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LIPID CONTENT OF BREAST MILK OF LACTATING WOMEN IN BENIN CITY, NIGERIA.

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ABSTRACT

A study on the lipid profile of breast milk expressed from women in Benin City as influenced by age, parity, lactation duration, socio-economic status of the mother and sex of the baby was embarked upon. All the women chosen in the study practice exclusive breast feeding and, nursing successfully their evidently healthy infants. The age of the mother did not have any significant change on the total lipid, cholesterol and phospholipid composition of breast milk. Also, the sex of the baby did not affect lipid composition of breast milk of the mother. However, the results obtained show that parity (i.e. number of previous births), lactation period and socio-economic status of the mother separately altered milk lipid profile. While there was a gradual significant increase in total lipid as the lactation duration increased, a decrease in cholesterol and phospholipid was observed. Total lipid, cholesterol and phospholipid contents of breast milk increased as the number of previous births increases. Lastly, milk total lipid of lactating women from rich socio-economic background was higher than women with poor background.

KEYWORDS: Lipid, Breast milk, Age, Parity, Socio-economic Status.

INTRODUCTION

There has been a renewed interest in breast-feeding in this part of the world and many teaching hospitals in this country have been designated Baby-Friendly Centers to enhance the practice of exclusive breast-feeding. A number of advantages have been advanced in support of this practice, which has enhanced its acceptance (Goldman, 1993; Birch et al., 1993; Koletzko et al., 2001). Its wide spread practice and acceptability have increased the desire among health workers to know more about the impact of environment and, maternal status on lactation and milk quality. Knowledge of the nutrient content of milk is needed to be able to assess the adequacy of breast milk in meeting nutrient requirements of pre-and full term infants whose mothers are of different background with respect to postpartum activities, parity, gender of baby etc.

Human milk is constantly changing body fluid. It is well established that colostrum (which is the milk secreted immediately after parturition) differs in composition from mature milk (Kulski and Hartmann, 1984; Brown, 1982). It is also reported that changes occur in mature milk with increasing postpartum period and circadian variations have been noted for a number of milk constituents and total milk volume (Neville, 1995; Jensen et al., 1980; Jackson et al., 1988; Hytten, 1954). Milk fat contributes to the satiety value of a meal and is a concentrated source of energy, providing 50% of whole milk food energy. The total fat content is about 3.8%. It is needed for the myelinization and development of the nervous system. It is the second greatest constituent in milk by percentage of concentration and provides essential fatty acids and vitamins (Jensen et al., 1980). Milk composition may be influenced by several factors. Extensive data on milk composition have been published (Kunz, et al., 1999; Rodriguez-Palmer et al., 1999) but the interaction with maternal status has not been thoroughly studied. While there has been a lot of information on the nutritional adequacy of milk in different stages of lactation and maternal status in advanced countries, the same cannot be said of developing nations such as ours.

The purpose of this study is to determine and compare the lipid composition of milk produced by women of different backgrounds and at different stages of lactation with the aim of assessing the adequacy of lipid content of breast milk fed to various categories of infants.

METHODOLOGY

Materials

Informed consent was obtained from every participant. Expressed breast milk was obtained from nursing mothers who had their evidently healthy infants and attending postnatal clinics in University of Benin Teaching Hospital (UBTH) Benin City. All the women nursing young infants

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(6months or less) practiced exclusive breast-feeding. Samples were collected from one hundred and fifty women. The women were in their third month of lactation except otherwise stated (see table 2). The samples were separated into different groups according to the ages of mother and baby, parity, gender index of baby and socio economic status of the parents (in accordance to the classification schedule of Olusanya et al. (1985). Milk samples were collected each morning, during the study period just before next feeding. About 10ml of milk was manually expressed from both breasts directly into a sterile container. The samples were stored in a refrigerator at 4°C when not in use. However, all samples were analyzed within 24 hours of collection.

Methods

Milk crude lipid was extracted by the method of Bligh and Dyer (1959).

Total lipid was estimated gravimetrically and by the sulfophospho-vanillin reaction according to Zollner and Kirsch (1962).

Total cholesterol was determined based on Zlatkis et al., (1953) method.

Total phospholipid content was estimated by the Bartlett (1959) method. The phospholipid was digested with perchloric acid and the liberated phosphorus determined by its reaction with ammonium molybdate.

All data were subjected to statistical analysis using Analysis of Variance (ANOVA) and Duncan's multiple range tests. A p value of ≤ 0.05 was considered to be significant.

RESULTS

The data for total lipid, cholesterol and phospholipid content of milk of lactating women of various age brackets is presented in table 1. The result shows that there was no significant difference between the age brackets studied in the concentrations of the lipid types. The values for total lipid, cholesterol and phospholipid for women below 20 and above 30 years were 2.98 ± 0.068 g/dl, 24.09 ± 1.00 mg/dl, 31.50 ± 0.8 mg/dl and 2.90 ± 0.058 g/dl, 23.53 ± 0.36 mg/dl, 32.23 ± 0.89 mg/dl respectively.

Table 2 indicates the lipid level of breast milk of lactating mothers according to duration of lactation as ascertained by ages of babies of less than one month and greater than six months. There were significant variations in the lipid types with respect to duration of breast-feeding. It was observed that the total lipid content of milk increased with increasing period of lactation. The reverse however, was observed with both cholesterol and phospholipid concentrations, which decreased with increasing period of lactation.

Parity was observed to influence significantly the lipid level of breast milk of women in Benin City. There was significant increase in milk total lipids of women who were para four or above as compared to nullips. Cholesterol and phospholipid contents were found to increase with increasing number of previous deliveries (Table 3). The socio-economic status of the lactating women was observed to influence the total lipid content of milk. Total lipid of milk obtained from women drawn from economically poor background (social classes V) was significantly lower than (class IV) socio-economic backgrounds. Incidentally, both cholesterol and phospholipid compositions of human milk were not significantly altered by maternal socio-economic status. Similarly, no significant gender

Table 1: The lipid concentration of milk of lactating women according to maternal age.

Age (years)	No of Sample	Total Lipid (g/dl)	Cholesterol (mg/dl)	Phospholipid (mg/dl)
≤ 20	32	2.98 ± 0.068	24.09 ± 1.00	31.50 ± 0.81
21 –25	37	2.88 ± 0.022	22.87 ± 0.39	32.50 ± 0.63
26 – 30	38	2.96 ± 0.054	22.89 ± 0.19	32.49 ± 0.79
>30	26	2.90 ± 0.058	23.53 ± 0.36	32.23 ± 0.89

- Results are expressed in Mean ± S.E.M.

Values are not significantly different from each other.

Table 2: Distribution of mean lipid levels of milk from lactating women according to duration of lactation [Age (months) of babies].

Age (Months) of Babies	No. of Sample	Total Lipid (g/dl)	Cholesterol (mg/dl)	Phospholipid (mg/dl
<1	36	2.44± 0.06 [a]	34.55 ± 0.26 [a]	40.05 ± 0.93 [a]
1 – 3	40	2.84 ± 0.040 [b]	23.14 ± 0.54 [b]	32.49 ± 0.60 [b]
4 – 6	38	3.14 ± 0.022 [c]	19.16 ± 0.52 [c]	30.52 ± 0.70 [c]
> 6	25	3.78 ± 0.054 [d]	12.17 ± 0.27 [d]	23.52 ± 0.70 [d]

-Results are expressed in Mean ± S.E.M.

-Values on the same column with superscripts of the same letter are not significantly different from each other.

Table 3: The effect of parity on the lipid concentration of breast milk of lactating women.

Parity	No. of Sample	Total lipid (g/dl)	Cholesterol (mg/dl)	Phospholipid (mg/dl)
None	28	2.86± 0.064 [a]	21.38 ± 0.29 [a]	32.22 ± 0.18 [a]
1	31	2.86 ± 0.054 [a]	24.06 ± 0.35 [b]	34.21 ± 0.11 [b]
2	30	2.74 ± 0.040 [a]	24.18 ± 0.23 [b]	34.44 ± 0.42 [b]
3	26	3.20 ± 0.048 [b]	28.66 ± 0.36 [c]	38.56 ± 0.19 [c]
≥ 4	19	3.36 ± 0.044 [b]	31.48 ± 0.17 [d]	40.46 ± 0.13 [d]

-Results are expressed in Mean ± S.E.M.

-Values on the same column with superscripts of the same letter are not significantly different from each other.

Table 4: Influence of baby's gender and family socio-economic status of lactating women on lipid content of breast milk.

Parameter (Gender)	No. of Sample	Total lipid (g/dl)	Cholesterol (mg/dl)	Phospholipid (mg/dl)
Male	45	3.00 ± 0.06	22.54 ± 0.27	31.70 ± 0.31
Female	36	2.86 ± 0.06	22.65 ± 0.21	32.31± 0.40
Socio-economic status				
High – middle (Class IV)	46	2.90± 0.06 [a]	23.29 ± 0.23 [a]	32.45 ±0.61 [a]
Low (Class V)	33	2.08 ± 0.08 [b]	22.95 ± 0.17 [a]	32.22 ± 0.42 [a]

- Results are expressed in Mean ± S.E.M.

-Values on the same column with superscripts of the same letter are not significantly different from each other.

variations (based on sex of index baby) were noted on the lipid types (Table 4).

DISCUSSION

Human milk from healthy and well-nourished mothers is the preferred form of feeding for neonates since the nutrient content supports normal growth and development (Lawrence and Lawrence, 1999; Koletzko et al; 2001). The amount of human milk ingested by the nursing infant is about 600ml per day and the average lipid content ranges from 3.2 to 3.5 %. About 50 % of the energy derivable from milk is provided by the lipid content and supplies essential nutrients such as fat-soluble vitamins and polyunsaturated fatty acids (Jensen et al., 1978, Giovannini et al., 1991).

In the present study, total lipid, cholesterol and phospholipid contents of human milk from lactating women in Benin City were undertaken. The result of our lipid analyses correlate very well with previous works (Potter et al., 1976; Picciano et al., 1978; Jensen et al., 1978, 1980; Hytten, 1954). Maternal age (lactating women) did not influence the lipid types studied. Also the sex of the infant (male or female) did not significantly alter the lipid content of human milk of 3-month lactating mothers. On the other hand, the babies' age (i.e. duration of lactation) significantly altered the lipid content of milk. It was observed that there was a gradual increase in the total lipid, cholesterol and phospholipid compositions of milk as the lactation period increases. This is in agreement with previous studies indicating that as the milk matures, the lipid content is increased to be able to provide the nutritional requirement and facilitate satiety in the growing infant (Tarjan, et al., 1965; Koletzko, et al., 2001; Anderson et al., 1981). Despite prolonged breast-feeding, the lipid concentrations of milk actually increased rather than decline, thus ensuring adequate caloric intake for the growing child. Perhaps such finding can assuage the common notion amongst parents that prolonged breast-feeding could be associated with inadequate caloric intake. Also there was a significant difference in the lipid content of milk of women from different socio-economic background. The total lipid of milk obtained from women drawn from poor socio-economic background was significantly lower than those of women from rich homes. Jelliffe and Jelliffe (1971) compiled data on fat contents of mature human milk from well and poorly nourished communities and discovered that there was a decline in milk fat from poorly nourished communities. Our present study underscores the need for adequate and proper nutrition in women especially during pregnancy and lactation. Parity was shown to affect significantly all the lipid types studied. As the number of previous birth increases, the lipid content also increased. The reason for this is not very clear. It may be that repeated breast-feeding coupled with enhanced breast-feeding practice are necessary stimuli for increased synthesis of lipids. In conclusion there is the need for adequate nutrition by pregnant and lactating women to be stressed, considering the enhanced milk lipid levels in women from rich homes.

REFERENCES

Anderson, G. H., Atkinson, S. A. and Bryan, M. H., 1981. Energy and macronutrient content of human milk during early lactation from mothers giving birth prematurely and at term. Amer. J. Clin. Nutr. 34: 258 – 265.

Bartlett, G. R., 1959. Phosphorus assay in column chromatography. J. Biol. Chem. 234: 466 – 468.

Birch, E., Birch, D. and Hoffman, D., 1993. Brest-feeding and optimal visual development. J. Pediatr. Ophathalmol. Strabismus 30: 33 – 38.

Bligh, E.G. and Dyer, W.J., 1959. A rapid method of total lipid extraction and purification. Can. J. Biochem. Physiol. 37: 911 – 917.

Brown, K. H., 1982. Clinical and field studies of human lactation: methodological considerations. Amer. J. Clin. Nutr. 35: 745 – 750.

Giovannini, M., Agostoni, C. and Salari, P.C., 1991. The role of lipids in nutrition during the first months of life. J. int. Med. Res. 19; 351 – 362.

Goldman, A. S., 1993. The immune system of human milk: antimicrobial, anti-inflammatory and immunomodulating properties. Pediatr. Infect. Dis. J. 12: 664 – 671.

Hytten, F. E., 1954. Clinical and chemical studies in human lactation. Brit. Med. J. 1: 176 – 182.

Jackson, D. A., Imong, S. M. and Silprasert, A., 1988. Circadian variation in fat concentration of breast milk in rural northern Thai population. Brit. J. Nutr. 59: 349 – 355.

Jelliffe, D. B. and Jelliffe, E. F., 1971. The uniqueness of human milk. An overview Am. J. Clin. Nutr. 24: 1013 - 1024.

Jensen, R.G., Clark, R. M. and Ferris, A. M., 1980. Composition of the lipids in human milk: A review. Lipids 15: 345 – 353

Jensen, R.G., Hagerty, M. M. and McMahan, K. E., 1978.

Lipids of human milk and infant formula: a review. Amer. J. Clin. Nutr. 31: 990 – 1016.

Koletzko, B., Rodriguez-Palmero, M., Demmelmair, H., Fidler, N. Sensen, R. and Sauerwald, T., 2001. Physiological aspects of human milk lipids. Early Hum. Dev. 65 (suppl.): 53 – 518

Kulski, J. K. and Hartmann, P. E., 1981. Changes in human milk composition during the inititation of lactation. Aust. J. Exp. Biol. Med. Sci. 59: 101 – 106.

Kunz, C., Rodriguez-Palmero, M. E and Koletzko, B., 1999. Nutritional and biochemical properties of human milk, part I: General aspects, proteins and carbohydrates. Clin. Perinatol. 26: 307 – 333.

Lawrence, R. and Lawrence, R. M., 1999. Breastfeeding. In: A guide for the medical profession. Mosby-Year Book Inc, St. Louis, MO.

Neville, M. C., 1995. Volume and caloric density of human milk. In: Handbook of milk composition (R.G. Jensen, ed.) Acad. Press, Inc. San Diego, CA P63.

Olusanya, 0., Okpere, E and Ezimokhai, M., 1985. The importance of social class in voluntary fertility control in a developing country. West Afr. J. Med. 4: 205 - 12.

Picciano, M. F., Guthrie, H. A. and Sheehe, D. M., 1978. The cholesterol content of human milk: a variable constituent among women and within the same woman. Clin. Pediatr. 17: 359 – 362.

Potter, J. M. and Nestel, P. J., 1976. The effects of dietary fatty acids and cholesterol on the milk lipids of lactating women and the plasma cholesterol of breast-fed infants. Amer. J. Clin. Nutr. 9: 54 – 60.

Rodriguez-Palmero, M., Koletzko, B. and Kunz, C., 1999. Nutritional and biochemical properties of human milk: II. Lipids, micronutrients and bioactive factors. Clin. Perinatol. 26: 335 – 339.

Tarjan, R., Kramer, M., Szoke, K., Lindner, K., Szarvas, T. and Dworschak, E., 1965. The effect of different factors on the compostion of human milk: II. The composition of human milk during lactation. Nutr. Diets. 7: 136 – 140.

Zlatkis, A., Zak, B. and Boyle, A. J., 1953. A new method for the direct determination of serum cholesterol. J. lab. Clin. Med. 41: 486 – 493.

Zollner, N. and Kirsch, K., 1962. Total lipid determination using the sulfophospho-vanillin reaction. J. Exp. Med. 135: 545 – 550.