Original Research Article

Comparative Study of Heavy Metals in Breast Milk of Breast feeding Mothers in Urban and Sub-urban Subjects in Rivers State

Abstract

The breast milk is one fluid that could contain heavy metals and this can be dangerous to the health of breastfeeding. The increase in urbanization and industrialization often come with increased level of heavy metals in the environment especially in developing countries where environmental protection is poorly managed. The aim of this study was to compare the heavy metal composition in breast milk in postpartum women in urban and semi-urban areas in Port Harcourt.The study was conducted among 59 postpartum subjects between 0 and 10days of child delivery in each group. Sampling was done through a simple randomized system. Human breast milk was collected using a manual breast pump. Heavy metals; Lead (Pb), Cadmium (Cd) and Mercury (Hg) were assayed using atomic absorption spectrophotometer with their corresponding cathode lambs. Result revealed that there was no significant difference in the mean of the heavy metals assayed between both groups ($p>0.05$). This work has shown that nutrient and heavy metal composition in breast milk of postpartum women may not vary based on urban and sub-urban settlements.

Keywords: Breast milk, lead, cadmium, mercury, urban, sub-urban

1.0 Introduction

Along the food chain, breastfeeding babies are at the top since their nutrition source is from another human who is already classified at the top of the food chain. Hence contamination of the human breast milk is particularly of great concern to child's health.The concerns for environmental contamination in the breast milk should also be raised for the bottle feedings. There is no guarantee that the formula and other alternative food sources will reduce the exposure risk once the baby is weaned from breastfeeding. Additionally, infant formulas are

associated with the risk of eliminating the positive biopsycho-social development provided by the substances in breast milk protecting and developing the brain as well as those provided by the bond between the mother and the infant. Formulated infant milk could contain more heavy metals than the natural breast milk [1]. Cow's milk used for the production of infant formula may not only contain heavy metals, but also those substances referred to as lipophilic persistent organic pollutants. The use of fish-derived food products in the feeding of cows may be associated with much higher levels of contamination with Pb as well as the lipophilic organo-chloride pesticides in the cow's milk than in human breast milk [2]. Many studies have clearly documented the presence of much higher levels of Pb in infant formula than in breast milk. In addition, water used for diluting the formula may have been contaminated with heavy metals such as Hg and Pb [3]. Feeding bottles produced industrially in workplaces contaminated with toxic agents may also raise a risk of toxicity. The increase in urbanization and industrialization often come with increased level of heavy metals in the environment especially in developing countries where environmental protection is poorly managed. In recent times, studies have shown an increase in heavy metals level in the environment and the characteristic bioaccumulation tendency of heavy metals along the food chain [4,5,6]. The breast milk is one fluid that could contain heavy metals and this can be dangerous to the health of breastfeeding babies. [7]. Several studies have been conducted on the heavy metal composition in breast milkcomposition in breast milk in other parts of the world but 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 nutrients composition in breast milk in postpartum women in urban and semi-urban areas in Port Harcourt.

2.0 Materials and Methods

2.1 Study Area

The research study was conducted at clinics and hospitals in Port Harcourt and Eleme. 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

The study was conducted among postpartum subjects between 0 and 10days of child delivery. The subjects were recruited at the Postnatal Clinic.

Inclusion Criteria

The following are the inclusion criteria

- Subjects will be registered with the clinic or hospital
- Subjects between 0 and 10 days of childbirth
- Subjects attending postnatal clinic
- Subjects between the ages of 18 and 45
- Subjects must reside within Port Harcourt and Eleme

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 randomized method, samples were collected from subjects. 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. [8,9]

2.4 Specimen Collection

In this study, the manual breast pump technique or method was used in collecting breast milk from postpartum women. 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. After collection, the milk was transferred to an appropriate container for storage or immediate laboratory analysis.[10]

2.5 Sample Analysis

Methodology for Heavy Metals

Lead (Pb)

Procedure

The plumbing ion has been examined by a 283.3nm wave length atomic absorption sample [6]. A slit, air and acetylene gas flow have been modified to alter the waves length. Additional parameters were taken into account and controlled as suggested for the instrument. A sufficient time was allowed to stabilize the hallow cathode lamp before aspiring standards for calibrating equipment. The suction tube and system have been severely cleansed with water distilled before aspiration to a test sample solution for the standard test condition was achieved after calibrating the devices with standard lead concentrations.The plum ion concentration in the sample was further polarised from the conventional diagram of plum ion. The concentration of the equipment was indicated in mg/l and ppm, adjustments in selectable units were required.

Cadmium Ion

Air and acetylene gas have been adjusted for 229 nm wavelength. Other configurations for the hollow cathode gas instrument provided enough time to stabilize the spectrograph standard and were vacuumed and the result extrapolated from the standard graph.

Mercury (Hg)

Mercury detection, A total of 25 mL of the samples of milk were digested in a semi-closed glass digestive unit using 7 mL of HNO3 (Merck, Deutschland) and 7 mL of 30% hydrogen peroxide (Merck, H2O2). The volume was adjusted with ddH2O after cooling to 50 mL. Mercury was identified using a mercury/hydride (FIAS 4100, Perkins) weight hollow cathode mercury lamp, operated at wavelengths of 253.7 nm, in all digestationsutilising atomic spectrophotometry cold vapour absorption infection. For the determination of mercury, the quartz absorption cell was employed.

2.6 Statistical 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 $p < 0.05$.

Table 1: Comparing heavy metals zinc, lead and mercury

Heavy metal	*urban*	*Sub-urban*	*P-value*	*Remark*
Lead (mg/l)	0.15±0.1	0.07±0.1	0.28	Ns
Cadmium (mg/l)	0.1±0.03	0.0±0.0	0.36	Ns
Mercury (mg/l)	0.01±0.01	0.01±0.01	0.82	Ns

N=128

Ns= none significant

In urban group, Lead level was 0.15±0.1mg/l and 0.07±0.1mg/l in sub-urban group (T-value = 1.2; P-value <0.05). In urban group, Cadmium level was 0.1±0.03% and 0.0±0.0% in sub-urban group (T-value = 0.36; P-value <0.05). In urban group, Mercury level was 0.01±0.01% and 0.01±0.01% in sub-urban group (T-value = 0.82; P-value <0.05).

3.0 Result and Discussion

Lead is one of the heavy metal in nature and there are various sources of this metal in our environment, implying that persons can be exposed to lead toxicity from a variety of sources. The sources of lead in our environment include, automobile air, emissions, paint, gasoline, water distribution system, industrial wastes, lead-containing foods. In a study conducted by [6] reported high presence of lead in Port Harcourt and how the presence of lead in the environment bio-accumulated in the living organisms in the environment. Although quite a lot of people ranging from children to adults could be vulnerable to lead poisoning, but pregnant, lactating women and children are more at risk of lead poisoning. Breastfeeding mothers exposed to lead poisoning could have the lead cross into the breast which may pose more danger to both mother and child. In this study, it was revealed that lead was present in breast milk of lactating mothers in the urban area (Port Harcourt) and sub-urban area (Eleme) of Rivers State. The level of lead in breast milk of lactating mothers where higher in the urban area than in the sub-urban area with mean values of 0.15±0.1mg/l and 0.07±04mg/l respectively, although this difference in mean was not statistically significant. The increased level of industrial activities in the metropolis could be the cause of the mild increase of lead in breast milk of breastfeeding mothers in urban area while the reserve could be the case of the level of breastfeeding mothers in the sub-urban area. Reports have also showed that lead could cross from the mother's blood into the cord blood

and consequently affect the fetus, which will leave the child with a threatened health later in future. Owing to the level of lead in the breast milk, it could lead to transfer of lead to the breast-feeding child and pose a more future complication to the child's health.

Cadmium is a heavy metal with unknown physiological function in human. This means cadmium has no beneficial relevance in our body. The presence of cadmium in the body is believed to cause lots of toxic affect to the body organs due to loss of protein function as a result of the binding of cadmium to certain proteins in the body. In this study, cadmium was assayed in the breast milk of breastfeeding mothers in urban and sub-urban groups to ascertain the impact of the environment on cadmium composition in breast milk. The study showed that women in the urban group showed detectable level of cadmium (0.1±0.03mg/l). Women in the sub-urban group showed no detectable level of cadmium (0.0±0.0mg/l) however, this mean difference was not statistically significant. This implies that women in the urban area more at risk of cadmium toxicity than women in the sub-urban. This could be due to the increased industrial activities in the metropolis than in the sub-urban area. The major uses of cadmium are in pigment manufacturing, battery production, metal plating and plastic production. All of these activities are more situated in the metropolis than in the non-metropolitan areas of the state. Based on WHO limit (1ug/l), the mean cadmium level of subjects recruited in the urban area was way above the permissible limit. This is supported by a comprehensive review suggesting that the overall estimate of cadmium from many studies is 5.38ug/l [11]. This could be due to the increased black sooth phenomenon in Port Harcourt. Cadmium is associated with smoking, thus inhalation of polluted air by virtue of smoking or industrial activities may have contributed to the increased cadmium in breast milk.

In this study mercury was measured in the breast milk of postpartum women in urban and sub-urban areas in Rivers State. Results from the urban group revealed similar result with that of the suburban group 0.01±0.01mg/l. Although these values are low, as compared to the reference values in other biofluid like blood (0-60mg/l), mercury in breast milk could still pose toxicity threat to the new born baby whose body organs are still developing and as such vulnerable to toxicity effect, more so, when mercury has no known biological function in human.

Conclusion

This work has shown that nutrient and heavy metal composition in breast milk of postpartum women may not vary based on urban and sub-urban settlements. Studies are encouraged to focus on comparing heavy metals in breast milk between urban and rural settlements.

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