

Assessment of fluoride in mothers milk and its relationship with food consumption habits, fluoride levels in Hamadan in 2016-2017

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Abstract

Background: The aim of current survey is to determine the relationship between maternal diet and fluoride level in breast milk.

Materials and Methods: 6 cc of breast milk samples in polyethylene tube were collected from 113 lactating healthy women. Concentrations of fluoride were analyzed using Ion-selective electrode system. Then information on personal characteristics and maternal diet was collected by questionnaires. The relationship between individual characteristics and maternal diet with fluoride level in breast milk was determined by statistical analysis and SPSS 21.

Results: There was significant relationship between Fluoride Level in breast milk with number of child, Month of lactation, type of tea, Bony meat juice, cow liver, and fish ($p < 0.05$). While There was no significant relationship between Fluoride Level in breast milk with mother age, mother employment, Type and amount of drinking water and Dairy consumption type ($p > 0.05$).

Conclusions: mother's diet can affect the amount of fluoride in breast milk, so dietary counseling for lactating mothers with special emphasis on the use of fluoride-rich foods for better growth of infants and prevent future dental caries is recommended.

Keywords: breast milk, fluoride, maternal diet.

Introduction

Dental caries is the most common bacterial diseases that generally caused by streptococcus mutans as the main and the most disease-generating microorganism (1). Early childhood caries (ECC) is a general health problem affecting children during infancy and before age of school (2). correct pregnancy diet and nutrition of infants after birth, like consumption of milk and dairy products, meat, vegetables, fruits, cereals and sufficient amounts of vitamins (A, B, C, D and E) and calcium in addition to consuming fluoride raise teeth resistance against caries (3). Fluoride intake during development of teeth and before their eruption, aids to decrease the rate of dental caries processes (4). Fluoride is a natural element available

almost in all types of drinking water and soil (5) and also in the form of mineral salts. However, the measurement of its ionic form is an important factor in human health studies (6).

As Fluoride is accumulated in the hard tissues ,it plays a vital role in the mineralization of bones and teeth(7) so frequent use of this element plays, undoubtedly, an important role in preventing dental caries in children and adults(8) Milk is the only food source of newborns during the first six months of their life. Although consuming other dietary supplements is initiated after milk, according to physicians, however, milk still remains the main nutritional source of infants.(2)

There is a close relationship between dental fluorosis and the amount of absorbed fluoride during teeth development period (9). The incidence and prevalence of dental caries has been significantly reduced in recent decades due to the wide use of fluoride. However, the increased prevalence of dental fluorosis has been reported in both fluoridated and no-fluoridated communities at the same time (10). In 2012 Ghada et al. evaluated the fluoride level of mothers' breast milk. They concluded that there is a significant relationship between the fluoride concentration of mothers' milk and their drinking water (11). A systematic review in 2009 suggested that consuming infant formula may be associated with the increased risk of some identifiable levels of dental fluorosis (enamel)(12). In 2003, Rahul et al. compared fluoride concentration of mothers' milk, cow milk and infant formula in India. They showed that there is a little amount of fluoride in human and cow milk while it was below optimum level in water(13) . The aim of this study is to evaluate the relationship between the frequency of consuming fluoride-contained food and the fluoride level of mothers' breast milk among Hamadani females in 2016.

Materials and Methods

This is a cross-sectional study with conventional randomized multi-stage sampling. In the first stage, 10 health centers were randomly selected among total health centers of Hamadan. In the second stage, the list of families with suckling babies was provided and some breastfeeding mothers were selected in random. They were initially screened and evaluated in terms of inclusion criteria and finally 113 mothers were included in the study. This study used FFQ questionnaire in two parts. The first part covers demographic and personal information and the second one deals with nutrition type associated with fluoride-contained foods. This study adopted content validity. To this end, the questionnaire was submitted to 3 pediatric dentists, a community dentist and a nutrition specialist and final corrections were made on the questionnaire according to their comments. To assess the reliability of the questionnaire, 30 cases of the study population were assessed by the questionnaire as the pilot group and the reliability of questionnaire was determined based on their answers to the items of the questionnaire and using re-test technique (two measurements with an interval of one week) and the reliability was calculated to be 0.68.

Exclusion criteria were as follows: Any systemic condition making cases follow a special diet including diabetes, hypertension, gallstone, blood fat (cholesterol and triglyceride), consuming any fluoride supplement during the last month(11), chronic kidney disease (14), consuming calcium supplement or/and aluminum-contained anti-acids (11). The collected samples(mothers' breast milk) were sealed by Paraffin within poly-ethylene tubes and fluoride level was measured three times by ion selective electrode model Ino Lab 740, Germany (WTW) equipped with fluoride ion measuring electrode .When device indicator remained fixed, the fluoride level of that

sample was recorded (ppm). And data was analyzed using SPSS 21.

Results

Table 1 shows the descriptive statistics of breastfeeding mothers in terms of their demographic and midwifery information.

Table 1: The descriptive statistics of breastfeeding mothers (N=113) in terms of demographic and midwifery information

Variable		Frequency	Percent
Age (year)	20-25	30	26.5
	26-30	56	49.6
	31-35	24	21.2
	>35	3	2.7
Employment	Unemployed (housewife)	3	2.7
	Employed	81	71.7
Education	Below diploma	16	14.2
	Diploma	64	56.6
	Over diploma	6	5.3
	B.S and higher levels	27	23.9
Delivery type	Natural	63	55.8
	Cesarean section	50	44.2
Child order	The first child	79	69.9
	The second child	27	23.9
	The third child	7	6.2
Breastfeeding month	Month 1	40	35.4
	Month 2	-	-
	Month 3	7	6.2
	Month 4	3	2.7
	Month 5	3	2.7
	Month 6 and above	60	53.1

Table 2 shows the descriptive statistics of mothers' distribution in terms of the type of consuming water and fluoride-contained food

Table 2: The descriptive statistics of mothers' distribution (N=113) in terms of consuming water and fluoride-contained food

Variable		Frequency	Percent
Consuming water	Water of water supply network	77	68.1
	Mineral water	17	15
	Boiled water	19	16.8
Water filtration device in home	Yes	7	6.2
	No	106	93.8
Consuming breastfeeding supplement (milk- increaser)	Yes	34	30.1
	No	79	69.9
Consuming herbal teas	Yes	27	23.9
	No	86	76.1
Tea type	Black tea (tea bag)	26	23
	Green tea (tea bag)	-	-
	Black tea (non-bagged)	84	74.3
	Green tea (non-bagged)	3	2.7
Consuming dairy products	Yes	113	100
	No	-	-
Type of dairy product	Pasteurized	70	61.9
	Home-made	43	38.1
	Total	113	100
Type of consumed fish	Canned fish	20	17.7
	Fresh fish	63	55.8
	No fish	30	26.5
	Total	113	100

Table 3 shows the descriptive statistics of the frequency of cases in terms of the frequency of consumed foods

Table 3: The descriptive statistics of the frequency of cases in terms of the frequency of consumed foods (percent)

Frequency Food	Never	Once every month	1-3 times every month	Once every week	2-4 times every week	5-6 times every week	Once every day	2-3 times every day	4-5 times every day	+6 times every day
Milk (glass)	-	2.7	-	5.3	2.7	6.2	31.9	51.3	-	-
Diluted yogurt (glass)	17.7	2.7	15	5.3	29.2	18.6	11.5	-	-	-
Yogurt (glass)	-	-	2.7	-	-	14.2	45.1	29.2	-	-
Butter, cream (spoon)	44.2	6.2	-	-	6.2	14.2	29.2	-	-	-
Cheese (30 grams)	2.7	-	-	-	6.2	10.6	74.3	6.2	-	-
Curd (spoon)	20.4	35.4	23.9	8	12.4	-	-	-	-	-
Fish (a small slice)	11.5	27.4	17.7	37.2	6.2	-	-	-	-	-
Tea (cup)	2.7	-	8	-	6.2	30.1	30.1	38.9	8	2.7
Cow liver (a medium-sized slice)	60.2	28.3	8.8	2.7	-	-	-	-	-	-
Iranian stew (with bone)	8.8	8.8	15	28.3	38.9	-	-	-	-	-
Cow or chicken bone soup	21.2	-	23.9	14.21	37.2	-	-	-	-	-
Daily water (glass)	-	-	-	-	-	-	-	8.8	14.2	77

Table 4 shows the mean and standard deviation of the fluoride level of Hamadani mothers' milk by child order, breastfeeding month, employment status, water type, tea type, consumed dairy products, the frequency of eating fish, Iranian stew with bone, cow liver, cow or chicken bone soup and daily drinking water.

Table 4: The mean and standard deviation of the fluoride level of Hamadani mothers' milk by child order, breastfeeding month, employment status, water type, tea type, consumed dairy products, frequency of eating fish, Iranian stew with bone, cow liver, cow or chicken bone soup and daily drinking water.

Fluoride (ppm)				
Variable		Number of respondents	Mean	Standard deviation
Children order	1	79	0.0062	0.002
	2	27	0.0060	0.003
	3	7	0.0040	0.000
Breastfeeding month	1	40	0.0055	0.0020
	2	-	-	-
	3	7	0.0050	0.000
	4	3	0.0070	0.000

	5	3	0.0020	0.000
	6 and above	60	0.0065	0.00258
Employment	Unemployed	81	0.0060	0.0022
	Employed	32	0.0057	0.0029
Water type	Water pipeline	77	0.0057	0.0027
	Mineral water	17	0.0066	0.0014
	Boiled water	19	0.0062	0.0017
Tea type	Black tea bag	26	0.0079	0.002
	Green tea bag	-	-	-
	Black tea (non-bagged)	84	0.0054	0.0022
	Green tea (non-bagged)	3	0.0040	0.0000
Type of dairy products	Pasteurized	70	0.0058	0.0025
	Home-made	43	0.0061	0.0022
Fish eating rate	Never	13	0.0045	0.0008
	Once every month	31	0.0055	0.0024
	1 to 3 times every month	20	0.0058	0.0029
	Once every week	42	0.0064	0.0023
	2 to 4 times every week	7	0.0080	0.0000
Iranian stew (with bone) eating frequency	Never	10	0.0089	0.0014
	Once every month	10	0.0033	0.0048
	1 to 3 times every month	17	0.0054	0.0079
	Once every week	32	0.0071	0.0027
	2 to 4 times every week	4	0.0052	0.0020
Cowl liver eating frequency	Never	68	0.0058	0.0025
	Once every month	32	0.0062	0.0023
	1 to 3 times every month	10	0.0068	0.0019
	Once every week	3	0.0030	0.0000

Cow or chicken bone soup	Never	24	0.0066	0.0026
	1 to 3 times per month	27	0.0045	0.0020
	Once every week	16	0.0067	0.0000
	2 to 4 times every week	42	0.0057	0.0014
	5 to 6 times every week	4	0.01	0.0026
Daily water drinking	2 to 3 times every day	10	0.0041	0.0024
	4 to 5 times every day	16	0.0060	
	6 times and more every day	87	0.0067	

According to linear regression results, milk supplement has a positive and significant effect on the fluoride level of mothers' milk ($B=0.001$ and $p<0.001$) while herbal tea ($p=0.036$ and $B=-0.002$) and water filtration device ($p=0.047$ and $B=-0.002$) has a negative effect on it. The evaluation of Pearson's correlation coefficient and frequency graph reveals that there is a relationship between age and fluoride level (table 5). It can be found from the regression line slope in the frequency graph that as mothers' age increases, the fluoride level of their milk decreases and vice versa (graph 1). The evaluation of

Table 5: Pearson correlation coefficient by mothers' age, frequency of fluoride-contained food intake and fluoride level in mothers' milk

Studied variable	Count	Pearson coefficient	Sig. level
age	113	-0.15	0.10
Fluoride level in mothers' milk	113		
Food intake frequency	113	+0.15	0.10
Fluoride level in mother' milk	113		

Pearson's correlation coefficient and frequency graph indicates that there is a relationship between food intake frequency and the fluoride level of mothers' milk. Again, it can be concluded from the regression line slope in the frequency graph that as food intake frequency increases, the fluoride level of mothers' milk increases and vice versa (graph 2).

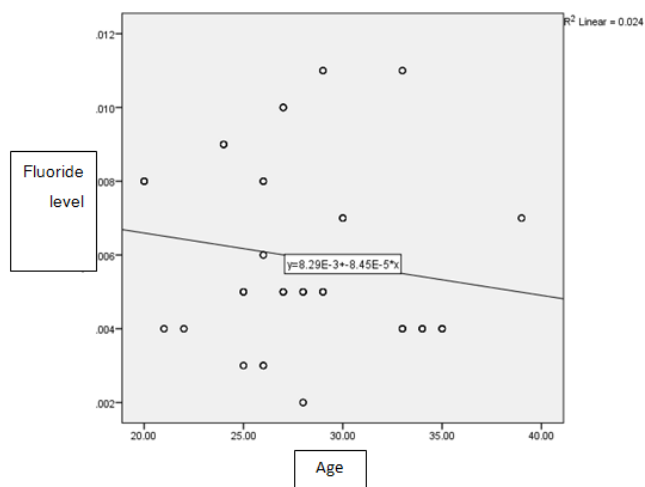


Fig. 1: Dispersion of age and fluoride level of mothers' milk

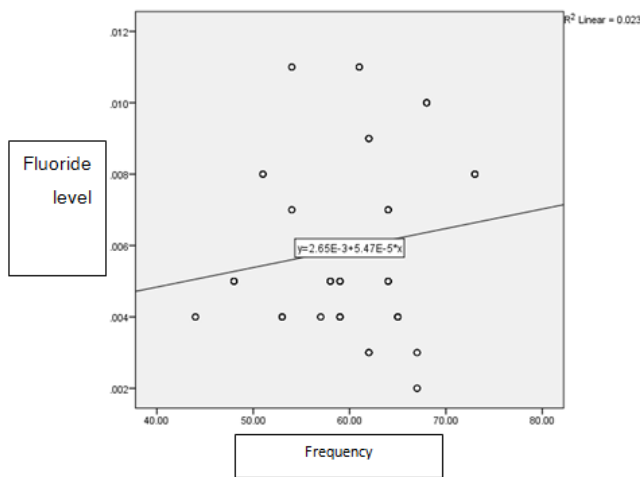


Fig. 2: Dispersion of food intake frequency and fluoride level of mothers' milk

Discussion

Mother's milk is an important indicator of providing newborns with a given level of fluoride(15). This is an epidemiologic, descriptive study with no intervention. The comparison of its reports about the concentration of fluoride in mothers' milk with those of other studies in different countries showed that the reported concentration in this study (0.0059 ppm) is lower than the mean fluoride concentration reported in Latife's study in Malaysia

(0.077 ppm)(15), Sener's study in Turkey (0.006)(16), Sumsak's study in Thailand (0.017)(17), Debka's study in Canada (0.0062) (18) and Ghada's study in Egypt (0.0207) (11). Such differences may occur due to different reasons including the difference in analysis techniques, doses of fluoride-contained supplements and differences in socio-economic conditions of studied sample. Another reason may be the fact that the cases of this study were fast while those of other studies were not (17-19). According to WHO, the standard level of mothers' milk fluoride is 5-10 µg/l (17) and this study reported the same range for fluoride level. There were no significant relationship between breastfeeding mothers' age and fluoride level. However, it can be suggested that as mothers' age increases, fluoride level decreases. Although there is no similar study on fluoride level, other studies on the other elements of mothers' milk including iron, zinc and copper showed that there is a significant inverse relationship between age and the level of these elements in mothers' milk(20). The majority of this study cases have only one child and a significant relationship was observed between children order and fluoride level so that cases that had previously one child, showed maximum fluoride in their milk. In addition, this study observed a significant relationship between breastfeeding month and fluoride level so that as breastfeeding month increases, fluoride level increases. This finding agrees with Etling et al. results. They evaluated ionic changes to sodium, potassium, calcium, magnesium and fluoride in 113 milk samples in the first month of breastfeeding and reported that the level of these ions increases over time (21). In this study, the fluoride level of Hamadianian mothers' milk did not change by employment status (p=0.195). In addition, the type and amount of consuming water had no relationship with fluoride level. This agrees with the results of Sumsak (17), Paulin (22) and Spak (23).

However, the studies of Iman (24), Sener et al. (16) and Debka (18) showed a relationship between fluoride level in mothers' milk and the content of drinking water, so that the higher the fluoride level of consuming water, the higher fluoride level in the milk of those mothers who drink that water. Regarding tea drinking and different tea types, this study obtained a significant relationship ($p < 0.001$) between drinking tea bags and fluoride level. These results confirm the results of previous studies on the elevated level of fluoride in black tea compared to green tea (25). The level of fluoride reported in this study show that the cases of this study do not receive sufficient level of fluoride. The results of two sampling stages showed that under a constant diet, the level of fluoride has no significant difference in mothers' milk ($p = 0.682$) compared to the first stage samples and it remains constant. According to observations, mothers' diet can affect fluoride level in their milk and consequently affect the fluoride level received by newborns. This agrees with the results of Dabeka et al (26) and Spak et al (27).

Conclusion

The concentration of fluoride in mothers' milk was obtained 0.0059 ± 0.0024 ppm, which agrees with the standard levels reported by WHO. The results of this study showed that Hamadani mothers with the same diet have the same fluoride level in their milk and there is a significant relationship between fluoride concentration and mothers' diet. Nevertheless, a study with more samples can provide more clear results. Breastfeeding mothers are suggested to receive diet consultation emphasizing fluoride-rich food in order to better grow suckling babies and to prevent their dental caries in future.

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