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Evaluation of Nutrient Composition in Breast Milk of Breast Feeding Mothers in Urban and Sub-Urban Subjects in Rivers State

Ikewuchi Catherine Chidinma[1*], Kalaotaji Glory Biambo[2], Jonathan Nyebuchi[3], Amadi Chikadibia Fyneface[4] and Nwika Goodnews[4]

[1]Department of Biochemistry, University of Port Harcourt, Rivers State, Nigeria.
[2]Department of Nursing, Rivers State University, Rivers State, Nigeria.
[3]Department of Medical Laboratory Science, Rivers State University, Port Harcourt, Nigeria.
[4]Department of Medical Laboratory Science, Pamo University of Medical Sciences, Rivers State, Nigeria.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The human breast milk is considered to be the perfect food for infants, specifically adapted to their needs. Changes in lifestyle and environment may impact on breast milk composition. This study was aimed at comparing the nutrients composition in breast milk in postpartum women in urban and sub-urban areas in Rivers State. The cross-sectional study was conducted among 59 postpartum subjects between 0 and 10days of child delivery in each group. Sampling was done through a simple random sampling method. Human breast milk was collected by means of a manual breast pump for the analysis of carbohydrate, protein and lipid using ClegAnthrone Method, Kjedahl Method and Soxhelt Extraction Method respectively. The results revealed that carbohydrate level was 6.1±0.5% in urban group and 5.0±0.1% in sub-urban group which was statistically significant (t-value=2.2; p-value=0.04). Protein level was 3.5±0.6% in urban group and 3.9±0.3% in sub-urban group which was statistically non-significant (t-value=0.6; p-value=0.57).

**Corresponding author: Email: catherine.ikewuchi@uniport.edu.ng*

Lipid level was 6.1±0.5% and 5.0±0.1% in urban and sub-urban groups respectively which was statistically non- significant (t-value=1.2; p-value=0.27). This study has revealed that differences in settlements (urban and sub-urban) have no impact on breast milk composition except in carbohydrate.

Keywords: Breast milk; carbohydrate; protein; fat; urban; sub-urban.

1. INTRODUCTION

Human breast milk is produced by human mammary gland and serves the primary role of nourishment for the newly born baby. As discussed in a review by Mead and his team, breastfeeding provides the infant with a number of nutrients and substances that protect and facilitate the growth of the brain including selenium, glutathione, vitamin E, cysteine, tryptophan, choline, taurine S100B protein, sialic acid, and polyunsaturated fatty acids [1]. The breast milk serves as the primary food for babies until they are mature enough to take solid food, therefore, the quality of nutrient composition is very important for the growth and general health of the baby, which is why the evaluation of the nutrient composition of breast is necessary. According to World Health Organization (WHO), breastfeeding has health advantages for both the mother and the kid [2]. The content of human milk has been found to be influenced by race, environment and lifestyle [3]. Another research underlined the importance of ethnicity and showed the difference in the amounts of human milk vitamin D [4]. It was discovered that the high levels of osteopontin in breast milk in Asian women are more frequent than in Danes, according to ethnic groups [5]. Therefore, changes in environment and living conditions could be considered as background contributors to nutrient composition in breast milk. Several studies have been conducted on evaluation of nutrient composition in breast milk in other parts of the world but assessment of nutritional composition of breast milk in poorly developed areas like in sub-urban and rural settlements have been poorly studied. Little or no work of such has been conducted in this part of the country (Port Harcourt). The aim of this study was to compare the nutrient composition of breast milk in postpartum women in urban and sub-urban areas in Port Harcourt.

2. MATERIALS AND METHODS

2.1Study Area

The research study was conducted at the Community Primary Healthcare facilities in Port Harcourt metropolis (Primary Healthcare Centre Orogbum and Primary Healthcare Centre Elelewon) and Eleme sub-urban (Model Health Centre Akpajo and Primary Healthcare Centre Nchia). Port Harcourt is the capital city of Rivers state and it is located in the south-south geopolitical zone of Nigeria.

2.2 Study Population

Based on research design, it was a cross-sectional study and population studied was breastfeeding mothers. Out of this population, 118 postpartum subjects participated in the study; 59 subjects were recruited from urban group and 59 subjects were recruited from the sub-urban area. Subjects between 0 and 10days of child delivery were recruited at the Postnatal Clinic for the study.

2.2.1 Inclusion criteria

The following are the inclusion criteria:

- Subjects registered with the clinic or hospital
- Subjects between 0 and 10 days of childbirth
- Subjects between the ages of 18 and 45
- Subjects that resided within Port Harcourt and Eleme

2.2.2 Exclusion criteria

The following are the exclusion criteria:

- Subjects not registered and managed by the clinic or hospital
- Subjects with impaired breast milk production

2.3 Sampling Method

All subjects who met the eligibility requirements and provided their written consent were recruited for the study. Port Harcourt is a metropolis and subjects recruited from this area were categorized as “urban group” while subjects recruited from Eleme area were categorized as

"suburban group". In a simple random sampling method, subjects were recruited. Subjects were asked to choose from a container having a numbering system of "0" and "1" and all subjects who picked "1" were selected and those who picked "0" were not selected [6,7].

2.4Specimen Collection

In this study, the manual breast pump technique or method was used in collecting breast milk from postpartum women [8]. In the collection room, the subjects were asked to partly undress in a manner that the breast was revealed and then the pump was applied to drain breast milk. After collection, the milk was transferred to an appropriate container for storage or immediate laboratory analysis.

2.5 Sample Analysis

2.5.1 Carbohydrates

2.5.1.1 By CLEG Anthrone method

A 25ml volumetrical flask has been weighed by 0.1g sample and a 62% perchloric acid by adding 1ml distilled water and 1.3ml, shaking for the whole 20 minutes to homogenize the sample. The bottle has been produced using distilled water and a stopper up to 25ml mark. The solution was filtered or allowed to settle and decant through glass filter paper. 1 ml of filtrate has been collected and placed in a 10ml test tube, it has been water distilled to volume.The pipette was put to a clean test tube with 1ml of solution and 5ml of anthrone reagent. Similarly, 1ml of distilled water was combined with 5 ML of anthrone reagent and the whole blend with 1ml of distilled water and 5ml of anthrone reagent read in blank form at 630nm of the wavelength. Lactose solution 0.1ml has also been developed and treated with anthrone reagent as a sample. The standard lactose absorption was read and the carbohydrate value was calculated using the following form.

Calculation;

$$\%CHO \text{ as lactose} = \frac{25 \times \text{absorbance of sample}}{\text{Absorbance of standard lactose} \times 1}$$

2.6 Nutrients Analysis (Protein) By Kjedahl Method

2.6.1 Stage 1: Digestion

The sample weighed 0.1g into a clean conical bottle of 250ml capacity, put 3g of digestive catalyst to the bottle and also added 20ml sulphuric acid, and heated for digestion. Content of the sky colouring from black to blue. The digest was refrigerated to room temperature with distilled water diluted to 100ml.

2.6.2 Stage 2: Distillation

Diluting the 20ml of a digest into a distillation fibre was measured and the flask was stored on the electrostatic or hot plate heater. A slim condenser linked to a receiver holding 2% boric acid indicator was attached to the distillation flask. A syringe connected to the steel head of the single-arm steel injects 40ml of sodium hydroxide into the digest till a strong digestive alkaline develops. The mixture was brought to boil and the ammonia gas was distilled into the beaker via the condenser. The colour, when the ammonia distillate was added into boric acid, changed from purple to greenish.

2.6.3 Stage 3: Titration

The distillate has been titrated from greenish using the standard solutions for hydrochloric acid 0.1N. This change was recorded as a titre value by the volume of hydrochloric acid added.

Calculation;

$$\%\text{ crude protein} = \frac{\text{titer value} \times 1.4 \times 100 \times 100}{1000 \times 20 \times 0.1}$$

Where;

Titer value = volume of HCl used in titrating the ammonium distillate
1.4 =nitrogen equivalent to the normality of HCl used in the titration 0.1N
100 = the total volume of digest dilution
100= percentage factor
1000 = conversion factor from gram to milligram
20= integral volume of digests analyzed or distilled
0.1 = the weight of sample in gram digested

2.7 Lipid

2.7.1 By soxhelt extraction method

2.7.1.1 Procedure

In a filter paper, 2g of the material was placed in an extractor soxhlet. A weighted dry distillation flask was put in the extractor. Then the distillation flask was inserted through the

condenser end connected to the extractor of the soxhlet (acetone). The installation was conducted using a stand clamp. Cooled water jet could flow into the condenser, which resulted in the refluxation of the heated solvent. The lipid was removed via continuous refluxation in the solvent chamber. The flask was then fully dried in the air oven and weighed again, to get the weight of the lipid, when the lipid was removed from the test sample, the condenser, the extractor and the solvent were detached and evaporated for lipid concentration.

Calculation;

% lipid = (Weight of flask and extract of empty flask - weight of empty flask / Weight of sample extracted1) x 100

2.8Statistical Analysis

Data collected were recorded in Microsoft Excel spreadsheet and were analyzed using SPSS 21.0. Descriptive statistics was done, such as the mean and standard deviation to determine the central tendency and the measure of spread of each variable. T-test was also done to determine if there was a significant difference in the means of the groups (urban group and sub-urban group). The level of statistical significance was set at p <0 .05.

3. RESULTS

In comparing macronutrients (carbohydrate, protein and lipid), two groups were considered (urban and sub-urban groups) as shown in Table 1. In urban group, carbohydrate level was 6.1±0.5% and 5.0±0.1% in sub-urban group (T-value = 2.2; P-value <0.05). In urban group, protein level was 3.5±0.6% and 3.9±0.3% in sub-urban group (T-value = 0.6; P-value >0.05).In urban group, lipid level was 2.4±0.3% and 3.8±1.1% in sub-urban group (T-value = 1.2; P-value >0.05).

4. DISCUSSION

In this study, two groups were considered within a postpartum period of 10days; the urban group had 59 participants and sub-urban group also had 59 participants of postpartum women with mean age of 35±5.0yrs and 28±3.0yrs respectively. Their breast milk samples were assayed to determine the variation or changes in nutrient composition between the two groups. Studies have reported that nutrient composition varies throughout the lactation period and over a single meal [9]. In this study on macronutrient composition in breast milk of lactating mothers, it was found that the carbohydrate level was higher in urban group than in the sub-urban group. The mean difference between the two groups was statistically significant. This implies that the breast milk of postpartum women in the urban

Table 1. Comparing the mean levels of carbohydrate, protein and lipid

Nutrients	Urban	Sub-urban	T-value	P-value	Remark
Carbohydrate (%)	6.1±0.5	5.0±0.1	2.2	0.04	Ss
Protein (%)	3.5±0.6	3.9±0.3	0.6	0.57	Ns
Lipid (%)	2.4±0.3	3.8±1.1	1.2	0.27	Ns

N = 59; SS = statistical significant

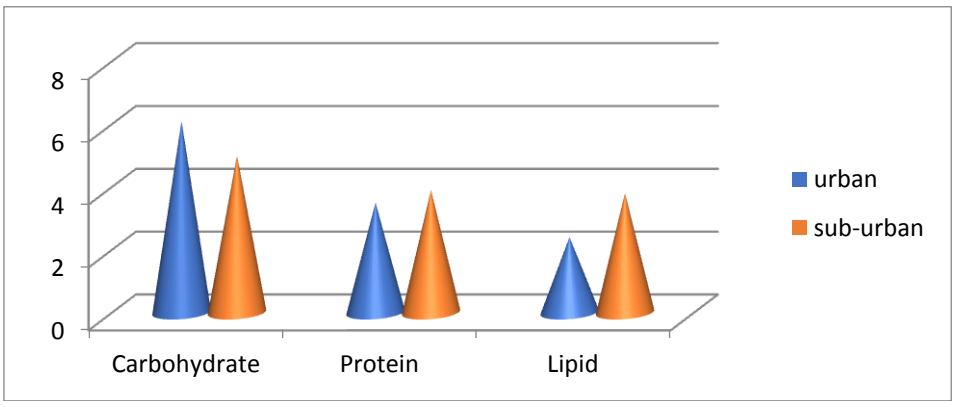

Fig. 1. Showing chart presentation of carbohydrate, protein and lipid

area had higher percentage of carbohydrates (6.1±05%). This difference between carbohydrate levels in both groups could be due to changes in lifestyle and feeding habits between both groups. Among all the nutrients assayed, carbohydrates was higher in percentage than others because in early breast milk, studies have reported that carbohydrate provides the main source of energy for the first 12 months, and as such the level of carbohydrate remains higher than other nutrients but declines after 12 months and lipid replaces it as the energy source. This study is in consonance with other studies pointing that carbohydrate has the highest level among other nutrient within the first 12 month [10]. This pattern was consistent in both groups (urban and sub-urban) studied: in the urban group, carbohydrate had the highest level (6.1±0.5%); protein (3.5±0.6%) and lipid (2.4±0.3%). Also in the sub-urban group carbohydrate had the highest level (5.0±0.1%), protein (3.9±0.3%) and lipid (2.8±1.1%). The mean difference in the protein levels between both groups was not statistically significant. The same applies to lipid; the difference in mean levels between both groups was not statistically significant.

5. CONCLUSION

This work has shown that nutrient composition in breast milk of postpartum women may not vary based on urban and sub-urban settlements except carbohydrate.

6. RECOMMENDATION

Changes may be significant in extreme settlements such as urban and rural but that was not within the focus of this study, therefore, studies may be required to look at changes in nutrients composition in urban and rural areas.

CONSENT AND ETHICAL APPROVAL

Ethical clearance for this study was obtained from the Ethics Committee, Rivers State Hospital Management Board. Informed written consent was also obtained from the subjects before recruiting subjects into the study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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