

Fluoride levels in breast milk and infant foods

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The aim of the present study is to determine the fluoride concentrations of breast milk, several milk formulations, cow's milk and yogurt shake in a nonfluoridated area, in order to estimate the fluoride intake of infants and evaluate fluoride supplementation suggestions. Breast milk samples were collected from 57 lactating mothers. Ten brands of milk formulations, 9 different brands of cow's milk and 3 brands of yogurt shake were purchased from the market. Fluoride concentrations of the samples were analyzed using a specific fluoride electrode. The average fluoride level was 0.019 ± 0.004 ppm in breast milk, 0.022 ± 0.007 ppm in cow's milk and 0.022 ± 0.003 ppm in yogurt shake. Fluoride levels of milk formulations prepared by distilled water were ranging between 0.118 to 0.021 ppm. It is concluded that in non-fluoridated areas, fluoride intake of infants from the above sources is not very high and fluoride supplements may be prescribed.

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INTRODUCTION

Fluoride has a significant effect on prevention of dental caries and fluoride supplements have been proven to cause caries reductions in children living sub-optimally fluoridated areas. The effectiveness of prenatal fluoride exposure is still being questioned today where; clinical and statistical evidence to support the benefit of prenatal fluoridation is inconclusive.¹⁻⁴ The best effect is achieved if fluoride is available from birth, but about 85% of the greatest reduction are obtained when fluoride consumption starts between ages 3 and 4. In high caries susceptible surfaces, pre-eruptive fluoride is more effective whereas post-eruptive fluoride is effective on low caries susceptible surfaces such as smooth surfaces of the tooth. In high-risk groups, pre-eruptive fluoride is capable of increasing the topical fluoride effect significantly.¹⁻⁵

Recent reports have continued to suggest an association between fluoride supplementation and enamel fluo-

rosis. However, in high-risk groups, it seems necessary to take the advantage, on individual basis, the caries reduction benefit of pre-eruptive fluoride that exceeds the disadvantage of the chance of slight fluorosis.^{1,5-10}

The objective of any systemic fluoride administration is to obtain the maximum caries preventive effect with a low risk of fluorosis. The studies consistently concluded that a caries preventive effect of about 60% was found in the primary dentition when the initial age of fluoride supplementation was 2 years or younger.^{2,3,10}

It is essential to provide adequate amount of fluoride during the mineralization period of teeth.^{1-5,10} There has been controversy about giving fluoride supplements to infants younger than 6 months of age when there is practically no fluoride in the water supplies. Authors recommended that no fluoride supplements be given to infants with exception of breast fed babies.^{8,11} Therefore, it is important to point out that the fluoride intake in the first year of life in order to prescribe fluoride supplements. The aim of the present study is to determine the fluoride concentrations of breast milk and several milk formulations and cows' milk and yogurt shake in a non-fluoridated area, in order to estimate the fluoride intake of infants and evaluate fluoride supplementation suggestions.

MATERIALS AND METHOD

Breast milk samples

Milk samples were collected from 57 lactating mothers about 4 or 5 days after delivery. The subjects were all living in Izmir and the surrounding areas where public water contained approximately 0.3ppm fluoride. The mothers were not using fluoride supplements or any

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drugs other than iron and multivitamin preparations (without fluoride) during pregnancy.

The breast was swabbed with cotton wool and distilled water before collection. The mother gently pressed the breast or used a breast pump to collect 15-20 ml of milk into the plastic tubes. All samples were frozen immediately after collection and stored until determination.

Milk formulation samples

Samples of milk formulations in the market were purchased (Table 1). They were prepared according to the instructions of the manufacturer with distilled water. All samples were thoroughly mixed using stirrers for 15 minutes and only plastic laboratory equipment is being used throughout the study.

Table 1. Milk formulations tested are presented with manufacturer name and country

PRODUCT NAME	MANUFACTURER	COUNTRY
Almiron	N.V. Nutricia Zoetemeer	Netherlands
Humana 1	Milchwerke Westfalen	Germany
Humana HN	Milchwerke Westfalen	Germany
Nutrilon 1	N.V. Nutricia Zoetemeer	Netherlands
Nutrilon forte	N.V. Nutricia Zoeteineer	Netherlands
Nutrilon LF	N.V. Nutricia Zoetemeer	Netherlands
Nutrilon soya	N.V. Nutricia Zoetemeer	Netherlands
SMA H	Wyeth Nutrition	France
SMA S-26	Wyeth Nutrition	France
Starmil	Wyeth Nutrition	France

Cow's milk samples

Nine samples of cow's milk and 3 brands of yogurt shake, which is a popular drink in this country, were bought from the markets. Yogurt shake is a milk product that is made from yogurt, water and salt.

Fluoride measurements

The fluoride concentrations of the samples were analyzed using a specific fluoride electrode (Model 96-09, Orion Research, USA). The electrode was calibrated according to the recommendations of the manufacturer before each two-hour session of analysis using appropriate fluoride standards.

Fluoride concentrations were determined by adding equal volume of buffering solution, TISABII (Cat. No. 940909, Orion Research, USA) to the sam-

ples, ensuring that the breast milk thawed and the milk formulations cooled down to room temperature. All samples were stirred using magnetic stirrers through the measurements.

RESULTS

Fluoride concentrations in 57 lactating mothers were ranging between 0.005ppm and 0.025ppm. The average fluoride level in breast milk was 0.019±0.004 ppm. Almost sixty-five percent (64.91%) of the mothers were drinking tap water from the city supply, whereas, 35.09% were buying the drinking water from the market. In a previous study, the fluoride levels in the city supply and bottled water in Izmir were detected as lower than the optimal level.¹²

Fluoride concentrations of various milk formulations prepared with distilled water are presented in Table 2.

Fluoride concentrations of cow's milk and yogurt shake that are purchased from the market are seen in Table 3. Average fluoride concentration of cow's milk was 0.022±0.007 ppm and of yogurt shake was 0.022±0.003 ppm.

Table 2. Fluoride content of milk formulations prepared by distilled water (ppm).

PRODUCT NAME	FLUORIDE CONTENT (PPM)
Humana 1	0.025
Stannil	0.025
Humana HN	0.026
Nutrilon soya	0.027
Almiron	0.014

Table 3. Flouride content of cow's milk and yogurt shake samples (ppm).

COW'S MILK (Brands name)	FLOURIDE CONTENT (PPM)
Mis	0.017
Pinar	0.013
SEK	0.015
Sütaş	0.014
Tansaş	0.077
Pinar Light	0.013
Mis Ca Plus	0.010
Nestle for Kids	0.021
Nestle for Mothers	0.014
YOGURT SHAKE (Brand names)	
Mis	0.017
Pinar	0.027
Eker	0.021

DISCUSSION

Fluoride is a nutrient beneficial to dental health. Although all foods contain at least traces of fluoride, fluoride in water is the most important source for humans. For temperate climates the optimal fluoride level in water supplies for reduction of dental caries without causing fluorosis is 1ppm.^{1,2,11} For infants and young children, the fluoride intake from water with 1ppm fluoride would be equivalent to 0.5 to 1mg of fluoride per day because they may drink 2 to 4 glasses of water daily.¹

Studies have quoted low levels of fluoride in mother's milk whether the mother is living in fluoridated or non-fluoridated area.^{1,13-18} The mother, who is drinking fluoridated water, does not secrete milk of the same fluoride concentration as in the drinking water, but the fluoride content in the mother's milk reflects the plasma level.^{13,18} The results of this study is an agreement with that of previous studies with a very low fluoride level (0.019 ± 0.004 ppm). Because breast fed infants usually consume little or no water, they could only receive very low levels of fluoride. Assuming that an infant consumes about an average of 600ml of mothers' milk per day, then the infant would take 0.0114mg fluoride daily in our region. In 6 months of only breast feeding period, it may seem necessarily to give fluoride supplements. WHO suggests 0.25mg of fluoride for children less than 2 years of age in regions with less than 0.3ppm fluoride in drinking water.^{2,3,13}

Authors reported a wide range in fluoride content of milk-based formulas and recommended that no fluoride supplements be given to infants less than 6 months of age unless they are breast-fed. Studies stated that these wide ranges of variations in ppm of fluoride of different brands of milk formulations reflect the fluoride levels where the products were manufactured.¹⁹⁻²³ Fluoride content of several milk formulations showed variations in our study. These findings show the inherited fluoride in the formulation, which may increase with the fluoride content of the water used in preparing. Manufacturers should include fluoride content on labels of the milk formulations and should state that the addition of fluoridated water will effect the fluoride content as well.

Due to economic disadvantages of low socioeconomic status, when feeding the infant with breast milk it is impossible cow's milk is used rather than milk formulations for feeding.^{19,23,24} Fluoride concentrations in cow's milk has been reported to vary with fluoride levels of the drinking water, but was found to be in the range of 0.03-0.06 ppm.²⁴ Similarly, the findings of our study suggest a low level of fluoride in cow's milk ranging between 0.01 to 0.07 ppm.

Yogurt is a very popular baby food in our country. Sometimes, yogurt shake that is prepared by yogurt, water and salt is given to infants as a milk product. Low levels of fluoride is determined for different brands of

yogurt shake in the present study as well. The average fluoride level of the yogurt shake was similar to that of the cow's milk.

Based on the above results, it is concluded that the fluoride intake differs according to the feeding regime of the infant. Low levels of fluoride are consumed when the infant is breast-fed. The fluoride intake might be higher for the babies, who are bottle fed showing variations according the water used in preparing. However, in non-fluoridated areas infant's fluoride intake is not very high and fluoride supplements may be prescribed.

Vlachou *et al.*²⁰ suggested analysis of locally used baby and infant foods is needed before recommending fluoride. Babies should be considered on individual basis, taking socioeconomic factors as well as the dietary facts into account. The way the mother prepares the formula, the weight of the infant, the amount of water consumed according to the climate should be considered in prescribing fluoride supplements. Frequent contact with the mother to ascertain changes in feeding habits is necessarily as well.

The schedule for infants to 2 years olds was reduced to 0.25mgF/day from 0.5mgF/day due to reports of fluorosis.¹⁻³ Body weight is also implicated in fluorosis. So for infants in non-fluoridated areas, fluoride could be prescribed according to age and body weight. Fluoride supplementation requires a high degree of subject cooperation and disadvantage of uncontrolled fluoride uptake. Although not in our country, fluoride supplements available with vitamins could be easily given to infants rather than a fluoride tablet or drop alone. Fluoride vitamin combinations would facilitate administration and provide definite caries benefits.³ If evidence for routine vitamin and mineral supplementation in properly nourished normal children is insufficient then fluoride in combination with vitamin D which is essential for the first year could be prescribed.

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