

Fluoride Consumption in Jeddah Area : Risk and Benefits – A Pilot Study

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Introduction : An inverse relation between caries and water borne fluoride ranging from 0-2 ppm was found by Dean⁽¹⁾, and was confirmed later by Weaver^(2, 3). The optimum dose in drinking water to reduce caries incidence is accepted as \approx 1 ppm in temperate climate⁽⁴⁾ and lower (0.6 mg) in hot climate⁽⁵⁾. Higher levels are associated with mottling⁽⁶⁾ and increased incidence of caries⁽⁷⁾. Moreover, non skeletal effects of excess fluoride were noted in animals, humans and microorganisms. These effects included anemia^(8, 9), eosinophilia⁽¹⁰⁾, reduced thyroxine and triiodothyronine⁽¹¹⁾, reduced blood calcium⁽¹²⁾, disturbance of carbohydrate metabolism⁽¹³⁻¹⁶⁾, elevation of serum glucose⁽¹⁷⁾, inhibition of insulin secretion⁽¹⁸⁾, renal damage⁽¹⁹⁾, increased serum PTH concentration⁽²⁰⁾, and impaired glucose tolerance with elevated serum immunoreactive insulin and low fasting glucose: insulin ratios⁽²¹⁾. Over the past 50 years, especially with the wide spread use of fluoride in dental products, the availability of fluoride and consequently exposure of the population to it has increased significantly⁽²²⁻²⁶⁾. The situation is made critical for children by the inappropriate use of daily fluoride supplements advocated by overzealous health practitioners, and quite often dentists, not knowing the fluoride content of the water in their area. The situation is not much different in the adult population if tea is drunk excessively, and fluoridated toothpaste and mouth rinses are used liberally. The net result is that the population may be consuming more fluoride

than the 1 mg/day dose suggested to produce maximal dental caries reduction with minimal risk.

High incidence of fluorosis were reported in different parts of the kingdom⁽²⁷⁻³⁰⁾. This drew the attention to the possibility of increased intake of fluoride amongst Saudi population. Therefore, it was planned to carry out a pilot study on inhabitants of the Jeddah area to investigate the various sources and amounts of fluoride ingested, in order to find out whether there is a risk of fluoride toxicity or not, and to see whether excessive intake, if present, has caused adverse effects on the health of the selected individuals, and hence to suggest appropriate preventive measures.

Materials and Methods

A Selection of Subjects and Collection of Samples and Dietary Data

Healthy subjects were recruited for the study from attendants of the screening clinics at the Faculty of Dentistry as well as from the student population at King Abdulaziz University, in the following groups:

- i - 7 - 12 years - 30 subjects
- ii - 13 - < 20 years - 30 subjects
- iii - 20 – 50 years - 85 subjects

Principals of random selection were used in selecting subjects, and individuals not willing to take part in the study or those discovered to have genetic, internal, or metabolic disorders prior to selection were excluded from the study. Dietary interviews were conducted with all participants using a

specially designed questionnaire that included information on their water and other fluids and food intake during the past 24-hours. The subjects were then given an appointment for dental examination (if not already performed at the screening clinic), and blood analysis. At the same time they were given a seven day food frequency questionnaire specially designed to include foods and beverages most likely consumed and of known fluoride content, and asked to return it on the day of the appointment. Compiling information from the two forms was used in calculating daily fluoride intake. They were also given urine containers, as well as another empty plastic vial and asked to collect their first morning urine, and a sample of their drinking water on the day of the appointment, and to bring both samples with them.

On the day of the given appointment, blood samples were collected from fasting subjects, for the estimation of glucose insulin, Parathyroid hormone (PTH), Free triiodothyronine (FT₃), Free thyroxine (FT₄), Thyroid stimulating hormone (TSH), calcium, phosphate, albumin, creatinine and CBC. Subjects were then given glucose solution (75 g of anhydrous glucose for adults and 1 g/kg weight for children) and blood samples were collected again 2 hours later for analysis of glucose and insulin. Dental examination was carried out while subjects were waiting for second blood collection.

The subjects' weight (to the nearest 0.5 kg), and height (to the nearest 0.5 cm) were measured and the body mass index (BMI) was calculated.

All collected urine and sera samples were frozen at -20°C for analysis at the end of collection time, while CBC was performed on the same day.

B - Dental Examination

A collaborating dentist examined the teeth of all recruited subjects to determine the presence or absence of caries without giving a DMFT score. They were also examined for fluorosis using Dean's criteria according to the WHO guidelines ⁽³¹⁾.

C - Calculation of Fluoride Intake

The minimum fluoride intake of all subjects was calculated by adding the calculated intake from water and beverages (analyzed in our laboratory) to that of the types of food included in the 24-hour recalls and 7 days food frequency questionnaire. Fluoride content of foods was obtained from various published sources ⁽³²⁻³⁸⁾ and when a range was quoted, the midpoint figure was taken. For children admitting to swallowing toothpaste or mouth-rinses, 25% of the fluoride content of the amount used of these products was added to the total from food and beverages. The 25% used is an average arrived at from earlier studies ⁽³⁹⁾, even though the range was zero to 100 percent. The average amount of toothpaste used was based also on earlier studies ⁽⁴⁰⁾. As for children not admitting to swallowing toothpaste and brushing twice a day an average of 0.2 mg/day was used based on study by U.S. Department of Health and Human Resources ⁽⁴¹⁾ and referred to in a later publication ⁽⁴²⁾. Half of that amount is used for children brushing once/day and $\frac{3}{2}$ of the amount is used for those brushing 3 times/day.

It was difficult to estimate an amount of fluoride ingested when using mouth-rinse, since no reference could be found after an extensive search. However the same report mentioned earlier⁽⁴¹⁾ gave an estimate for adults using daily mouthwash. Taking into account the difference in quantity of mouth-rinse used by a child compared to an adult, half of the amount estimated to be ingested by the adult is used when calculating the daily intake of children. The amount was multiplied by $\frac{3}{7}$ when the child used the mouth-rinse 3 times/week, or by $\frac{1}{2}$ if he used it every other day. Amounts ingested by adults when using tooth brush 2 times/day, or mouth-wash once a day were taken from the same report⁽⁴¹⁾ and paper⁽⁴²⁾, and added to the intake from food and beverages. Adjustment to varying practices in teeth brushing and use of mouth-rinse were made similar to what was described earlier for children.

D - Biochemical Estimations

Glucose, albumin, calcium, phosphorus, urea, creatinine were estimated in serum samples using Hitachi 917 clinical chemistry analyzer and special reagent packs by Roche, in the biochemistry laboratory at the university hospital. Free triiodothyronine (FT₃), free thyroxine (FT₄), thyrotropin (TSH), and parathyroid hormone (PTH) were estimated using an automated electrochem-illuminiscent immunoassay "ECLIA" utilizing special reagent packs (Roche) on the Roche Elecsys 2010 immunoassay analyzer.

Insulin was estimated using "Coat-A-Count" radio immunoassay kit obtained from "Diagnostic Products Corporation, USA" and an automated gamma counter (1470 by Wallac)

Fluoride was determined in water, urine and various beverages using potentiometric measurements, made with a fluoride-ion specific electrode (Orion model 96-09 combination electrode) connected to ion analyzer (Orion model 720 A) using standard methods⁽⁴³⁾.

E - Hematological Evaluation

The hematological evaluation of whole blood was carried out in the University Hospital Laboratory. A fully automated S-plus IV coulter counter (Coulter Electronics, U.K.) was used; 0.1 ml of blood, isotone III (saline) and lyse III (lysing agent) were needed. White Blood cell count (WBC), red blood cell count (RBC), haemoglobin concentration (Hgb), haematocrit ratio (HCT), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), and mean corpuscular haemoglobin concentration (MCHC), as well as differential count of leudocytes were measured.

Results

1. Analysis of fluoride in water and beverages

a. Water Samples

35 samples were analyzed, 25 of the bottled type, 4 from different stations selling drinking water in gallons, and 6 from tap water obtained from different parts of the city.

Fluoride concentration in tap water was similar to that in water sold as gallons (range 0.02 to 0.028 mg/l). Fluoride concentration in bottled water ranged

from 0.045 to 1.06 mg/l, with 21 types having a concentration >0.5 mg/l, 2 a concentration of >0.25 mg/l, and 2 a concentration of <0.1 mg/l.

Fluoride concentration was estimated in 9 different brands of tea prepared in three different ways to obtain light, medium and dark brews. Infusions using two types of green tea were also analyzed. The concentration of fluoride in light tea ranged from 0.406-0.862 mg/l, while the range in medium brew was 0.89-2.56 mg/l, and 1.162-3.26 mg/l for dark brewed tea. Green tea had a concentration of 3.16 mg/l for one brand, and 4.08 mg/l for another brand.

The fluoride concentration in Arabic coffee ranged from 0.049-0.238 mg/l, while the range in Turkish coffee was 0.067 to 0.082 mg/l, and the range in instant coffee (4 brands) was 0.066 to 0.098 mg/l.

Fluoride concentration in soda drinks (4 brands including regular and light) ranged from 0.026 mg/l to 0.11 mg/l, while the range in energy drinks (4 brands) was 0.067-0.33 mg/l. The range in fruit flavoured drinks (14 types from 8 brands) was 0.045-0.123 mg/l, while that in fruit juices (14 types from 9 brands) was 0.094-0.506 mg/l. The highest concentration was found in red grape juice, and apple juice had generally higher fluoride content than orange juice.

2. Fluoride Intake of All Subjects

The fluoride intake of all age groups from different sources is presented in table 1. The number of subjects ingesting more than the recommended daily amount ⁽²²⁾ are also shown. The highest percentage of subjects with high intake was found in the adult group, and the lowest in the teenage group. High intake was due to different causes according to age groups. Causes included excessive use of fluoride containing dental products, tea drinking, and ingestion of water containing >0.7 mg/l of fluoride. In the children and teenagers groups, no one

cause was responsible for the high intake, but a combination of two or more, while in the adult group tea drinking and /or overzealous use of dental products were behind the high intake.

Table 1. Range of Fluoride Intake of All Subjects from Different Sources (mg/Day) and Number of Subjects Exceeding the Recommended Intake

Different Sources of Fluoride	Fluoride Intake (mg/day)			
	Children Groups n=30	Teenage Groups n=30	Adult Group	
			No Fluorosis n=70	With Fluorosis n=15
Toothpaste	0 – 0.438	0.01 – 0.225	0.01 - 0.225	0 – 0.225
Mouthwash	0 – 0.25	0 – 0.5	0 – 0.5	0 – 0.5
Water	0.02 – 1.267	0.02 – 1.267	0.02 – 1.478	0.02 – 1.478
Tea and Coffee	0 – 1.02	0 – 1.272	0 – 1.7	0.02 – 2.975
Cold Beverages	0.05 – 0.1	0.01 – 0.1	0.015 – 0.3	0.015 – 0.3
Food	0.2 – 1.6	0.15 – 2.4	0.24 – 2.6	0.67 – 1.52
Total Intake	0.546 – 3.284	0.86 – 5.1	0.97 – 5.7	1.13 – 5.85
No. of Subjects with Higher Than Recommended Intake	16	6	46	9

3. Urinary Fluoride Levels in the Studied Groups

The results of estimating fluoride in urine samples from all subjects are presented in table 2. as mean \pm SD and actual ranges of different sub groups. Our results are in the range of published data^(43, 45-49). The means of the high intake sub groups were all significantly higher than the mean of the corresponding low or optimal intake sub groups. This validates our division of subjects into low or optimal

and high intake sub groups, since urinary fluoride excretion is the recommended method of monitoring intake⁽⁵⁰⁾. However, there was an over lap between the values of the 2 sub groups in the children's group and the group of adults without fluorosis. The over lap was mostly in the range of 0.41 - 0.64 mg/l.

Table 2. Urinary Fluoride Levels in the Different Sub Groups

Groups & Sub Groups	Fluoride Levels (mg/l)	p value
a - Children's Group		
Low or Optimal Intake sub Group (n = 14)	0.389 ^a ± 0.174 ^a (0.132 - 0.732) ^b	1.4 x 10 ⁻⁴
High Intake Sub Group (n = 16)	1.17 ± 0.693 (0.522 - 2.5)	
b - Teenagers' Group		
Low or Optimal Intake sub Group (n = 24)	0.411 ± 0.132 (0.222 - 0.570)	6.4 x 10 ⁻⁴
High Intake Sub Group (n = 6)	0.622 ± .020 (0.583 - 0.642)	
c - Adult Group		
i. Adults without fluorosis		
Low or Optimal Intake Sub Group (n = 22)	0.505 ± 0.122 (0.242 - 0.64)	6.9 x 10 ⁻⁴
High Intake Sub Groups (n = 48)	0.778 ± 0.311 (0.41 - 1.616)	
ii. Adults with fluorosis		
Low or Optimal Intake Sub Group (n = 6)	0.374 ± 0.113 (0.223 - 0.450)	4.0 x 10 ⁻⁶
High Intake Sub Group (n = 9)	0.943 ± 0.223 (0.756 - 1.236)	

a = mean ± SD

b = actual range

n = number of subjects

4. Biochemical and Hematological Evaluation of Study Groups

The mean \pm SD of the different biochemical parameters and blood indices are calculated for the low or optimal fluoride intake and the high fluoride intake sub groups of the study groups. Results are presented in tables 3 to 5.

Examining results in Table 3. show that in the children group glucose values were all within the normal range, except for some subjects in the high intake sub group that showed higher than expected 2hpp glucose values. The fasting insulin is insignificantly higher in the high intake sub group, while the 2hpp insulin : glucose ratio is significantly higher ($p=0.048$).

In the teenager's group, the 2hpp glucose was >6.5 mmol/l in some subjects, and all 2hpp insulin values were >35 IU/L in the high intake sub group. In addition, the 2hpp insulin : glucose ratio was slightly higher in the high intake sub group.

In the adult group with no fluorosis, the mean 2hpp glucose was significantly higher ($p=0.023$) in the high intake sub group with many values higher than normal range. Mean fasting insulin, and mean 2hpp insulin values were both significantly higher in the high intake sub group ($p=0.031$ and 0.042 respectively). Similarly the mean insulin : glucose ratio while fasting and 2hpp were also significantly higher in the high intake sub group ($p=-.0298$ and 0.037 respectively).

In the group of adults with fluorosis, many subjects in the high intake sub group had higher than normal 2hpp glucose values, and hence the mean was significantly higher ($p=0.018$). Moreover, both fasting and 2hpp insulin means were both significantly higher ($p=0.0087$ and 0.046 respectively), and the mean fasting insulin : glucose ratio was also higher ($p=0.022$).

Looking at the results of FT₃, FT₄ and TSH in Table 4., the following was noted:

Mean TSH was higher in the high intake sub groups of children, teenagers and adults with fluorosis compared to the corresponding means of low or optimal intake sub groups (p values in table 4.) However no significant difference between the means of the sub groups of adults without fluorosis could be detected, but some subjects in the high intake sub group had higher than normal values.

Mean FT₃ and Mean FT₄ were both significantly lower in the sub group of adults with fluorosis compared to the corresponding means of the sub groups of low or optimal intake. Moreover, some subjects in the high intake sub group of adults without fluorosis had lower than normal FT₄.

The means of PTH levels in all the high intake sub groups were significantly higher than the means of the corresponding low or optimal intake sub groups (p value in table 4.), and many subjects had normal values (i.e. hyperparathyroidism).

The means of phosphate values in all the high intake sub groups were significantly lower than the means of the corresponding low or optimal intake sub groups (p value in table 4.) with some values below normal level.

Mean calcium levels in the high intake sub groups of children and adults without fluorosis were both lower than the corresponding means of the low or optimal intake sub groups (p=0.017 and 0.043 respectively).

Mean creatinine levels in the high intake sub groups of children and teenagers were both lower than the corresponding means of the low or

optimal intake sub groups ($p= 0.043$ and 0.004 respectively). However, no values were outside the normal range.

Mean urea level in the high intake range sub group of adults without fluorosis was significantly lower than the mean of the low or optimal intake sub group ($p= 0.046$), and some cases had lower than normal albumin values.

The results presented in Table 5 show the blood parameters. The following was noted:

In the children group the mean hemoglobin level is significantly lower in the high intake sub group ($p=0.042$) with some cases having values < 11 g/l, as well as hematocrit values < 31 , MCV < 77 fl and MCH < 26 pg, considered to be the lower end of acceptable range for the age group⁽⁵⁴⁾. Moreover some cases had increased % eosinophils above normal as was reported in an earlier study⁽¹⁰⁾.

In the teenage group the mean WBC was lower in the high intake sub group, which was not seen in previous reports. In addition the mean RBC was lower ($p=0.0079$) with some values lower than normal as reported earlier in animals⁽¹²⁾. Moreover, the hematocrit mean was significantly lower ($p=0.0027$), with some values $< 30\%$, and the hemoglobin mean also lower ($p=0.0043$) with all values < 11.5 g/l, and some < 10.0 g/l. Furthermore, the MCH mean was significantly lower ($p=0.047$), and the % eosinophils also lower ($p=0.042$). Finally there were some MCV values < 72 fl, MCH values < 24 pg, and MCHC values < 32 g/dl considered to be the lower end of the acceptable range.

In the adult group without fluorosis, the mean WBC was lower in the high intake sub group, ($p=0.026$) with some values less than the normal range, similar to findings in the teenage group. However, the mean % eosinophils was significantly higher ($p=0.047$) as was seen in the children group. In addition, the RBC mean was also lower ($p=0.015$), with some subjects lower having values less than normal. There was no significant difference between the means of the two sub groups with respect to hemoglobin or hematocrit, but many subjects in the high intake sub group had hemoglobin values <12 with some < 11 g/l even. Further more, the mean MCV, the mean MCH and the mean MCHC were all lower in the high intake sub groups (p values in table 5).

In the adult group with fluorosis WBC mean was lower in the high intake sub group ($p=0.048$) with some values lower than normal, but no significant difference was noted for the mean % eosinophils, RBC hemoglobin, hematocrit, MCV, MCH, or MCHC eventhough some subjects had lower than normal values.

Discussion

A high percentage of our studied subjects were ingesting higher than recommended intake of fluoride daily. The calculation of the intake was validated by estimating fluoride in urine samples. The mean value in the high intake sub group was always significantly higher in all age groups (Table 2). The over lap in values noted in the children group and the group of adults without fluorosis could be due to various factors.

Other factors might interfere with fluoride excretion leading to higher or lower than expected values. It has been suggested ^(51, 52), that such factors may include variations in urinary flow rate or pH, as well as differences in fluoride deposition/retention by the skeleton due to individual differences in bone metabolism, such as may occur during growth and development. In fact the lowest values in the children's high intake sub group were found in children with above average weight and height for age, indicating possible increased fluoride retention due to growth spurt. Similar findings were noted in earlier report ⁽⁵³⁾, and similar suggestion was made. On the other hand, the lowest levels in the high intake adult group were found in subjects showing impaired glucose tolerance. This could have affected their urinary flow rate by increasing it, thus have resulted in increased volume and reduced concentration. Higher than expected urinary levels in low or optimal intake sub group could be due to low ingestion of fluids generally, thus leading to more concentrated urine and higher urinary fluoride. However, since 24-hour urine sample was not collected, this cannot be verified.

The causes of high intake differed between different age groups, but tea drinking and over use of dental products singly or combined were the major causes in the adult population.

Fluorosis was only noted among adults, and it seemed to be due to excessive intake during early childhood as the subjects with fluorosis were all residents of rural areas during their childhood and depended on water from wells for drinking and cooking. This indicates that the danger of dental fluorosis is minimal in people residing in the Jeddah area all their lives. However, effects of fluoride excess on metabolism could not be ruled out. In fact, the results seen in tables 3-5 show clearly the adverse effects of excessive ingestion of fluoride. Higher than normal post

glucose load glucose values, and high fasting as well as post glucose load insulin levels, accompanied in many cases with high insulin: glucose ratio was noted in all the sub groups with high fluoride intake, indicating either insulin resistance or production of biologically inactive insulin, and leading to impairment of glucose tolerance. This was suggested in earlier studies⁽²¹⁾.

Further more, sub clinical hypothyroidism was noted in some subjects from all sub groups with high fluoride intake, indicated by high TSH levels and low or low normal FT₄. However this effect was not seen in all subjects. This was reported in earlier studies⁽¹²⁾. The significantly higher mean TSH in the high intake sub group of adult subjects with fluorosis points to the reversible nature of the effect of fluoride on the thyroid, which was not reported in literature before.

In addition, hyperparathyroidism was noted in many subjects ingesting high amounts of fluoride in all study groups. This was seen in previous reports^(20, 55-56). Results from the group of adults with fluorosis indicate the reversible nature of the effects of fluoride on the parathyroid. The high PTH levels have caused mean phosphate levels to be significantly lower in all sub groups with high fluoride intake compared to corresponding sub groups with low or optimal intake. However, it failed to increase mean calcium levels, and in fact, it was found to be significantly lower in the children group and the adult group without fluorosis.

Finding lower mean urea in the high intake sub group of adults without fluorosis compared to the other sub group, accompanied by low albumin levels in some subjects might indicate an effect of high fluoride intake on the liver. Sodium fluoride was reported to cause a decrease in total serum proteins in rats, and an increase in serum transaminase activity⁽⁵⁷⁾, pointing to potential effect of fluoride excess on liver synthetic function.

Anemia reflected on lower hemoglobin mean and low RBC count mean in the high intake sub group of two of the study groups was also reported in earlier study ⁽¹²⁾ The lack of significant difference between the means of hemoglobin of the two sub groups of adults with and without fluorosis could be due to the presence of a high percentage of females (with expected lower hemoglobin values) in the low or optimal intake sub groups. If the sub groups were of similar composition a difference might have been found. The results of hematological parameters in the group of adults with fluorosis are difficult to interpret since apart from the WBC counts no significant difference could be seen between the 2 sub groups. Moreover, the RBC count of all subjects in this group were on the low side of the normal range (apart from 2 with lower than normal value in the high intake sub group) in spite of good varied nutrition. Could the ingestion of excess fluoride in early childhood have continued to have an effect on hemopoietic system? No reports in literature could be found regarding this point, and more investigations are needed to clarify this point.

Recommendations

- I. The ministry of health employees must be informed and made aware of the obtained results.
- II. Dentists must encourage parents to use children's toothpaste for their children, thus decreasing the actual intake from this source.
- III. The use of mouth-rinse containing fluoride on daily bases or more than once a day, must be discouraged in adults and children.
- IV. The proper use of dental products must be introduced into kindergartens and primary schools with emphasis made on the dangers of over-use.

- V. Dental products containing large concentration of fluoride must be labeled as "Poisons", to draw attention to possible danger, specially to children.
- VI. Excessive tea drinking must be discouraged by health workers.
- VII. The use of supplements in young children is to be considered unnecessary and harmful except in special cases when danger of caries is strongly suspected, and even then not for a prolonged period.
- VIII. A larger study must be initiated to include villages of the Mecca – Jeddah road and Jeddah – Medina road, where drinking from wells is more common, to investigate the possibility of fluoride toxicity and take steps to avoid it.
- IX. Food analysis of different constituents of our stable diet must be initiated to determine its fluoride content exactly.
- X. Bottled water must be monitored by the authorities more closely, since labels are very inaccurate, and types containing > 0.7 mg of fluoride /l must be discontinued.
- XI. Doctors treating kidney patients in particular must be made aware of the danger of fluoridated water, tea and other fluoride containing products.

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استهلاك الفلور في منطقة جدة - فوائده ومضاره : ٢٣٥

دراسة استطلاعية

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المستخلص : أجريت هذه الدراسة لقياس الفلور بين سكان منطقة جدة لتحري مدى زيادة الاستهلاك عن الحد المسموح به ، و نتائج مثل هذه الزيادة على الصحة العامة . تم استقطاب ١٤٥ فرداً من الأصحاء و كانت أعمارهم تتراوح بين ٧-٥٠ عاماً ، و من خلال مقابلة شخصية سجلت العادات الغذائية و كميات الغذاء المستهلكة من قبل الأفراد و كذلك استخداماتهم للمنتجات الصحية المحتوية على الفلور . كما تم فحصهم سريرياً و فحص أسنانهم للكشف عن الإصابة بالتسوس و الفلوروسيز . و قد وجد ١٥ فرداً بالغاً مصابين بالفلوروسيز . و في نفس الوقت أخذت عينات من الدم في حالة الصيام . لقياس الجلوكوز و الأنسولين و هرمونات الغدة الدرقية و الجار درقية و الهرمون المحفز للغدة الدرقية و الكالسيوم و الفوسفات و الألبومين و اليوريا و الكرياتينين ، ثم أخذت عينة دم أخرى بعد ساعتين من تناول الجلوكوز لقياس مستوى الأنسولين و الجلوكوز كما أخذ من كل الأفراد عينة بول و عينة من مياه الشرب أيضاً لقياس الفلور فيهما .

تم قياس الفلور في كافة أنواع مياه الشرب ، و الشاي و القهوة و المشروبات الأخرى ، و استعمل ذلك بالإضافة إلى المعلومات الغذائية الأخرى في حساب كمية الفلورايد الذي يتناوله كل فرد ، و بناءً على ذلك تم تقسيم الأفراد إلى مجاميع حسب العمر و حسب الاستهلاك اليومي من الفلور ، بحيث وضع الأفراد الذي يستهلكون أكثر من المطلوب في مجموعة و الآخرين في مجموعة أخرى ضمن المجموعات العمرية ، و مثلت المجموعة الأولى نسبة مئوية كبرى من المجموع الكلي في مختلف الأعمار و قد بدا على بعض هؤلاء الأفراد علامات نقص نشاط الغدة الجار الدرقية بالإضافة إلى اضطراب في تحمل الجلوكوز و أنيميا . و قد عكس مفعول زيادة الفلور في حالة التقليل من استهلاكه في معظم الحالات ما عدا الأنيميا . و كان من أسباب زيادة استهلاك الفلور عند الأطفال و المراهقين زيادة استهلاك المواد الطبية المحتوية على الفلور ، بينما كان السبب الرئيسي في البالغين هو زيادة شرب الشاي . و بناءً ما سبق فقد استنتج أن زيادة استهلاك الفلور يشكل خطراً في مجتمعنا و لكن ليس خلال فترات الطفولة المبكرة . و يبقى الخطر مستمراً لعدم وجود تغيرات ظاهرة ، و لكن الآثار الجانبية تؤثر على التفاعلات الحيوية في الجسم و على تكوين خلايا

الدم ، لذلك لابد من التحذير من خطر استخدام المواد المحتوية على الفلور في عناية اليومية بالأسنان على المدى الطويل ، و الإكثار من شرب الشاي ، كما أنه لابد من توعية العامة إلى أخطار زيادة استهلاك الفلور .