

Fluoride Levels of Mothers' Breast Milk in Egypt

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Abstract

Introduction: Fluoride exists naturally in water sources and is derived from fluorine. It is well known that fluoride helps, prevent and even reverse the early stages of tooth decay.

Aim: The aim of the present study was to determine the fluoride levels in plasma and breast milk of lactating mothers in Egypt (Cairo and Giza Governorate).

Material and Methods: Two hundred healthy lactating mothers aged between 20-40 years old were asked to give plasma and milk samples voluntary. Breast milk samples were directly refrigerated until measurements. The fluoride concentrations of plasma, milk and drinking tap water were assessed using an ion-selective fluoride electrode combined with an ion analyzer.

Results: The fluoride levels of plasma, breast milk and drinking tap water samples were 0.0207 ± 0.012 , 0.0111 ± 0.0044 ppm, and 0.482 ± 0.117 ppm, respectively. A significant direct correlation between fluoride content in breast milk and drinking tap water was found ($r=0.858$, $p < 0.01$).

Key words: Breast milk; Fluoride; Tap water

Introduction

Breast milk is considered to be the best nutrient for infants (universal food for new born) especially in the first six months of life, where milk is considered as the main diet (contains all of the essential nutrients for their development and growth). After 6 month of age, the dietary importance of milk gradually changes due to supplementation of other foods. In Egypt, there are several trials and programs trying to increase the trend to breast feeding, and is growing high. Most children are fed with breast milk which is a natural human product and cost nothing especially for poor families, and it does not need any preparation (**Egypt; Demographic and Health Surveys [EDHS], 2004, 2006, and 2008**). The level of fluoride in breast milk plays an important role as a fluoride supplement to the infant. Fluoride is the most clinically medicine used for reducing dental caries. The concentration of fluoride is critical regarding the potential dental fluorosis that may result from high concentrations of dietary fluoride (**Ekstrand et al., 1994**). Dental caries in young children is an important dental health problem. Source of fluoride is from various foods; drinking water and fluoride containing products comprising dentifrices,

mouth rinses, tablets, drops () but fluoride containing products are not commonly used by infants (≤ 2 years)

here in Egypt. Regarding infants, the major dietary intake constitutes the breast milk, cow's milk and infant milk formulations, in which the fluoride content varies widely (**Buzalaf et al., 2004; and Rahul et al., 2003**). Approximately 99% of the total body fluoride is retained in bones and teeth (**Whitford 1996**). Kidneys are the primary route for the removal of fluoride from the body. Other routes of fluoride excretion are sweat, feces, saliva and breast milk of lactating mothers (**WHO 1994; and Usuda et al., 2007**).

Materials and methods

This study has been approved by the ethical committee of General organization for teaching hospitals and institutes.

Two hundred mothers aged between 20-40 years old were included in the study. Mothers who take fluoride supplements were excluded (which is very rare here in Egypt). Milk was collected from lactating mothers. For milk samples, the breast was swabbed with cotton wool and distilled water before

milk collection. The mothers were requested to provide a sample of breast milk according to **Marsha (2002)**. Milk was collected into a sterilized fluoride-free container. Milk was stored at -18°C until analyses. To determine fluoride concentrations an ion-selective electrode (Model 710A, pH/ISE meter, Orion Research, USA) was used in conjunction with an ion analyzer (Orion Research, USA) to measure the fluoride concentrations of the plasma, breast milk and tap waters samples according to **Whitford (1996)**; **Taves (1968)**; **Waterhouse et al., 1980**.

STATISTICAL ANALYSIS

The data were analyzed using the SPSS software, version 11.0. Pearson correlation analysis was used to assess any possible relationship between fluoride levels of plasma, tap water and breast milk.

Results

The concentrations of fluoride in plasma, breast milk, and drinking tap water are presented in Table 1. The mean fluoride concentration of the plasma, breast milk, drinking tap water samples was 0.0207 ± 0.012 ; 0.0111 ± 0.0044 ppm, and 0.482 ± 117 ppm, respectively. A significant, direct correlation between fluoride concentration of breast milk, and drinking tap water samples were found ($r=0.858$) and a direct correlation between fluoride concentration of breast milk, and plasma were found ($r=0.541$).

Discussion

Breast-feeding protects the newborn against infectious diseases in developing as well as in developed countries. Breast-feeding gives protection against gastrointestinal and respiratory tract diseases. This protection is provided by specific antibody dependent and broad, nonspecific protective factors in human milk (proteins, glycoproteins, and lipids), **which is** associated with lower global morbidity and mortality of breast-fed infants. Breast milk possesses unique nutritional, biochemical, anti-infective and anti-allergic properties. As breast-fed infants obtain fluids almost exclusively from their mothers, breast milk represents an important way for delivering fluoride with certain levels to infants (**Latifah and Razak 1989**). The Exclusive breastfeeding (% of children under 6 months who are fed breast milk alone) in Egypt was reported to be 53.20 % in 2008,

according to the World Bank compared to 30% in 2004, and $< 40\%$ in 2006 (**Egypt; Demographic and Health Surveys, 2004, 2006 and 2008**).

The mean level of fluoride in human milk has been a topic of investigation for many years. Medical literature contains a wide range for fluoride levels in breast milk. According to the **WHO 2002**, the breast milk fluoride levels range from <0.002 to about 0.1 ppm, with most values being between 0.005-0.010 ppm. The mean breast milk fluoride concentrations obtained here is (0.0111 ± 0.0044 ppm) which are in line to somewhat with the **WHO 2002**.

The mean level of fluoride in drinking tap water is 0.482 ± 0.117 which agree with Egyptian Standards, ES: 190-1/2007 which stated that allowable maximum level of fluoride is 1.8 mg/l (ppm). A significant, direct correlation between fluoride concentration of breast milk, and drinking tap water samples, consumed by the mothers, were found ($r=0.858$) which agree with **Dabeka et al., 1986** and disagree with **Spak et al., 1983**.

In our study, a direct correlation was found between plasma fluoride concentration and breast milk fluoride level i. e. plasma fluoride concentration increase as fluoride level in breast milk increase. This increase is attenuated due to distribution of F to the interstitial and intracellular fluid uptake by calcified tissues and renal excretion (**Whitford 1996**).

In our study Fluoride level of plasma was 0.0207 ± 0.012 (range: 0.0065-0.057) ppm which agree to somewhat with **WHO 2002**; and **Yağmur et al., 2007** and disagree with **Li et al., 1995**. The diversity of values may be due to the participation of fasting as well as non fasting participants; methods used to determine F level; F level of drinking tap water consumed by the participants (**WHO 2002**).

Theoretically, a limited transfer of fluoride from plasma to breast milk should occur (**Ekstrand et al., 1981**). The mechanism(s) responsible for the selective transfer of fluoride into breast tissue is obscure. It is thought that a physiological plasma-milk barrier functions against to fluoride (**Fejerskov et al., 1996**). The transportation of fluoride from plasma to milk is a matter of controversy, since no conclusive evidence to support occurrence of transportation or not. (**Ekstrand et al., 1981**; and **Spak et al., 1983**).

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Table (1): Mean fluoride concentration of breast milk, and drinking tap water samples (ppm)				
Fluoride (ppm)				
		Plasma	Breast milk	drinking tap water
Mean±SEM		0.0207±0.012	0.0111±0.0044	0.482±0.117
Range	Min	0.0065	0.002	0.26
	Max	0.057	0.017	0.77
Correlation		r=0.858, p≤0.01		
		r=0.541, p≤0.05		

محتوى لبن الام من الفلوريد في مصر

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1: المعهد القومي للتغذية، 2: هيئة الطاقة النووية

مقدمة: الفلوريد موجود بشكل طبيعي في مصادر المياه ومستمد من الفلورين. من المعروف جدا أن الفلوريد: يساعد، يمنع، ويعكس المراحل المبكرة من تسوس الأسنان.

الهدف: الهدف من هذه الدراسة هو تحديد مستويات الفلوريد في البلازما و حليب ثدي الأمهات المرضعات في مصر (القاهرة ومحافظه الجيزة).

المواد والطرق: تم اختيار مائتين من الأمهات المرضعات الاصحاء الذين تتراوح أعمارهم بين 20-40 سنة للتطوع. و قد تم اسئذانهم في إخذ عينة دم (و تم فصل البلازما و حفظها لحين التحليل) واللبن و كذلك عينة من الماء طواعية. كان يتم حفظ عينات اللبن مجمدة حتى التحليل. تم تقدير نسبة الفلوريد في البلازما واللبن و مياه شرب الحنفية باستخدام الكترود انتقائية (أيون فلوريد) مقترنة بمحلل أيون.

النتائج: كانت مستويات فلوريد البلازما، حليب الثدي و مياه شرب الحنفية كالتالي 0.012 ± 0.0207 ، 0.0044 ± 0.011 جزء من المليون، و 0.117 ± 0.482 جزء من المليون، على التوالي. وجد ارتباط مباشر ذو دلالة احصائية بين نسبة الفلوريد في حليب الثدي و مياه شرب الحنفية ($r = 0.858, P < 0.01$)

الكلمات الرئيسية: الثدي الحليب؛ فلوريد؛ مياه الحنفية