCIUM	IRON	MAGNESSIUM	PHOSPHORUS	ZINC
Breast milk 1	25.90	7.50	9.53	16.00	6.45
Breast milk 2	29.00	8.00	9.50	16.10	6.03
Breast milk 3	21.80	8.10	9.00	15.30	4.15
Breast milk 4	27.50	7.30	10.31	19.03	7.05
Peak	9.90	1.17	10.44	3.11	4.16
Lactogen	11.70	6.30	10.78	1.83	3.33
My boy	12.60	2.88	9.90	1.88	4.50
SME Gold	15.50	6.30	11.30	1.95	2.80

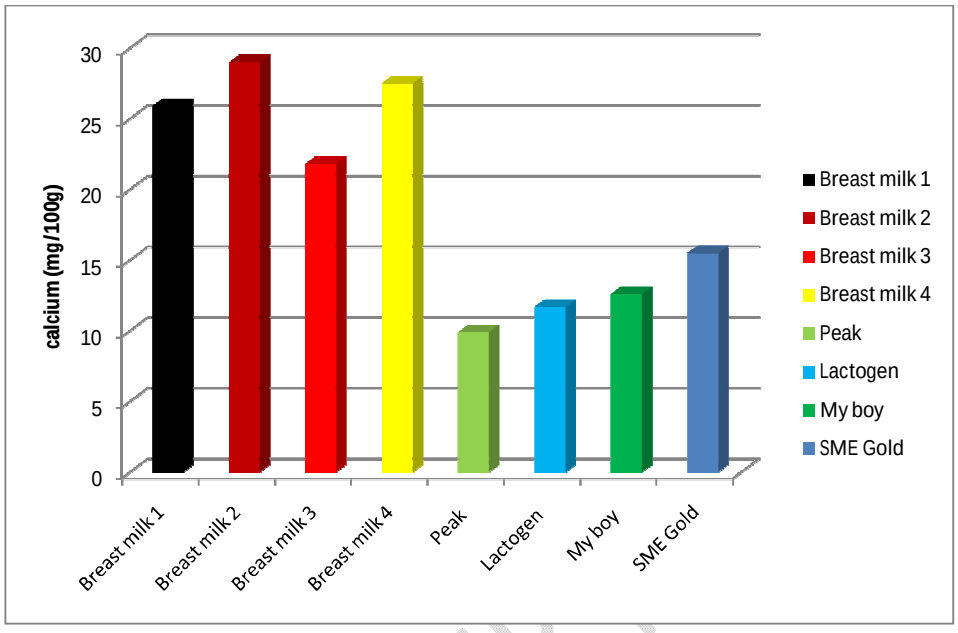

Fig.15 Calcium content in different milk

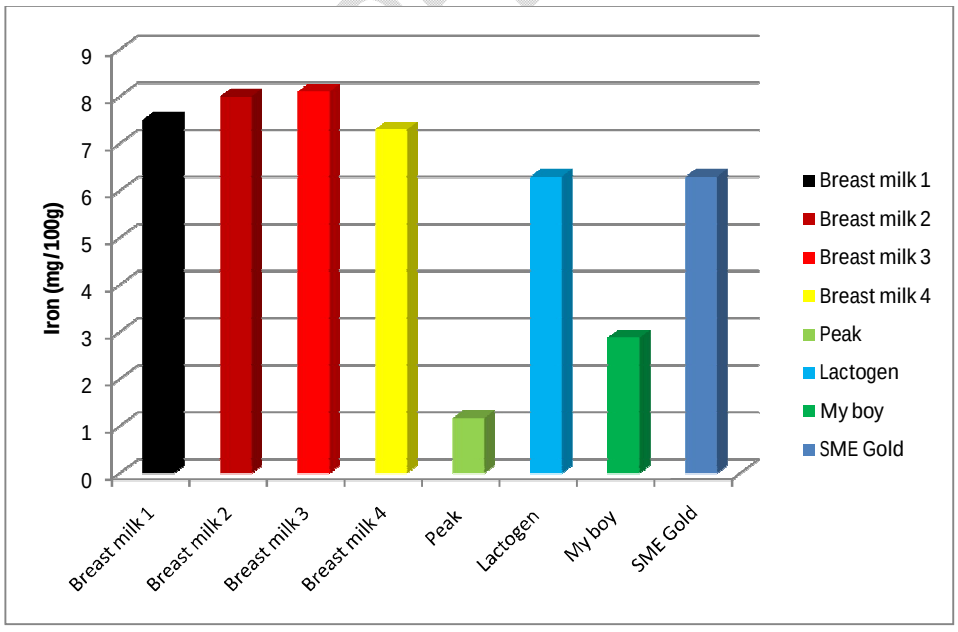

Fig.16 Iron content in different milk

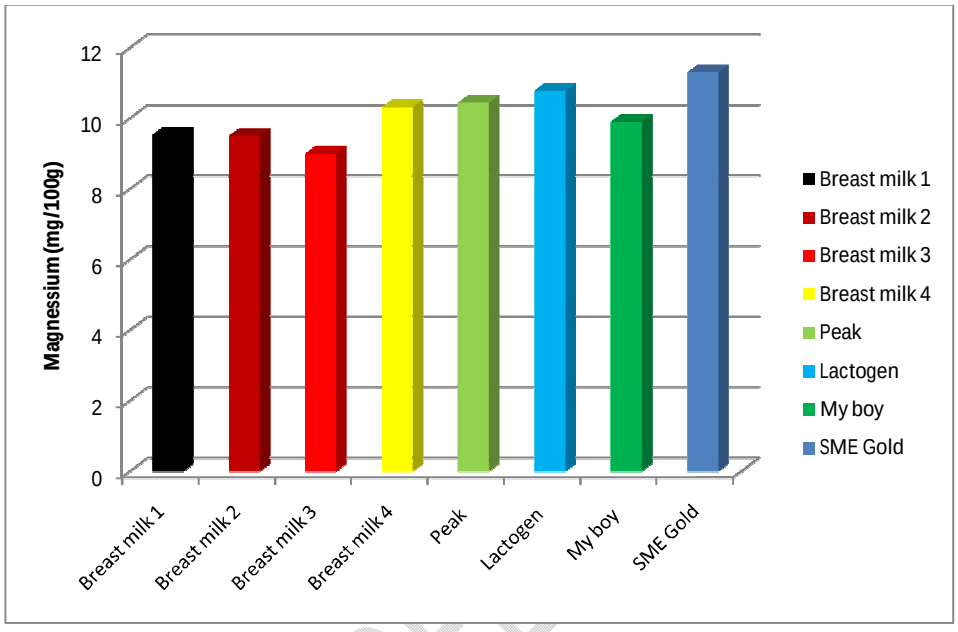

Fig.17 Magnesium content in different milk

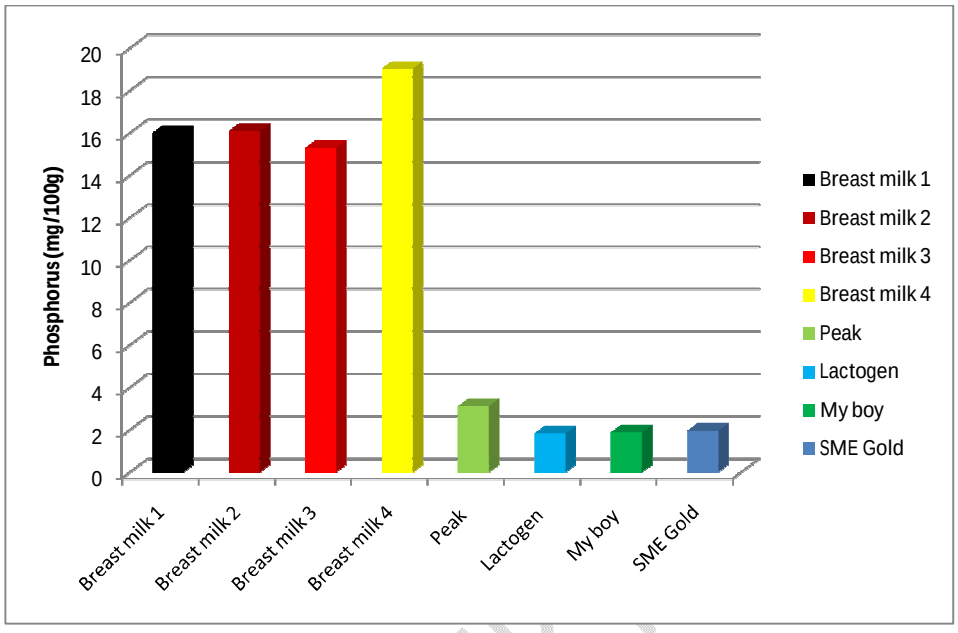

Fig.18 Phosphorus content in different milk

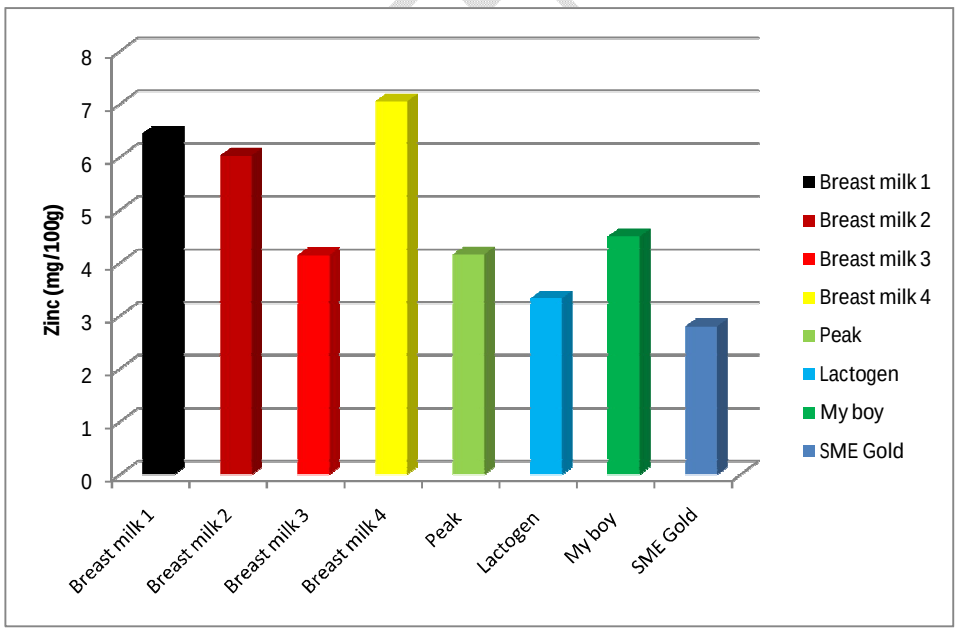

Fig.19 Zinc content in different milk

Table 3 : VITAMIN COMPOSITION (Mg/100g)

SAMPLE	VITAMIN A	VITAMIN B2	VITAMIN C	VITAMIN D	VITAMIN E
Breast milk 1	5.87	0.77	7.31	9.11	0.55
Breast milk 2	5.81	0.83	6.77	1118	1.03
Breast milk 3	5.00	0.59	7.30	9.84	0.67
Breast milk 4	5.53	0.37	7.00	10.00	0.57
Peak	3.33	0.62	7.66	6.10	0.37
Lactogen	3.58	0.33	6.43	6.81	0.55
My boy	2.80	0.51	5.17	5.33	0.13
SME Gold	5.11	0.57	6.00	6.22	0.53

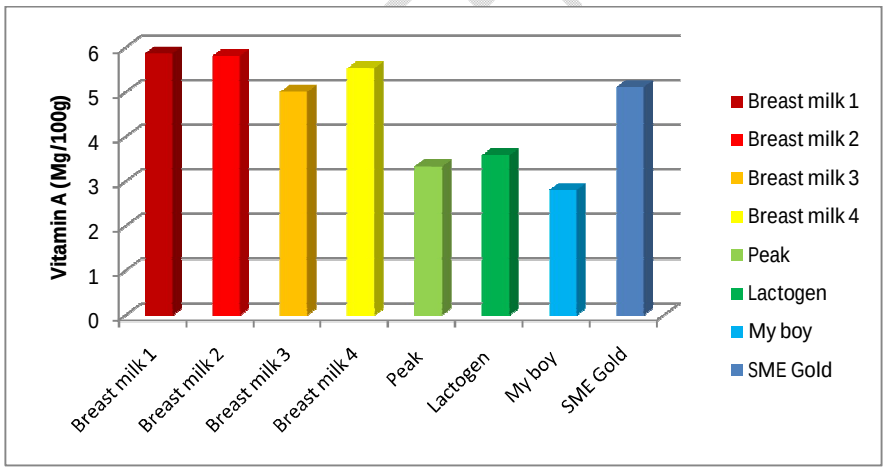

Fig.20 Vitamin content in different milk

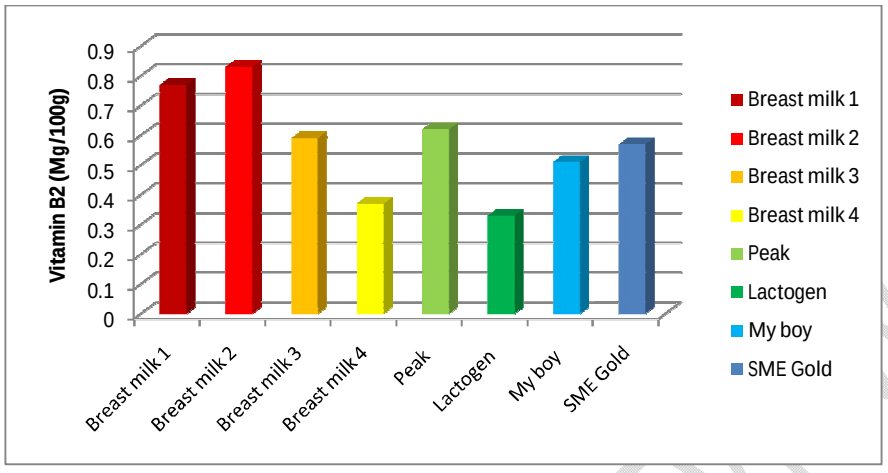

Fig.21 Vitamin B2 content in different milk

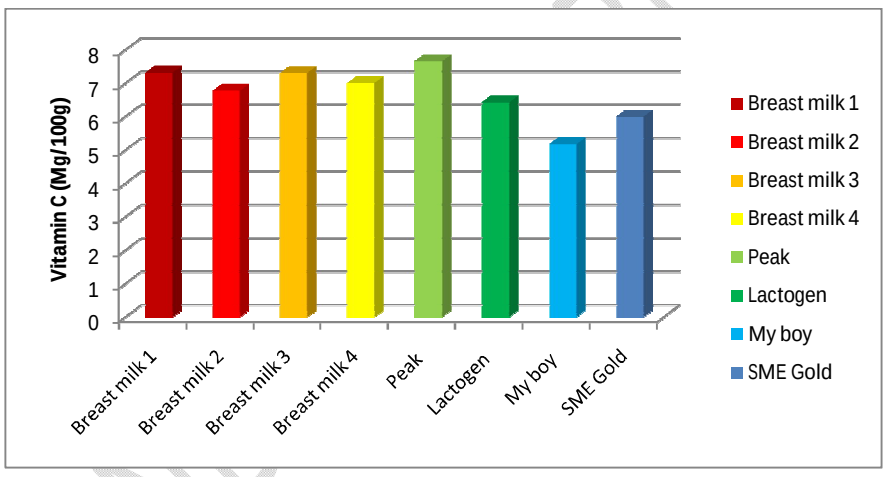

Fig.22 Vitamin C content in different milk

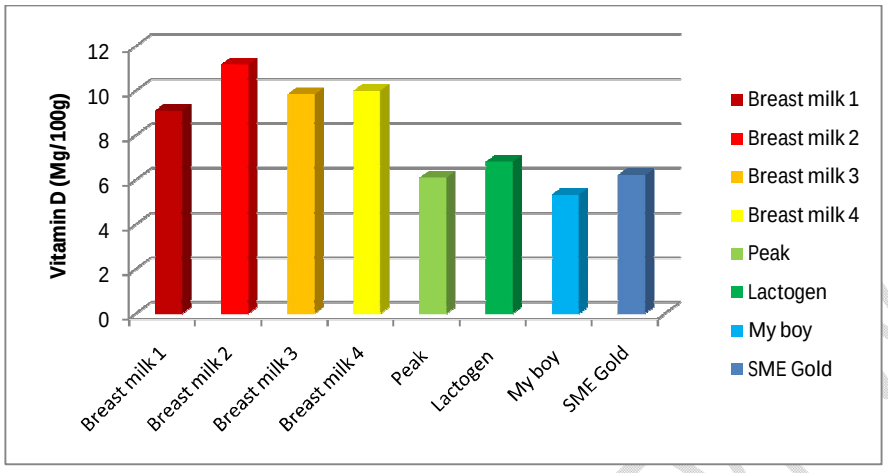

Fig.23 Vitamin D content in different milk

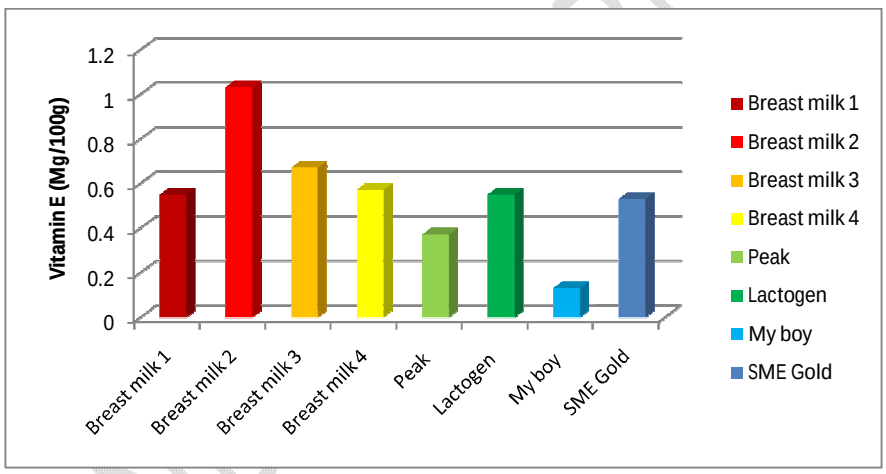

Fig.24 Vitamin E content in different milk

Discussion

The difference among proximate analysis of the infant formulae brand can be attributed to the different sources of raw materials processed to manufacture the different brands (Singh et al., 2013). The result of the proximate analysis above showed that the moisture contents of breast milk fluctuates between 62.00 to 51.40 showing that human breast milk contain 87% of water and other milk samples studied ranged from 11.20 to 12.40, with PEAK BABY MILK sample having the highest moisture content and the SME GOLD sample from the least. The moisture contents of the milk samples studied were lower than that reported by Del Prodo *et al.*, 2011 . This could be due to the fact that it was the dried weight of the milk samples that were analysed. The significant of moisture content in milk is that, high moisture content

implies high water activity which supports microbial growth consequently reducing the shelf life of the milk sample. Low moisture contents on the other hand, implies low water activities, low water activities causes reduction in microbial growth and the predominant microbial culture consequently increasing the shelf life of the milk samples as a result of low availability of water for microbial growth (Lonnerdal, 2013). The very low moisture contents suggest that 'when properly packaged and stored even under ambient conditions, these samples would have a long shelf life.

In similar studies ,The ash contents which is a reflection of the mineral compositions of the milk sample breast milk ash content fluctuates between 7.50 to 4.70 and other sample ranged from 5.10-5.80 (Joardar et al., 2016). The milk sample collected from SME GOLD has the highest ash content of 5.80. This could be due to the salt lick activities by the cattle use in producing the cow milk. The low ash content in this study might be attributed to the effect of fortification and loss of organic matter during processing.

The crude protein values of breast milk fluctuates between 22.20 to 18.02 having the highest protein content out of the samples and other ranges 15.00 – 19.50 with sample from SME GOLD being the highest and PEAK BABY MILK the least, the type of feeds giving to cows as well as lactation could be responsible for the high protein content seen in the milk sample collected from SME GOLD. Protein is important for babies in their growth, so increase in the protein content of this food is needed to optimise nutritional values derived from their intake. It is very important that a child gets enough protein in their daily diet. They are the building blocks of body tissue and can also serve as a fuel source [The National Academic Press, Washington,]. Protein can be found in all cells of the body and is the major structural component of all cells in the body, especially muscle. They are complex combinations of smaller chemical compounds called amino acids which are used as precursors to a nucleic acid, co-enzymes, hormones, immune response, cellular repair, and other molecules essential for life. Additionally, protein is needed to form blood cells. Protein is needed by everyone to maintain and repair the body, and it is especially important for babies and young children because protein supports growth and development. Protein is important for babies because walking requires protein to power muscles, and brain cells need this nutrient to learn speech and language skills. Healthy 1- to 3-year-olds need 0.55 grams of protein per pound daily, which means the average child should get 16 grams of protein each day (Jackson, 2014). The crude fibre content of breast milk fluctuates from 0.60 to 0.33 and other sample ranged from 1.81 -1.00 with LACTOGEN being the highest ,MY BOY the least .The low fibre content in this study may be due to the fact that dehulled raw materials were used in the formulation. Low fibre influences nutrient availability positively while high fibre lowers plasma cholesterol levels (Herrea, 2012). The values for crude lipid content of the milk samples were significantly different and it ranged from 0.28 -0.31 with milk sample collected from MY BOY having the highest fat content and milk sample collected from LACTOGEN the least. The fat contents of all the milk samples were higher could be due to the fact that, it was the dried weight of the milk samples that were analysed.

Fat is widely known as a source of energy but excess fat contents in foods constitute health risk. . For this reason, the milk sample collected from LACTOGEN will be safer to consume than the milk samples collected from MY BOY, PEAK BABY MILK and SME GOLD. However, an appropriate inclusion of essential fatty acids in infants and children's diet is vital because it does not only increase energy density and ensure proper neural development but also serves as a transport vehicle for fat soluble vitamins (Joardar et al., 2016).

Comment [a16]: Please check this statement again

Comment [a17]: This is not a citation

Comment [a18]: No reference(s) whatsoever.

The carbohydrate content of breast milk is the least fluctuating from 14.78 – 18.48 and other sample ranged from 64.18 – 55.29 with MY BOY being the highest and PEAK BABY MILK the least. Carbohydrates are important in infant and children's diet as it provides energy. FAO/WHO recommended that foods fed to infants and children should be energy dense ones. This, according to the recommendation is necessary because adequate energy fuels child's metabolism, support growth, keeps their brain and nervous system working and maintains overall health whereas low energy foods tend to limit total energy intake and the utilization of other nutrients and functions as mentioned (Savino et al., 2013). The result for mineral compositions in the milk samples are shown in the result above in chapter four. The essential mineral content in the studied samples are comparable with breast milk mineral content. The CALCIUM content of breast milk being the highest fluctuates between 29.00-21.80 and others ranged between 9.90-15.50. The milk sample collected from SME GOLD the highest and PEAK BABY MILK the least.

The PHOSPHORUS (P) concentrations of breast milk fluctuates between 19.03-15.30 and the other milk samples ranged between 1.83-3.11. The milk sample collected from PEAK BABY MILK has the highest P value, while the milk sample collected from LACTOGEN has the least value for P.

The concentration MAGNESSIUM in BREAST MILK fluctuates from 10.31-9.00 and the other milk samples ranged from 11.30-9.90 with SME GOLD the highest and MY BOY the least.

The value of Zn in the breast milk fluctuates between 7.05-4.15, others ranged from 2.80-4.50 and Fe from 1.17-6.30. The milk sample collected from MY BOY has the highest values for Zn and SME GOLD the least . Zn is essential for physiological processes including development, lipid metabolism, brain and immune functions and deficiency of Zn, allows the body to be more susceptible to disease caused by viral, bacteria and fungi infections (Stevens *et al.*, 2019*)* Iron on the other hand is an integral part of many proteins and enzymes that maintain good health. It is an essential component of proteins and is involved in oxygen transport. However, excess Fe may result in poisoning even death while Herrea, 2012 found no significant differences in the level of Fe and Zn in cow milk with respect to differences in breed.

The vitamin composition of milk samples , Vitamin A content in breast milk fluctuates between 5.87-5.00 and other sample value ranged from 2.80 – 5.11 with SME GOLD the highest, MY BOY the least.

Vitamin B2 content in breast milk fluctuates from 0.83-0.32 with other milk sample value ranged from0.33-0.62 with PEAK BABY MILK the highest and LACTOGEN the least.Vitamin C content in breast milk fluctuates between 7.31-6.77 and other sample ranged from 5.17-7.66 with PEAK BABY MILK being the highest and MY BOY the least. Vitamin D content in breast milk fluctuates from 11.18-9.11 and the other sample ranged from 6.81 -5.33 with LACTOGEN the highest and MY BOY the least. Vitamin E content in breast milk fluctuates between 1.03-0.55 and others ranged from 0.13-0.55 with LACTOGEN the highest and MY BOY the least.

CONCLUSION

The proximate composition and levels of trace metals in purposively four brands of infant milk formula aged 0-6 months sold in Nigeria were determined using Atomic absorption spectrophotometer techniques and they showed significant differences across different brands. Also, the commercial baby food samples

Comment [a19]: Full meaning??

Comment [a20]: Reference?

Comment [a21]: ????

Comment [a22]: This is just a mere repetition of the results

Comment [a23]: This is just a mere repetition of the results

Comment [a24]: The conclusion should be summarized in few lines, this is too voluminous.

Comment [a25]: On what grounds?? There was no any statistical analysis whatsoever.

(MYBOY, NAN and SME GOLD) have a low moisture content which suggests an asset as this prolongs the shelf life and also inhibits microbial activity on these products thereby preventing spoilage. Commercial baby food good is a good source of energy and other mineral elements but cannot be relied on as the sole source of complete nutrient intake needed daily by its consumers since they were all low in protein and fibre. These baby foods have to be paired with other protein of choice to get the full nutrient value expected. The result of this work revealed that all the five milk samples had similar nutrient composition in terms of the moisture, carbohydrate content, lipid, protein and ash content with other liquid milk sold in Nigeria. The findings from the present study may go a long way in contributing to the existing knowledge in the area of nutrition and functional foods research. From the discourse, the study suggests the milk, have fairly high fat and ash contents. They may thus be incorporated into diets as cheaper and/or more accessible source of nutrients to curtail some nutritional deficiencies. Moreover, the relatively high antioxidant activities observed in the liquid milk indicate the potential health benefits of the fruits. Breast milk is the best nutrition for infant growth and development, and is also rich in antibodies that provide the first source of adaptive immunity in a newborn's intestinal tract. In preterm or low birth weight newborns, a mother's own milk is the first choice for preterm infants; when it is unavailable, donor breast milk is considered as the next best choice. For healthy newborns whose mothers are unable to provide sufficient breast milk, the current option of choice is infant formula

Comment [a26]: Where is NAN coming from??

Comment [a27]: On what basis??

Recommendations:

In view of the results obtained from this study, the following recommendations are hereby forwarded.

a. It is recommended that, people should be taking milk in order to meet up the recommended daily intake of nutrients.

b. It is also recommended that, consumption of fresh liquid milk should be strongly encourage because processing of milk into powder leads to a considerable loss in ascorbic acid contents.

c. Further studies are required to investigate the antinutrient contents of more of our milk.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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Comment [a28]: The referencing style is not consistent, please make it consistent with the journal's guidelines

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