

RATE OF CONSUMPTION AND RECOMMENDATIONS OF FLUORIDE INTAKE IN EGYPT FROM DRINKING WATER AND THE EFFECT ON THE HEALTH OF CHILDREN AND ADULTS

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ABSTRACT

The present work aims to study the rate of consumption of fluoride in drinking water in Egypt to know the effect of this level in the health of children and adults. The fluoride concentration in water consumed by Egyptian population was determined to supply some of needed information related to fluorine in drinking water. Drinking water samples were collected monthly from twelve governorates in Egypt. The fluoride content in tap water (the origin is River Nile) from the ten governorates (Cairo, Giza, Kaliobia, Fayoum, Menia, Mansoura, Alexandria and Ismailia) ranged from 0.330 - 0.377 mg /L with an average of 0.36 mg /L, whereas the drinking water from Marsa - matrouh and Arish (the origin of water is wells) contained high levels of fluoride. The average value being 0.761 and 0.926 mg /L, respectively. Eight types of in-bottle water samples were purchased from Egyptian markets. The fluoride concentration was determined and the samples were divided into three groups, A,B and C according to fluoride concentration. Mean fluoride concentration were 0.18, 0.42 and 0.54 mg F/L for groups A,B, and C, respectively. The rate of consumption of fluoride from drinking water was calculated as 0.585, 0.675, 0.823, 1.08, 1.215, 1.147, 1.057, 0.900 and 0.810 mg daily for ages 1-2, 2-4, 4-6, 6-13, 13-19, 20-50, 50-59, 60-69 and 70-79 years, respectively. So, It is recommended to use drinking water (tap water) for all ages except children aged from 1-2 and 2-4 year, since the daily intake is higher than their daily need and can be subjected to a major risk after dental fluorosis, therefore, it is necessary to make dilution for the drinking water by using distilled water free from fluoride. The rate of consumption of fluoride of in - bottle water ranged from 0.292 to 0.607 for group A, 0.682 - 1.338 for group B and 0.877 - 1.822 mg daily for group C. However, for group A (0.18 mg /L), the fluoride intake was less than the daily needs for all ages, so they are subjected to dental caries while for group B (0.42 mg /L), the fluoride intake for ages 1-13 years is very high, so they are subjected to health problems at the long run. For adults, this level provides their daily need, and for group C (0.54 mg /L), the daily intake is very high for all ages, so it is not recommended to be used.

Key words: Health, Fluoride, Drinking water, In-bottle water

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(Received February 9, 2004)

(Accepted April 28, 2004)

INTRODUCTION

Dental caries being the most common dental disease, had driven the attention of most researchers all over the world to find different methods for its prevention (Newbrun, 1982 and 1992; EL- Sayed, 1989; Abd El-Latif, 1994 and El-Awamry *et al* 1998). Dental caries is a multifactorial disease. It occurs as a result of several factors that influence the occurrence and progress of this disease (Newbrun, 1982). Prevention of dental caries by fluoride is considered to be one of the most successful method in caries reduction (Dijkman *et al* 1986). Fluoride intake by human is a result of ingestion of water, food and inhalation of air containing fluoride (WHO, 1984).

Fluoridation of communal water supply has been proved to be the most economical practical and effective method for prevention of dental caries (Backer *et al* 1978; Kunzel, 1984 and Peter & James 1986). Water and food are the main sources of fluorine intake and the amount of fluorine absorbed by the body is related to the amount of water and type of food ingested by the individual (Osis, 1974 and Hattab & Wei, 1988). Because of the widespread distribution of fluoride in nature, it has not been possible to produce a diet that is completely deficient in this element, and its presence indicates some physiological importance to man (Waldbott, 1963). There is an inverse relationship between the fluoride concentration in drinking water and dental caries prevalence of the population (Stephen *et al* 1988). Fluoride concentration in the optimum amount ingested by individuals is beneficial to teeth and reduce the incidence of dental caries by up to 50%. In high doses there

can be injurious disturbing enamel formation and causing a condition known as mottled enamel (Stephen *et al* 1988). On communal basis, it was found that at fluoride level of about 1.0 ppm in drinking water optimum reduction in dental caries occurs with no significant mottling (Majer, 1970 and Murray, 1978). Numerous studies have shown that consumption of fluoride in community water supplies at levels recommended for optimal dental health has no harmful effect on humans. The toxic effects of fluoride can be classified as acute, due to a single ingestion of a large amount of fluoride, or chronic, due to long term ingestion of smaller amounts. The World Health Organization (WHO, 1984) has set a maximum concentration of 1.5 ppm fluoride in drinking water to avoid dental fluorosis. In united states, the optimal concentration of fluoride recommended for caries prevention is between 0.7 and 1.2 ppm, depending upon the annual average maximum daily air temperature in the community (WHO, 1984). The mechanism by which fluoride can decrease the incidence of dental caries can be summarized in the following:

- 1- Replacing the hydroxyl group of the hydroxyl apatite crystals present in the surface enamel by ionic exchange forming fluoroapatite which is less soluble in acids (Shafer *et al* 1963). Fluoride was credited with being the element responsible for the unique hardness of enamel (Glenn *et al* 1984).
- 2- Fluoride reduces the bacterial ability to ferment carbohydrates and to produce acids through its direct antimetabolic effect on plaque micro organism (Svanberg and Westergen, 1983).

- 3- Fluoride may also interfere with the action of bacterial enzymes in the breakdown of fermentable carbohydrates into organic acid (Eggen and Rolle, 1983).
- 4- Fluoride can interfere with the tendency of plaque to adhere to the tooth surface by decreasing its surface energy (Dejong *et al* 1984).
- 5- Fluoride has the ability to precipitate minerals from saturated solution, so it favours the precipitation of calcium phosphate from saliva on enamel surface. Thus, of acids in post eruptive maturation of enamel as well as in the remineralization of partially demineralized enamel in early caries (Joyston and Kidd, 1982).
- 6- Also, fluoride may alter the morphology of the teeth in areas with high fluoride ions content in its drinking water, the teeth in these areas are smaller in size with shallower fissure (Levine, 1976 and EL-Molla, 1991). The aim of this study is to determine the fluoride concentration in drinking water mainly consumed by Egyptian population to supply some of needed information related to fluorine in drinking water. Because there is an inverse relationship between the fluoride concentration in drinking water and the dental caries prevalence of the population. Since the normal concentration of fluoride makes the surface of the enamel smooth, glossy and has a pale creamy white color while the low concentration leads to dental caries, whereas the high concentration leads to harmful effect presented by four cases of enamel fluorosis ranging from very mild, mild, moderate and severe cases.

MATERIAL AND METHODS

I- Sampling

I-1-a. Drinking tap water

Samples of drinking water (the main source is the River Nile) were taken after allowing the water to flow for five minutes. One liter was taken in a plastic container previously washed with distilled water, dried in air and washed with the water of the samples. Four samples were collected monthly at the year 2002 starting from January till december, from each of 10 governorates: Cairo, Giza, Kaliobia, Fayoum, Menia, Mansoura, Alexandria, Ismailia, Suez and Port said (480 samples).

I-1-b. Drinking well water

Samples of drinking water (the main source is well water) were collected from Marsa - Matrouh and Arish and treated as previously mentioned in I -1-a (96 samples).

I-2. In - bottle water

Eight types of In-bottle water samples were purchased from local supermarket. Four samples from each type were collected monthly at the year 2002 starting from January till December (384 samples).

I-3. Distilled water

Samples of distilled water were used throughout the whole study as blank samples.

II. Determination of fluoride

Fluoride concentration in drinking water was determined as described by

(Standard method, 1984) using ATI ORION 960 (Ion meter) using fluoride ion selective electrode 96 -09 BN. The electrode filling solution and the total ionic strength adjustor, buffer solutions (TISAB) were prepared as described in the electrode instruction manual.

RESULTS AND DISCUSSION

1- Fluoride concentration in drinking water (Tap water)

Data obtained from analysis of fluoride concentrations of tap water is shown in Table (1). It is evident from these data that fluoride concentration of tap water obtained from 12 governorates of Egypt ranged from (0.333 to 0.377)mg / L with a mean of 0.36 mg / L except that of Marsa - matrouh and Arish were 0.761 and 0.926 mg/L, respectively. From the analysis of drinking water source through the 12 governorates of Egypt, it was observed that Cairo, Giza, Kaliobia, Fayoum, Menia, Mansoura, Alexandria, Ismailia, Suez and Port- said had nearly the same fluoride concentration. This is because the main source of water is the River Nile.

Nile water is a soft water, its contents of either metal ions or other anions is considerably low (Eid, 1981 and El-Sayed, 1989). Whereas the fluoride content of the tap water obtained from Marsa -matrouh and Arish were considerably high (0.761 and 0.926 mg / L, respectively. This is due to the fact that the main source of water in these locations are wells. Well's water is an underground water which contains high percentage of ions.

2- Fluoride concentration in In - bottle water

Table (2) shows the fluoride concentration in groups A, B and C of In - bottle water samples purchased from local supermarkets where fluoride concentration was 0.18 , 0.42 and 0.54 mg F/L for A,B and C, respectively.

3- Dosage schedule

Table (3) shows the recommended dosage schedule for fluoride supplementation at various ages and according to the drinking water fluoride content. This schedule may be adopted for liquid supplements or tablets. The American Dental Association suggested a dosage of 0.25 mg of fluoride daily for the period from birth to age of two years as possible satisfactory alternative, and a dosage of 0.5 mg of fluoride from two to four years of age and 0.75 mg of fluoride daily from four to six years of age and 1.0 mg of fluoride daily for more than six years of age. No fluoride supplement is needed if the water contains more than 0.7 ppm.

4- Optimal fluoride concentration and climatic conditions

Table (4) represents the amount of daily fluoride intake based on body weight and climatic conditions (Galagan and Vermillin, 1957 and Newbrun, 1972). There are large biologic variations in the amount of water ingested daily between individuals; however, the total fluoride intake is less variable, so it is necessary to determine the amount of fluoride that should be added to water.

Table 1. Fluoride concentration as mg/L in drinking water allover the year 2002 from 12 governorates of Egypt

Months Location	Jan.	Feb.	March	April	May	June	July	August	Sep.	Oct.	Nov.	Dec.	Average and Range
Cairo	0.340	0.338	0.336	0.333	0.340	0.342	0.345	0.335	0.332	0.322	0.326	0.310	0.333 0.310-0.345
Giza	0.378	0.372	0.376	0.353	0.356	0.351	0.380	0.368	0.362	0.359	0.350	0.356	0.363 0.350-0.380
Kaliobia	0.352	0.359	0.354	0.338	0.337	0.335	0.356	0.349	0.342	0.336	0.330	0.339	0.344 0.330-0.356
Fayoum	0.381	0.379	0.373	0.365	0.367	0.382	0.372	0.375	0.372	0.366	0.363	0.366	0.372 0.363-0.382
Menia	0.349	0.344	0.346	0.353	0.369	0.372	0.380	0.369	0.362	0.342	0.355	0.341	0.357 0.342-0.380
Mansoura	0.336	0.330	0.340	0.360	0.352	0.363	0.362	0.342	0.356	0.350	0.346	0.333	0.348 0.330-0.366
Alexandria	0.346	0.350	0.352	0.360	0.366	0.355	0.370	0.340	0.365	0.340	0.356	0.345	0.354 0.340-0.370
Ismailia	0.375	0.362	0.352	0.386	0.375	0.380	0.366	0.390	0.382	0.380	0.369	0.375	0.375 0.352-0.390
Suez	0.365	0.379	0.373	0.352	0.365	0.370	0.356	0.362	0.380	0.383	0.385	0.380	0.371 0.352-0.385
Port - Said	0.360	0.383	0.376	0.382	0.379	0.368	0.382	0.373	0.388	0.366	0.385	0.376	0.377 0.360-0.385
Marsa - Matrouh	0.790	0.789	0.785	0.795	0.793	0.705	0.710	0.709	0.702	0.785	0.782	0.796	0.761 0.710-0.785
Arish	0.915	0.925	0.933	0.919	0.936	0.936	0.919	0.940	0.928	0.932	0.919	0.912	0.926 0.912-0.940

Table 2. Fluoride concentration as mg/L in different mineral water all over the year 2002 in Egypt

Months Type	Jan.	Feb.	March	April	May	June	July	August	Sep.	Oct.	Nov.	Dec.	Average and Range
Group A	0.179	0.176	0.175	0.180	0.183	0.185	0.186	0.183	0.181	0.180	0.178	0.180	0.18 0.175 - 0.186
	0.183	0.180	0.177	0.179	0.177	0.182	0.181	0.178	0.176	0.184	0.185	0.180	0.18 0.176-0.185
	0.179	0.183	0.180	0.182	0.179	0.177	0.184	0.180	0.182	0.184	0.175	0.179	0.18 0.175 - 0.184
	0.182	0.179	0.173	0.179	0.183	0.180	0.182	0.185	0.180	0.182	0.178	0.178	0.18 0.173 - 0.185
Group B	0.430	0.425	0.416	0.422	0.416	0.423	0.424	0.426	0.420	0.417	0.413	0.420	0.42 0.413-0.430
	0.407	0.414	0.422	0.426	0.417	0.430	0.416	0.422	0.424	0.420	0.430	0.413	0.42 0.407 - 0.430
Group C	0.565	0.543	0.557	0.542	0.560	0.556	0.568	0.542	0.563	0.551	0.547	0.560	0.55 0.542 - 0.568
	0.542	0.531	0.536	0.530	0.546	0.531	0.517	0.519	0.510	0.542	0.530	0.534	0.53 0.510 - 0.546

Table 3. Recommended supplemental dosage schedule in mg F/ day according to fluoride concentration of drinking water*

Weight (Kg)	Age (years)	Concentration of fluoride in drinking water (ppm)		
		<0.3	0.3 to 0.7	>0.7
3.4 -12.4	Birth to 2	0.25	0	0
12.4 -16.4	2 to 4	0.50	0.25	0
16.4 - 21.5	4 to 6	0.75	0.50	0
21.5 - 45	6 -13	1.00	0.75	0
> 45	> 13	1.00	1.00	0

* The American Dental Association (1984) and the American Academy of Pediatrics (1979)

Table 4. The Relationship of optimal fluoride concentrations in drinking water and climatic conditions**

°C	°F	Recommended mg /L
< 18.3	<64.9	1.1 - 1.3
18.9 - 26.6	66.0 - 79.9	0.8 - 1.0
> 26.7	> 80.1	0.5 - 0.7

** From: Newbrun (1972)

5- Consumption of fluoride in drinking water (D.W) where the main source is the River Nile for children and adults

Water, naturally is the most important source of fluoride. The amount of fluoride intake from water is dependent on the fluoride content of water and on the amount of water consumed daily (Stephen *et al* 1988).

Table (5). shows the recommended dosage schedule for fluoride supplementation and the rate of consumption at various ages for children 1-13 years and adults more than 13 years according to the fluoride content of drinking water. The mean daily consumption of drinking water is 1625 mL for children aged 1 to 2 years, 1875 mL for children aged 2 to 4 years, 2258 mL for children aged 4 to 6 years and 3000 mL for children aged

Table 5. Consumption of fluoride in drinking water (D.W) main source is the River Nile in Egypt

Age (years)	• Recommended supplemental Dosage mg F/ day	** Daily amount of water (mL)		Fluoride concentration in D.W mg / L	Rate of consumption of fluoride in D.W (mg)		Daily amount of D.W diluted with distilled water to reach the recommended dosage
		Range	Mean		Range	Mean	
Children							
1-2	0.25	1300 - 1950	1625	0.36	0.468-0.702	0.585	931
2-4	0.50	1500-2250	1875	0.36	0.540-0.810	0.675	487
4-6	0.75	1830-2745	2258	0.36	0.659-0.988	0.823	-
6-13	1.00	2400-3600	3000	0.36	0.864-1.296	1.08	-
Adults							
13-19	1.00	2700-4050	3375	0.36	0.972-1.458	1.215	-
20-50	1.00	2550-3825	3188	0.36	0.918-1.377	1.147	-
50-59	1.00	2350-3525	2959	0.36	0.846-1.269	1.057	-
60-69	1.00	2000-3000	2500	0.36	0.720-1.080	0.900	-
70-79	1.00	1800-2700	2250	0.36	0.648-0.972	0.810	-

•The American Dental Association (1984) and The American Academy of Pediatrics (1979)

••Results calculated according to the National Academy of Sciences (1989)

6 to 13 years, 3375 ml for adults aged 13-19 years, 3188 ml for adults aged 20-50 years, 2959 ml for adults aged 50 to 59, 2500 ml for adults aged 60-69 years and 2250 ml for adults aged 70 to 79 years. The mean fluoride concentration in drinking water in Egypt is 0.36 mg F/L, the rate of consumption of fluoride from water was therefore calculated and found to be 0.585, 0.675, 0.823 and 1.08 mg daily for children aged 1 to 2, 2 to 4, 4 to 6 and 6 to 13 years, respectively. Accordingly, children from 1 to 2, 2 to 4, 4 to 6 and 6 to 13 years should take fluoride supplement from drinking water 0.25, 0.5, 0.75 and 1.0 mg F/day, respectively. (American Dental Association, 1984 and American Academy of pediatrics, 1979). The fluoride supplements cover daily requirements for the prevention of dental caries. Therefore, children aged 1 to 2 years and 2 to 4 years which ingested excessive quantities of fluoride ranged 0.585 and 0.675 mg F/day, respectively can be subjected to a major risk for dental fluorosis. Dean (1942) and Arnold (1984) helped to establish the direct relationship between the fluoride concentration in drinking water and the severity of the fluorosed enamel. These conclusion were based on clinical examinations of the decayed, missing and filled teeth. The enamel fluorosis varies from very mild (the enamel is small, opaque, paper white areas scattered irregularly over the tooth but not involving as much as approximately 25% of tooth surface), mild (the white opaque areas in the enamel of the teeth are more extensive), moderate (all enamel surfaces of the teeth are affected, and surfaces subject to attrition show marked wear, brown stains is frequently a disfiguring feature) and severe (all enamel surfaces are affected, brown

stains are widespread and teeth often present a corroded-like appearance). So, it is recommended to make dilution for the drinking water using distilled water (1694 ml from drinking water diluted with 931 ml distilled water for children aged 1 to 2 years and 1388 ml from drinking water diluted with 487 ml distilled water for children aged 2 to 4 years) until reaching the recommended dosage of 0.25 and 0.5 mg F/day for children aged 1 to 2 and 2 to 4 years, respectively. The rate of consumption of fluoride from water was therefore calculated and found to be 1.215, 1.147, 1.057, 0.900 and 0.810 mg daily for adults aged 13 to 19, 20 to 50, 50 to 59, 59 to 69 and 69 to 79 years, respectively. Accordingly, the fluoride supplement from drinking water should be 1.0 mg F/day for all the above ages (American Dental Association 1984 and American Academy of pediatrics 1979). It is evident from the results that the fluoride supplements cover daily requirements for the prevention of dental caries. In this respect, the world health organization (WHO, 1984), recommended a maximum concentration of 1.5 mg/L fluoride in drinking water to avoid dental fluorosis. In USA, the optimum concentration of fluoride recommended for caries prevention ranges between 0.7 - 1.2 mg / L (WHO, 1984).

6- Consumption of fluoride in In-bottle Water in group A

Table (6) shows the mean fluoride concentration in group A having the value 0.18 mg F/L, the rate of consumption of fluoride was therefore calculated and found to be 0.292, 0.337, 0.419, 0.540, 0.607, 0.573, 0.528, 0.450 and

Table 6. Consumption of fluoride in mineral water (M.W) in group A

Age (years)	•Recommended supplemental Dosage mg F/ day	••Daily amount of water (mL)		Fluoride concentration in M.W (mg / L)	Rate of consumption of fluoride in M.W (mg)	
		Range	Mean		Range	Mean
Children						
1-2	0.25	1300 – 1950	1625	0.18	0.234-0.351	0.292
2-4	0.50	1500-2250	1875	0.18	0.270-0.405	0.337
4-6	0.75	1830-2745	2258	0.18	0.345-0.494	0.419
6-13	1.00	2400-3600	3000	0.18	0.432-0.648	0.540
Adults						
13-19	1.00	2700-4050	3375	0.18	0.486-0.726	0.607
20-50	1.00	2550-3825	3188	0.18	0.459-0.688	0.573
50-59	1.00	2350-3525	2959	0.18	0.423-0.634	0.528
1.050	1.00	2000-3000	2500	0.18	0.360-0.540	0.450
70-79	1.00	1800-2700	2250	0.18	0.329-0.486	0.405

•The American Dental Association (1984) and The American Academy of Pediatrics (1979)

••Results calculated according to the National Academy of Sciences (1989)

Table 7. Consumption of fluoride in mineral water (M.W) in group B

Age (years)	•Recommended supplemental Dosage mg F/day	**Daily amount of water (mL)		Fluoride concentration in M.W (mg / L)	Rate of consumption of fluoride in M.W (mg)	
		Range	Mean		Range	Mean
Children						
1-2	0.25	1300 – 1950	1625	0.42	0.546-0.819	0.682
2-4	0.50	1500-2250	1875	0.42	0.630-0.995	0.812
4-6	0.75	1830-2745	2258	0.42	0.768-1.152	0.960
6-13	1.00	2400-3600	3000	0.42	1.008-1.512	1.26
Adults						
13-19	1.00	2700-4050	3375	0.42	1.134-1.701	1.417
20-50	1.00	2550-3825	3187	0.42	1.071-1.606	1.338
50-59	1.00	2350-3525	2937	0.42	0.987-1.480	1.233
60-69	1.00	2000-3000	2500	0.42	0.840-1.260	1.050
70-79	1.00	1800-2700	2250	0.42	0.756-1.134	0.945

•The American Dental Association (1984) and The American Academy of Pediatrics (1979)

**Results calculated according to the National Academy of Sciences (1984)

Table 8. Consumption of fluoride in mineral water (M.W) in group C

Age (ycars)	Recommended supplemental Dosage mg F/ day	••Daily amount of water (mL)		Fluoride concentration in M.W (mg / L)	Rate of consumption of fluoride in M.W (mg)		
		Range	Mean		Range	Mean	
Children							
1-2	0.25	1300 - 1950	1625	0.54	0.702-1.053	0.877	
2-4	0.50	1500 - 2250	1875	0.54	0.810-1.215	1.1961	
4-6	0.75	1830 - 2745	2258	0.54	0.988-1.482	1.235	
6-13	1.00	2400 - 3600	3000	0.54	1.296-1.944	1.620	
Adults							
13-19	1.00	2700 - 4050	3375	0.54	1.458-2.187	1.822	
20-50	1.00	2550 - 3825	3188	0.54	1.377-2.065	1.712	
50-59	1.00	2350 - 3525	2959	0.54	1.269-1.903	1.586	
60-69	1.00	2000 - 3000	2500	0.54	1.080-1.620	1.350	
70-79	1.00	1800 - 2700	2250	0.54	0.972-1.458	1.215	

•The American Dental Association (1984) and The American Academy of Pediatrics (1979)

••Results calculated according to the National Academy of Sciences (1989)

0.405 mg daily for ages range from 1 to 2, 2 to 4, 4 to 6, 6 to 13, 13 to 19, 20 to 50, 50 to 59, 60 to 69, 70 to 79 years, respectively. Since, children from 1 to 2, 2 to 4, 4 to 6 and 6 to 13 years should take fluoride supplement from drinking water 0.25, 0.5, 0.75 and 1.0 mg F/day, respectively, therefore, children ingest low quantity of fluoride and can be subjected to a major risk for dental caries.

For adults, the mean rate of consumption is higher than the recommended supplemental dosage (1 mg F/day), and as a result, group A can not be used for children or adults.

7- Consumption of fluoride in In-bottle Water in group B

Table (7) shows the mean fluoride concentration in group B having the value 0.42 mg F/L, the rate of consumption of fluoride was therefore calculated and found to be 0.682, 0.812, 0.960, 1.260, 1.417, 1.338, 1.233, 1.050 and 0.945 mg daily for ages range from 1 to 2, 2 to 4, 4 to 6, 6 to 13, 13 to 19, 20 to 50, 50 to 59, 60 to 69, 70 to 89 years, respectively. Since, children from 1 to 2, 2 to 4, 4 to 6 and 6 to 13 years should take fluoride supplement from drinking water 0.25, 0.5, 0.75 and 1.0 mg F/day, respectively, therefore, children ingest excessive quantities of fluoride and can be subjected to a major risk for dental fluorosis. For adults, the mean rate of consumption is close to the recommended supplemental dosage (1 mg F/day) and as a result, group B can be used safely for adults.

8- Consumption of fluoride in In-bottle Water in group C

Table (8) shows the mean fluoride concentration in group C having the value 0.54 mg F/L, the rate of consumption of fluoride was therefore calculated and found to be 0.877, 1.196, 1.235, 1.620, 1.822, 1.712, 1.586, 1.35 and 1.215 mg daily for ages range from 1 to 2, 2 to 4, 4 to 6, 6 to 13, 13 to 19, 20 to 50, 50 to 59, 60 to 69, 70 to 89 years, respectively. Since, children from 1 to 2, 2 to 4, 4 to 6 to 13 years should take fluoride supplement from drinking water 0.25, 0.5, 0.75 and 1.0 mg F/day, respectively, therefore, children ingest excessive quantities of fluoride and can be subjected to a major risk for dental fluorosis. For adults, the mean rate of consumption is higher than the recommended supplemental dosage (1 mg F/day), and as result, group C can not be used for children or adults.

REFERENCES

- Abd EL-Latif, A.E. (1994). *Determination of Fluoride Contents of some Egyptian Food Items*. pp. 13-26. M.Sc. Thesis, Faculty of Oral and Dental Medicine, Cairo Univ., Cairo.
- American Academy of Pediatrics, Committee on Nutrition (1979). Fluoride Supplementation Revised Dosage Schedule. *Pediatrics*, 63: 150 – 152.
- American Dental Association, Council on Dental Therapeutics (1984). *Accepted Dental Therapeutics*. 40th Ed. pp. 320-323 Chicago (IL): Washington, D.C.
- Arnold, F.A. (1984). Fluorine in Drinking Water. Its Effect in Dental Caries. *J.Am. Dent Assoc.*, 36 p. 28.

- Backer, D.O.; W. Kunzel and J.P. Carlos (1978). Preventive Water Fluoridation. *Caries Res.* 33:12-14.
- Dean, H.T. (1942). The Investigation of Physiological Effect of the Epidemiological Method. In Fluorine and in Health. Edited by F.R. Moulton. Washington, D.C., *American Association for the Advance of Science*: 99:562 - 569.
- Dejong, H.P.; P. Deboer; A.W. Venpelt; M.J. Busscher and J. Arends (1984). Effect of Topically Applied Fluoride Solutions on the Surface Free Energy of Pellicle - covered Human Enamel. *Caries Res.*, 18: 505-508.
- Dijkman, A.G.; D.G. Nelson; W.I. Jongelded; A.H. Werkamp and J. Arenold (1986). In Vivo Plaque Formation on Enamel Surface Treated with Topical Fluoride Agents. *Caries Res.*, 19 P. 547.
- Eggen, K.H. and G. Rolle (1983). Surface Properties of Fluoride Treated Hydroxyapatite as Judged by Interaction with Albumin and Lysozyme. *Second Dent. Res.*, 91: 347 - 350.
- Eid, M.H. (1981). *Fluoride Contents in Drinking Water Allover Egypt*. pp. 49-73 M.Sc. Thesis, Faculty of Oral and Dental Medecine, Cairo. Univ., Cairo.
- El-Awamry, Z.K.; S.A. Hassan and A.S. Hamza (1998). The Use of Some Egyptian Medicinal Plants as a Natural and Safe Source of Fluoride to Protect Children from Dental Caries. *Annals Agric. Sci., Ain Shams Univ., Cairo*, 43(2): 561 - 574.
- El-Molla, M.A. (1991). *The Effect of Water Fluoride Ion Concentration on Tooth Size*. p. 17. M.Sc. Thesis, Cairo University, Faculty of Oral and Dental Medicine, Cairo.
- El-Sayed, A.A. (1989). *Effect of Purification and Treatment of Drinking Water on Fluoride Ion Concentration in Different Areas of Egypt*. pp. 35-65. M.Sc. Thesis, Faculty of Oral and Dental Medicine, Cairo University, Cairo.
- Galagan, D.J. and J.R. Vermillin (1957). Determine Optimum Fluoride Concentrations. *Public health* 72:491.
- Glenn, F.; W.S. Gleen and R. Duncan (1984). Prenatal Fluoride Tablet Supplementation and the Fluoride Content of Teeth. *JADA*, 23: 344-352.
- Hattab, F.N. and S.H. Wei (1988). Dietary Sources of Fluoride for Infants and Children in Hong Kong. *J. Red. Dentistry*, 10: 13-17.
- Joyston, S. and E.A.M. Kidd (1982). Effect on Fluoride Uptake by Enamel and on the Progress of Artificially Produced Caries Like Lesions of Applying Successively Two Different Fluoride Solutions. *Caries Res.*, 16: 34-41.
- Kunzel, W. (1984). Progress in Fluoridation and Defluoridation. *J. Int. Ass. Dent. Child.*, 15:57-64.
- Levine, R.S. (1976). The Action of Fluoride in Caries Prevention. *Br. Dent. J.*, 140: 9-14.
- Majer, F.J. (1970). *Fluorides in Water. Cited from Water Quality and Treatment*. A Handbook of Public Water Supplies Prepared by the American Water Work Association. 3rd Ed., pp. 307-440 Mc Graw-Hill Co., New York, USA.
- Murray, J.J. (1978). *Fluorides in Caries Prevention. Dental Practitioner Handbook* No. 20, pp. 160-170 John Wright and Sons Ltd, Bristol.
- National Academy of Sciences (1989). *Health Effects of Ingested Fluoride*. 10th Ed., pp. 362-365. National Research Council, Washington D.C.
- Newbrun, E. [ed.] (1972). *Fluorides and Dental Caries* pp. 733-737. Springfield IL Charles C Thomas Philadelphia, USA.

- Newbrun, E. (1982). Sucrose in the Dynamic of Caries Process. *Dent. J.* 32: 33.
- Newbrun, E. (1992). Current Regulations and Recommendations Concerning Water, Fluoridation, Fluoride Supplements, and Topical Fluoride Agents. *J. Dent. Res.*, 71: 1255-1265.
- Osis, D.; E. Wiatrowski; J. Samachson and H. Spencer (1974). Dietary Fluoride in Man. *J. Nutr.*, 104: 1313-1318.
- Peter, J. and N. James (1986). The Efficiency of Fluoride on Dental Caries Reduction by Means of a Community Water Supply. *J. Dent. Child.*, 53: 219-222.
- Shafer, W.G.; M.K. Hine and B.M. Levy (1963). *A Textbook of Oral Pathology*. Second Ed., pp. 366 - 433 W.B. Saunders Company, Philadelphia and London.
- Standard Method for the Examination of Water and Waste Water (1984), 16th Ed. American Public Health Association. Washington, D.C.
- Stephen K.W.; S.L. Creanor; J.I. Russell; C.K. Burchell; E. Huntington and C.F.A. Downie (1988) Three-Year Oral Health Trial with zinc - Containing Monofluorophosphate Dentifrices. *Community Dent Oral Epidemiol.* 16: 321-325.
- Svanberg, M. and G. Westergen (1983). Effect of SNF₂ Administered as Mouth Rinses on Topically Applied on Streptococcus in Dental Plaque and Saliva. *Scand. J. Dent. Res.*, 91: 123-129.
- Waldbott, G.L. (1963). Fluoride in Food. *Am. J. Clin. Nut.*, 129: 455 - 462.
- WHO, World Health Organization (1984). *Fluorine and fluorides*. *World Health Organization Geneva, Environmental Health Criteria* 36: 21 - 33. Published under the joint sponsorship of the United Nations Environment Programme, the International Labour Organization, USA.

مجلة حوليات العلوم الزراعية ، كلية الزراعة ، جامعة عين شمس ، القاهرة ، م ٤٩ ، ع (١) ، ١٩١ - ٢٠٧ ، ٢٠٠٤

معدل الاستهلاك والتوصيات من المأخوذ من الفلوريد فى مصر فى مياه الشرب وأثر ذلك على صحة الأطفال والكبار

[١٣]

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١- المعمل المركزى للأغذية والأعلاف - مركز البحوث الزراعية - الجزيرة - مصر

الفلوريد فى مياه الشرب فى محافظة مرسى مطروح والعريش عالية جدا ٧٦١ و. ، ٩٢٦ و. ملجم فلوريد / لتر على التوالى (مياه شرب مصدرها أبار) أيضا جمعت ٨ أنواع من المياه المعبأه من الاسواق المصرية وتم تقدير الفلوريد فيها وقد تم تقسيم العينات إلى ثلاث مجموعات أ ، ب و ج ، كان متوسط تركيز الفلوريد فى المجموعة أ ، ب و ج ، ١٨ و. ، ٤٢ و. ، ٥٤ و. ملجم فلوريد / لتر على التوالى. وحيث أن متوسط تركيز الفلوريد فى مياه الشرب (ماء صنوبر) كان ٣٦ و. ملجم / لتر التى مصدرها نهر النيل فان معدل استهلاك الفلوريد يكون ٥٨٥ و. ، ١٧٥ و. ، ٨٢٣ و. ، ١٠٨ و. ، ٢١٥ و. ، ٤٧ و. ، ٥٧ و. ، ٩٠٠ و. ، ٨١٠ و. ملجم يوميا على التوالى ووجد أن الأطفال من عمو ١- ٢ سنة و ٢- ٤ سنة يأخذوا كميات كبيرة من الفلوريد لذلك فهم أكثر عرضة لزيادة تصلب الاسنان وبالتالي سهولة الكسر وتيبس العظام مع تكرار الاستخدام على المدى البعيد لذلك يوصى بعمل تخفيف لمياه

استهدفت هذه الدراسة دراسة معدل الاستهلاك من الفلوريد فى مياه الشرب فى اثنى عشرة محافظة بجمهورية مصر العربية لمعرفة أثر هذا المعدل على صحة الأطفال والكبار. ولذلك تم تقدير تركيز الفلوريد فى مياه الشرب المستهلكة من الشعب المصرى لاعطاء بعض المعلومات عن مياه الشرب لوجود علاقة بين تركيز الفلوريد فى مياه الشرب والأضرار التى تصيب الأسنان والعظام حيث أن التركيز العادى يحمى الأسنان والعظام ، والمنخفض يؤدي إلى تسوس الأسنان والمرتفع يؤدي إلى تصلب الأسنان والعظام. جمعت عينات مياه شرب من اثنى عشر محافظة فى مصر شهريا طوال عام ٢٠٠٢. عشر محافظات مصدر مياه الشرب ماء صنوبر (نهر النيل) وهى محافظات القاهرة والجزيرة والقليوبية والفيوم والمنيا والمنصورة والاسكندرية والاسماعيلية والسويس وبورسعيد وكانت القيم متقاربة تتراوح من ٣٣٣ و. إلى ٣٧٧ و. ملجم فلوريد / لتر بمتوسط ٣٦ و. ملجم فلوريد / لتر. بينما كانت نسبة

المعبأه (٤٢ و ملجم / لتر) ٦٨٢ و، ٨١٢ و، ٩٦٠ و، ١ و٢٦، ١ و٤١٧، ١ و٣٣٨، ١ و٢٣٣، ١ و٠٥٠، ١ و٠٩٤٥. ملجم/يوم ونتيجة لذلك فإن معدل استهلاك الفلوريد مرتفع جدا للأطفال من عمر ١ - ١٣ سنة مما يعرضهم لزيادة تصلب الأسنان وتبيس العظام على المدى البعيد وبالنسبة للكبار فإن هذا المستوى كافي لمنحهم احتياجاتهم اليومية. وكان معدل استهلاك الفلوريد الخاص بالمجموعة جـ من المياه المعبأه (٥٤ و. ملجم / لتر) ٨٧٧ و، ١ و١٩٦، ١ و٢٣٥، ١ و٦٢٠، ١ و٨٢٢، ١ و٧٢١، ١ و٥٨٦، ١ و٣٥، ١ و٢١٥ و ملجم / يوم ونتيجة لذلك فإن معدل استهلاك الفلوريد يكون مرتفع جدا لجميع الأعمار لذا يوصى بعدم استخدامها.

الشرب لهذه الأعمار باستخدام المياه المقطرة (٦٩٤ ميللي من مياه الشرب المضاف إليها ٩٣١ ميللي مياه مقطرة للأطفال التي تتراوح أعمارهم من ١-٢ سنة و١٢٨٨ ميللي من مياه الشرب المضاف إليها ٤٨٧ ميللي مياه مقطرة للأطفال التي تتراوح أعمارهم من ٢-٤ سنة). كان معدل استهلاك الفلوريد الخاص بالمجموعة أ من المياه المعبأه (١٨ و ملجم / لتر) ٢٩٢ و، ٣٣٧ و، ٤١١ و، ٥٤٠ و، ٦٠٧ و، ٥٧٣ و، ٤٨٠ و، ٤٥٠ و، ٤٠٥ و ملجم/يوم ونتيجة لذلك فإن المأخوذ من الفلوريد يكون أقل من الاحتياجات اليومية الأزيمة لكل الأعمار مما يعرض الأطفال والكبار لتسوس الأسنان. وكان معدل استهلاك الفلوريد الخاص بالمجموعة ب من المياه

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