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Effect of Socio-economic Conditions on Lipid Composition of Breast Milk of Bangladeshi Urban Mothers

Yearul Kabir, Mahmud-ul-Islam and Zakir H. Howlader
Department of Biochemistry and Molecular Biology, University of Dhaka, Dhaka-1000, Bangladesh

Abstract: The relationship between socio-economic status and lipid composition in breast milk of 97 Bangladeshi urban mothers was investigated. Study subjects were aged 18-35 years and were selected randomly from three clinics of Dhaka (capital city of Bangladesh). An appropriate questionnaire was developed to obtain information on health condition of mothers and infants, age, height and weight of both the mothers and their infants, educational qualification of both mother and the father, family income, family size, housing condition, source of drinking water, sanitation and monthly expenditure for food. Mothers from the higher family income group showed significantly higher value of total lipid, triacylglycerol, cholesterol and phospholipid in their breast milk. Mothers belonging to the upper age group (30-35 years), had significantly lower lipid values. Mother's as well as father's education also affects the lipid composition of breast milk, because educated mothers and educated fathers are more concerned about proper care during pregnancy and lactation. Also educational level is related with family income. These findings suggest that family income and family education makes a significant contribution to higher lipid content in breast milk of urban mothers in Bangladesh.

Key words: Socio-economic conditions, lipid composition, breast milk

INTRODUCTION

Breast milk from a well-nourished, well-motivated mother is all that a baby requires to sustain growth and good nutrition during the first 4 to 6 months of life (Ahn and MacLean, 1980 ; Evans, 1978). Breast feeding is an unequalled way of providing ideal food for the healthy growth and development of the infants and has a unique biological and emotional influence on the health of both mother and child (Ghosh, 1997). The question of the composition and volume of breast milk produced by mothers on different situations of nutrition at different phases of lactation is a major issue in pediatric public health in the world, especially in resource-poor countries. Adequate growth and development of breast fed infants depend on the quantity and quality of breast milk. There is a great variability in the concentrations of energy-yielding nutrients in human milk, even within well-nourished populations (Garza and Butte, 1985).

Fundamentally, ultimate concerns are the nutritional adequacy of such milk for young infants in relation to calories, proteins, vitamins and minerals and the physiological and practical efficacy of supplementing the maternal or infant diets, when or if necessary. Various studies revealed that mothers dietary intake influences the quantity as well as the quality of breast milk (Emmett and Rogers, 1997, Jelliffe and Jelliffe, 1978).

It has been reported that education and socioeconomic status are among the important factors that may affect breast feeding behavior (Hufffman *et al*., 1980). The lipid content in human milk varies from 3 to 5% and consists of about 98% triacylglycerol, 0.5 to 1.0% phospholipid and 0.2 to 0.4% sterols (Ruegg and Blanc, 1981; Jensen *et al*., 1990). According to Macy *et al*. (1953) fat amounts to 2.3% in colostrum and 3.9% in mature milk. Variations may be caused by the dietary habits of the mothers. With regard to macronutrients, the lipid fraction of human milk seems to be of crucial importance. Lipids in human milk derive their importance not only as source of energy and as nutrients but also in relation to the development of the nervous system of the infant. Under normal conditions, it does not only provide the main source of energy, but in addition contains fatty acids and fat soluble vitamins that are essential to sustain normal growth and brain development (Walker, 1967). It has been found that the infant is able to absorb fats from human milk more efficiently than those from cow's milk. This difference may have two reasons: I) the nature of the enzyme lipase and ii) the fatty acid composition of the triacylglycerols (Blanc, 1981).

The total fat content of human milk varies considerably from one mother to other, from one phase of lactation to another, on the time of lactation and particularly during a feed. The first milk to flow during

suckling is called the foremilk. It has a fat content of only about 1-2% and looks thin. The watery milk helps satisfy the infant's thirst as it begins to suck. The later milk, called the hindmilk provides most of the energy. The percentage of fat in the hindmilk is greater than that in the foremilk (Gunther, 1968). Hytten and Thomson (1960) reported that the quality of human milk is independent of the nutritional status of the mother. On the other hand a number of studies on the quality of human milk indicate that the socioeconomic status has a linear relationship with biochemical composition (Rocquelin *et al*., 1998; Gopalan, 1958; Baily, 1965; Bassir, 1958).

Bangladesh is a poor developing country. Majority of our children are growing in poor family and most of the mothers are not educated and not aware of their children's development. By considering these things we studied the effect of socio-economic conditions and anthropometric indices on the lipid composition of breast milk of Bangladeshi mothers. To our knowledge, there is no published data on this type of study on Bangladeshi mothers.

MATERIALS AND METHODS

Study subjects and sampling: The study was conducted on ninety seven urban lactating mothers aged 18-35 years with low and high socioeconomic status having newborn infants up to one month of age. An appropriate questionnaire was developed to obtain the information on the health of mothers and infants, age, height and weight of both the mothers and infants, educational qualification of the mother and father, family income, family size, housing condition, source of drinking water, sanitation and monthly expenditure for food.

Milk was hand expressed into carefully washed and dried plastic polypropylene containers without preservatives and protected from heat and light. Collected milk samples were immediately placed on icebox or stored at 4°C at hospital and then stored at –70°C until analysed.

Extraction of lipid from milk: Milk samples were thawed to room temperature and extracted by the modified method of Folch *et al.* (1957). In brief, 0.5 ml milk was taken in the 15 ml screw cap tube and 9.0 ml chloroform/methanol (2:1, v/v) was added. The mixture was shaken and 3.0 ml of 0.9% NaCl was added and the tube was inverted few times. The mixture was centrifuged at 1000 g for 10 min. The upper layer (methanol/water) was removed and lower chloroform layer was collected and the lipid profile was analyzed.

Total cholesterol was determined enzymatically according to the method of Siedel (1983). Triacylglycerol was determined according to the method of Wahlefeld (1974). Phospholipid was measured colorimetrically by the method of Taussky and Shorr (1953). Milk total lipid was estimated from the lipid extraction by gravimetric method (Folch *et al*., 1957).

Data were treated statistically using the paired Student's t-Test for independent sample SPSS for MS-Windows release 6.0. All groups were compared with each other. $P < 0.05$ were considered significant.

RESULTS AND DISCUSSION

Study mothers aged from 18 to 35 years were divided into three age groups such as from 18 to 23 years (37.1% of the total), from 24 to 29 years (41.3% of the total) and from 30 to 35 years (21.6% of the total). Body weight and height of the mothers and their infants were within the standard range. Mother's body weight was ranged from 38.5 kg to 67.5 kg, height from 144 to 167 cm and the infant's body weight was from 2.26 to 3.70 kg and their height from 44.5 to 58.5 cm (data not shown). Most of the study mothers (53%) belonged to small family (4 or less than four members), 37% belonged to medium family (5-7 members) and only 10% mothers came from large families (8 or more family members).

In case of total lipid and triacylglycerol content, age group A (18-23 years) and B (24-29 years) were not statistically significant, but when age group C (30-35 years) was compared with age group A or age group B, they were found statistically significant. There was significant change in cholesterol content in all three age groups whereas change in phospholipid content was not significant when age group B and age group C was compared. These results indicate that the lipid content was found in a higher concentration in early age groups, which was found to decrease as age increased (Table 1).

The study mothers were divided into three groups according to monthly income of their families; 25.7% of the study mothers belonged to low-income group: < 3000 taka, 46.4% were from moderate income group: 3001-10,000 taka and 27.9% were from high income group: > 10,000 taka (one US dollar is equivalent to 58 taka). Table 2 indicated difference between low and moderate income group was found significant only in case of cholesterol but the difference between moderate and high or low and high income group was found significant in all four variables. Results show a direct relationship between family income and lipid content in human milk. May be, higher income group can expend more for their food, indicated a dietary relationship with lipid content in human milk. Consumption of foods from animal source like meat, fish, milk and milk products and seasonal fruits are

Table 1: Effect of mother's age on the concentration of total lipid, triacylglycerol, phospholipid and cholesterol in milk of lactating mother

	Age (Years)		
Variables	18-23 yrs(A), n=46	24-29 yrs(B), n=52	30-35 yrs(C), n=32
Total lipid (g dl^{-1})	3.30 ± 0.11^{a}	3.10 ± 0.21^{a}	2.70 ± 0.08^{b}
Triacylglycerol (g dl^{-1})	2.79 ± 0.12^{A}	2.81 ± 0.09^{A}	2.28 ± 0.13^{B}
Phospholipid (mg dl^{-1})	61.79 ± 4.39^{p}	50.76 ± 2.74^{q}	51.32 ± 2.81^{q}
Cholesterol (mg dl^{-1})	25.43 ± 1.39^{1}	22.53 ± 0.98^{2}	19.97 ± 1.64^{3}

Table 2: Effect of family income on the concentration of total lipid, triacylglycerol, phospholipid and cholesterol in milk of lactating mother

	Family income		
Variables	Low income group: <Tk.3000 n= 25 (A)	Moderate income group: Tk.3001-10,000 n= 45 (B)	High income group: >Tk. 10,000 n=27 (C)
Total lipid (g dl^{-1})	2.83 ± 0.15^{a}	2.95 ± 0.07^{a}	3.40 ± 0.10^{b}
Triacylglycerol (g dl^{-1})	2.35 ± 0.17^{A}	2.36 ± 0.18^{A}	2.89 ± 0.09^{B}
Phospholipid (mg dl^{-1})	41.24 ± 2.53^{p}	43.8 ± 2.72^{p}	63.4 ± 3.68^{q}
Cholesterol (mg dl^{-1})	18.69 ± 1.45^{1}	22.3 ± 1.33^{2}	26.41 ± 1.08^{3}

Table 3: Consumption frequency of various foods from selected food groups related with family income

Type of foods	Low income group n=25 (A)	Moderate income group, n=45 (B)	High income group, n=27(B)
Frequency of consumption of foods (times/week)			
Animal source (meat, fish, etc.)	1.04 ± 0.17^{a}	3.13 ± 0.16^{b}	4.67 ± 0.22^{c}
Plant source (rice, vegetables, etc.)	5.98 ± 0.21^{A}	5.05 ± 0.25^{B}	5.96 ± 0.21^{A}
Milk and milk products (ghee, butter, etc.)	0.7 ± 0.14^{p}	3.06 ± 0.15^{q}	5.11 ± 0.16^{r}
Seasonal fruits	2.61 ± 0.10^{1}	3.38 ± 0.23^{2}	5.14 ± 0.15^{3}

Table 4: Effect of mother's education on the concentration of total lipid, triacylglycerol, phospholipid and cholesterol in milk of lactating mother

	Mother's education			
Variables	Illiterate n=27(A)	Primary and below Secondary, n=20 (B)	Secondary and higher Secondary, n=24 (C)	Graduation and Post-graduation, n=26 (D)
Total lipid (g dl^{-1})	2.92 ± 0.12^{a}	$2.96\pm0.18^{a,b}$	$3.19\pm0.04^{b,c}$	3.39 ± 0.08^{c}
Triacylglycerol (g dl^{-1})	2.39 ± 0.14^{A}	$2.31\pm0.08^{A,B}$	$2.76\pm0.07^{B,C}$	2.96 ± 0.09^{C}
Phospholipid (mg dl^{-1})	40.6 ± 3.30^{p}	$43.9\pm3.95^{p,q}$	$52.0\pm2.39^{q,r}$	53.1 ± 2.19^{r}
Cholesterol (mg dl^{-1})	17.5 ± 1.27^{1}	$19.1\pm1.45^{1,2}$	$23.2\pm1.47^{2,3}$	23.4 ± 1.29^{3}

Values are mean±SE. When different education groups were compared for a variable, the different letter in the superscript means they were statistically significant, where $P<0.05$

Table 5: Effect of father's education on the concentration of total lipid, triacylglycerol, phospholipid and cholesterol in milk of lactating mother

	Mother's education			
Variables	Illiterate n=17(A)	Primary and below Secondary, n=15 (B)	Secondary and higher Secondary, n=22 (C)	Graduation and Post-graduation, n=43 (D)
Total lipid (g dl^{-1})	2.67 ± 0.18^{a}	2.75 ± 0.09^{a}	3.17 ± 0.09^{b}	3.36 ± 0.08^{b}
Triacylglycerol (g dl^{-1})	2.12 ± 0.21^{A}	2.23 ± 0.07^{A}	2.60 ± 0.1^{B}	2.94 ± 0.08^{B}
Phospholipid (mg dl^{-1})	42.91 ± 4.8^{p}	42.5 ± 4.37^{p}	44.53 ± 3.9^{p}	54.9 ± 3.04^{q}
Cholesterol (mg dl^{-1})	23.07 ± 1.5^{1}	23.0 ± 3.12^{1}	20.7 ± 1.39^{1}	23.06 ± 1.07^{1}

Values are mean±SE. When different education groups were compared for a variable, the different letter in the superscript means they were statistically significant, where $P<0.05$

significantly higher in higher income group compared to moderate or lower income group (Table 3).

The study mothers were also divided into four groups according to their educational level. Group A is totally illiterate, group B includes the primary and below secondary level, group C includes the secondary and higher secondary level and group D includes the graduation and post graduation level. Husbands of the study mothers were also divided into four groups as it was done for the mothers. The results are presented in Table 4 and Table 5. When different groups were compared, it was found that group A and C, Group A and D and group B and D were significantly different for all variables. The difference between neighboring groups, i.e., group A and B, group B and C and group C and D were not significant. Almost same result was found for the father's educational level, because in almost all cases educated mother belongs to educated husband's family.

These results are in agreement with the report of Wurtman *et al.* (1979). They reported that cereal grains and legumes based diet in Guatemalan mothers is the reason for less lipid content in their breast milk in comparison with animal product based diet of American mothers. The income is directly related to the educational level of mothers and their husbands. The impact of education on the composition of breast milk may be explained by the fact that usually the higher educated mothers as well as their educated husbands have higher family income and more knowledge about nutrition and are more conscious regarding their own and children's health. As a result, they consume proper diet during pregnancy and lactation, which ultimately reflects on the lipid composition found in the present study. This study agrees with the previous report, which revealed that the concentration of the total lipids was low in milk samples from Indian women belonging to the low socio-economic group (Belavady, 1978).

In conclusion, our results indicate that lipid composition in breast milk vary significantly with mothers age, education and family income. Even, we cannot assume that the breast milk composition is homogeneous

within a community, the overall result also indicates that the composition of breast milk of Bangladeshi mothers belonging to different socio-economic status differ significantly from the value reported for developed countries. The difference in lipid composition may be of nutritional significance for greater understanding of the nutritional status of infants. We therefore suggest that all efforts should be made by families to give importance to dietary intake of the lactating mothers as much as possible within their income. This would improve the quality of the breast milk for greater interest of infant's health and development.

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