ISSN-2319-2119

RESEARCH ARTICLE

O.A. Ekpete et al, The *Experiment, Mar, 2013 Vol. .8(2), 456-460*

THE NUTRIENT VALUE OF BREASTMILK AND SOME INFANT FORMULAE

ABSTRACT

Eight infant formulae and breast milk sample were analysed to evaluate their nutritive compositional properties. The highest moisture content was obtained for breast milk 22.30% and least for Nan 0.90%. Carbohydrate content is33.50 - 69.40,low ash content ranging from 1.73 - 4.50, fat content ranged from 5.40 – 26.33, protein content is from 5.25- 17.63, calcium ranged from 65.00- 107.70. The result showed that breast milk had the highest values from the determinations except for fat and calcium. Generally, it is assumed that the fat content of breast milk varies with the time of the day. Breast fed babies get the required nutrients and water.

KEYWORDS Breast milk, nutrient value, infant formulae, carbohydrate, protein.

INTRODUCTION

Breast milk can be provided exclusively for around the first 6 months, meeting all of the Infants nutritional needs. Breast milk is still very important beyond the first 6 months. Once complementary foods are introduced breast milk continues to provide important nutrients and growth factors up to 2 years. In Australia and New Zealand, breast milk is recommended during the infants first year of life and then continued if this suits mother and infant. The WHO recommends that breast milk continue to be part of a child's diet, to 2 years of age and beyond.Breast milk provides the perfect infant nutrition. Breast milk lacks nothing. It provides enough calories to support baby's rapid growth and contains the right amount of essential vitamins and minerals needed for proper brain and baby function. If the mother is not malnourished, an exclusively breastfed baby will not need artificial vitamin supplement for optimal health.If growing children do not have sufficient protein in addition to sufficient energy intake, they may suffer growth restriction, malnutrition and mental retardation in several cases Levenstein (1983).

Breast milk provides protection against infection early in life by passing immune factors from the mother to infant. Breast fed babies have fewer allergies, ear infections, respiratory, illness, urinary tract infection and fewer problems of constipation and diarrhoea. Breast feeding protects against sudden infant death syndrome, diabetes and chronic digestive disease Pyke (1995) and AAP (2005).The strong suckling required by breast – feeding aids in the development of facial muscles, which help in speech development and correct formation of teeth. Breast fed babies are less likely to be overfed because the amount of milk consumed cannot be monitored virtually as reported by Hyponen et al., (1999;)andErhinyodavwe et al., (2009). Comparative studies in affluent countries have indicated important advantage of breast feeding over infant formula for the recipient infants such as lower incidence rates of gastrointestinal and respiratory infections, reduced rates of juvenile type diabetic Hyponen et al., (1999; obesity Toschke et al., 2002 and long –term cognitive achievements Anderson et al., (1999) and Mortenson et al., 2002.

There are conditions that make infant formulae important. They are allergies, prematurity, genetic abnormalities and death of mother after child birth. The safety of commercially prepared infant formulae is regulated by the Food Development Association (FDA) which specifies the minimum amount of nutrients that can be present in formulae according to recommendation by the American Academy of Paediatrics Committee on Nutrition (AAP 1997).Nutritional balance is the main benefit of breast milk. It contains at least 100 ingredients not found in infant formulae. Babies who are exclusively breastfed for at least two months double their risk of developing insulin – dependent diabetes. Suckling can produce jaw development, physiologically, breast feeding causes contractions that help the mother's uterus return to size more quickly and promote weight loss in some women, especially when it continues for more than six months Karajalainem (1992). Formulae fed infants have a high risk of life threatening bacterial contamination.*Enterobacter sakazaki* is frequent contaminant in powdered formulae and can cause meningitis in new born. Health concerns for the formulae fed infant include risk of contaminated water, potential contaminants in formulae itself. Formulae have contaminants introduced during the manufacturing process; such as broken glass substances, fragments of metal and bacteria. Gbosh

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(1976) reported that enzymes and hormones are completely absent in formulae, it may also contain excessive levels of metals such as manganese, cadmium and lead.This paper compares the nutritive value of breast and infant milk formulae in terms of chemical composition by proximate analysis.

MATERIALS AND METHODS

SAMPLE COLLECTION AND ANALYSIS

Eight different brands of infant formulae were purchased from a major supermarket at Port Harcourt, Rivers State, Nigeria. The expiring dates for these brands of sample were checked and the breast milk sample was collected from a nursing mother through expression into a 120ml reagent bottle, which has been sterilized. The different brands of the infant formulae milk were dried to remove water and the dried matter was poured into tightly covered sterilized 100ml sample bottle for each of the analysis. The breast milk sample was dried at 150^{o}C for 5h to remove water and dried at 105^{o}C for three hours to get the dry matter. The determination of the moisture content, ash, crude fat and crude protein was done using the American standard method(A.O.A.C.1990).

DETERMINATION OF MOISTURE

I.0g sample of each infant –formula was weighed into a clean dried porcelain evaporating dish which was placed on an oven maintained at 105^{o}C for 6hrs. The evaporating dish was cooled in a dessicator to room temperature and was reweighed and recorded.Weight of moisture was calculated by subtracting the weight of dried sample from the weight of the fresh.

$$\%\ moisture = \frac{fresh\ weight - dried\ weight}{weight\ of\ fresh\ sample}\ x100 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

DETERMINATION OF ASH

1.0g of each infant formula was transferred into the crucible and reweighed. The crucible containing the sample was placed in a cold muffler furnace and the temperature was allowed to rise to 650^{o}C. This was heated for 3hrs and allowed to cool to room temperature and reweighed. The ash content was calculated using the equation.

$$\%\ Ash = weight\ of\ crucible\ \&ash - weight\ of\ empty\ crucible\ x\ \frac{100}{1} \quad \ldots\ldots\ldots\ldots (2)$$

DETERMINATION OF LIPID

2.0g of each infant – formula was inserted into a filter paper and was placed into a soxhlet extractor. The soxhlet extractor was placed into a pre-weighed dried distillation flask. Acetone was introduced into the distillation flask via the condenser and attached to the soxhlet extractor. The set –up was held in place with retort stand clamp. Cold water was allowed to flow into the condenser and the heated solvent was refluxed. The lipid in the soxhlet chamber was extracted in the process of continuous refluxing and when completed the extractor was disconnected and the solvent evaporated to concentrate the lipid. The flask was dried in the oven to constant weight and re-weighed to obtain the weight of lipid (fat).

$$\%\ lipid = \frac{weight\ of\ flask\ \&\ extract - weight\ of\ flask}{weight\ of\ sample\ extracted} x\ \frac{100}{1} \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

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DETERMINATION OF CARBOHYDRATE

0.1g sample of each infant formula was weighed into a 25ml volumetric flask and 1.3ml 62% perchloric acid $HClO_4$ was added and shaken for a period of 20 minutes to homogenize completely. The flask were made to 25ml mark with distilled water and stoppered. The solution formed was filtered through a glass filter paper, allowed to sediment and decanted. 1ml of the filtrate was collected and transferred into a 10ml volumetric flask. This was diluted to volume with distilled water. 1ml of this working solution was pipetted into a clean test-tube and 5 ml anthrone reagent was mixed and the mixture read at 630nm wavelength using distilled water as blank. A standard glucose of 0.1mg/ml was also prepared and treated as the sample with anthrone reagent. Absorbance of the standard glucose was read and the value of carbohydrate as glucose was calculated using the formula.

$$\%\ Carbohydrate = \frac{Fresh\ weight - dried\ weight\ x100}{Weight\ of\ fresh\ weight} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

DETERMINATION OF PROTEIN

0.1g sample of infant formulae was weighed and added into a clean conical flask of 250ml capacity. 3g digestion catalyst was added into the flask and 20 ml concentrated sulphuric acid was added and heated to digest the content from black to sky-blue colouration. The digestion was cooled to room temperature and was diluted to 10ml with distilled water. 20ml diluted digest was measured into a distillation flask and the flask was held in place of an electro thermal heater, hot plate. The distillation flask was attached to a Liebig condenser connected to a receiving adapter containing 10ml of 20% boric acid indicator. 40% sodium hydroxide was injected into the digest via a spring attached to the mono-arm steel head until the digested become strongly alkaline. The mixture was heated to boil and distill the ammonia gas via the condenser into the receiver beaker. The colour of the boric acid changed from purple to greenish as ammonic, distillate introduce into the boric acid.

TITRATION

The distillate was titrated with 0.IN hydrochloric acid back to purple from greenish. The volume of hydrochloric acid was added to effect, this change was recorded as titra value.

CALCULATION:

$$\%\ protein = \frac{Titre\ x\ 1.4\ x\ 100\ x\ 100}{1000mg\ x\ 20.0\ x\ 1.0g} \ldots\ldots\ldots\ldots\ldots (5)$$

1.4 = equipment to normality of HCL used in titration

100 = total volume digest was made up

100 = % factor

1000 = Conversion factor from g to Mg

20 = Aliquot volume of digest

1g = Weight of foil digested

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	MOISTURE	CARBOHYDRATE	ASH	FAT	PROTEIN	CALCIUM
NAN	0.90	36.50	2.30	19.26	5.25	72.70
S.M.A. GOLD	1.30	37.00	4.40	20.00	9.75	68.75
COWBELL MILK	1.10	37.50	3.50	26.33	8.75	78.50
FRISCO MILK	1.90	38.50	3.90	18.83	8.78	107.70
LACTOGEN	2.50	53.20	4.50	17.35	8.50	85.23
S.M.A	2.01	38.58	3.8	18.34	8.76	65.00
CERELAC	2.58	65.38	3.67	10.23	16.30	88.45
GOLDEN MORN	2.45	69.40	3.56	11.23	15.47	76.34
BREAST MILK	22.30	33.50	1.73	5.40	17.63	70.20

Table 1. Protein, carbohydrate, moisture, ash, lipid and calcium content of infant formulae and breast milk.

Moisture Content

Breast milk has high moisture content of 22.30% which is comparable to the value of 20.10% obtained by Erhinyodavwe *et al*., 2009. The moisture content of breast milk is higher than that of the infant formulae. Breast milk has enough water to meet the Required Daily Dietary Allowance (RDDA) value for infant per day. Infant formulae requires external source of water for it to meet its RDDA value.

Total Carbohydrates

Total Carbohydrates content from the infant formulae ranges from 37.00 to 69.40% while that of the breast milk was 33.50%. The percentage of carbohydrate obtained in the infant formulae follows the order: Golden morn > Cerelac > Lactogen > SMA > Frisco >Cowbell > SMA Gold > NAN.

Ash Content

The ash value which is an empirical measurement of the mineral constituent of foodstuff, volatile component, and essential in nutrition was measured. The ash value obtained for breast milk was 1.73%, while the infant formulae value ranged from 2.30 to 4.50%. The recommended Ash content of milk is 1% as reported by Bamiro and Fatoki (1990).

Fat Content

The fat content obtained for the infant formulae samples ranged from 10.23% to 26.33%. The percentage of fat obtained in the infant formulae follows the order: Cowbell > S.M.A. Gold > NAN > Frisco > S.M.A.> Lactogen > Golden morn > Cerelac.Itisgenerallyassumed thatthe fat content of breastmilk varies with time of the day. The lowest is in theearly morning until around midday and highest in the afternoon. It is reported by Erhinyodavwe*et al*., 2009 that in the later months of breast feeding fat content of breast milk decreases. Researchers have found that breastfed babies grow to adults with lower cholesterol (Cruz etal., 1994; Wang 1995). In breast milk, there is an enzyme called lipase. Lipase breaks down fat in small globules. This allows for better digestion and absorption in baby's stomach. The variation of the fat content of breast milk account for the low fat content obtained as

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5.40%. Babies who consume breast milk high in saturated fat may be at increased risk of developing high blood pressure and high cholesterol levels later in life Leeson et al., (2001)and Mott et al., (1990).

CONCLUSION

This study also show that combination of breast milk with infant formulae proved to be adequate to meet up with the RDDA valued for infants. From this study, we observe that infant fed on breast milk alone will get enough nutrients from the mother in view of high moisture contents, high protein content and carbohydrate. The analysis revealed that infant formulae can assist to meet up with the Daily Dietary Allowance.

REFERENCES

1. American Academy of Paediatrics (2005) Policy Statement. Breastfeeding and the use of human milk. *Paediatrics*, 115:496-506.
2. Anderson, J.W. Johnstone, B.M. Remley, D.T. (1999). Breast –feeding and cognitive development: a meta-analysis. American Journal of Clinical Nutrition, 70,525-535.
3. AOAC (1990). Official Methods of Analysis, 15th edition, Association of Analytical Chemists, Washington DC. Bamiro, F.O and Fatoki, O.S (1990). Food Chemistry 37, 269
4. Erhinyodavwe, O. Egele, R.O. Idolor, O. Ugbune, U. (2009). The nutrient value of breast milk and some infant formulae. Journal of Chemical society of Nigeria, 34 (1), 64-67.
5. Ghosh, S. (1976). The feeding and care of infants and young children. UNICEF New Delhi. Hypponen, E. Kenward,M.G. Virtanem, S.M.Piitulainen, A Virta-Autio, P. Tuomilhto, J. Knip, M. Akerblom, H.K. (1999). Infant feeding early weight gain and risk of type 1 diabetes. Childhood diabetes in Finland (Dime) study group. Diabetes care 22, 1961-1965.
6. Karajalainem, J. (1992).A Dovine albumin peptide as possible trigger insulin dependent diabetes, New Engl. J.Med., 327,302-307.
7. Leeson CPM, Katterhorn M, Deanfield JE and Lucas A. 2001. Duration of breastfeeding and arterial distensibility in early adult life: population based study. BMJ 322: 643-7.
8. Leventstein, H (1983). Best for babies the controversy overartificial feeding of infants in America, 180-1920. Journal of American history 79, 1, 75-94.
9. Mortensen, E.L.Michalsen, K.F. Sanders, S.A. Reinisch, J.M (2002). The association between duration of breast –feeding and adult intelligence. JAMA 287, 2365 -2371.
10. Mott GE, Jackson EM, McMahan CA, McGill HZ. 1990. Cholesterol metabolism in adult baboons is influenced by infant diet.J Nutrition. 120:243–251a
11. Pyke M (1995). Success and Nutrition John Marray.75. Toschke, A.M. Vignerova, J. Lhotska, L. Osancova, K. Koletzko, B. Von Kries, R. (2002). Overweight and obesity in 5 to 14 years- old Czech children in 1991. Protective effect of breast feeding. Journal of Paediatrics 141, 764-769.
12. Wang, Y.S. (1995). The effect of exclusive breast feeding on development and incidence of infection in infant. Journal of Human Lactation, 12, 27-30.

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