

Effects of High Fluoride on Reproductive Endocrine of Male Adults

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Abstract: In order to explore the effects of high fluoride exposure on the reproductive function of male adults, a study was conducted on 31 male adults (20-55 years old) in a high fluoride area with 26 subjects in normal area serving as a control group. The results showed that the levels of serum luteinizing hormone (LH) and follicle-stimulating hormone (FSH) were markedly increased ($P<0.001$) among the subjects in the high fluoride area; and that the serum level of testosterone (T) was significantly decreased ($P<0.01$) as compared to the control group. This indicates that high fluoride exposure may affect the reproductive endocrine function of the male human body.

Keywords: High fluoride; Testosterone; Luteinizing hormone; Follicle-stimulating hormone; Male adults

Excessive fluoride intake carries serious toxic effects on not only mineralized tissues such as tooth and skeleton but non-mineralized tissues as well. Based on intensive research on fluorosis, the reproductive toxicity of high fluoride exposure has become a focal point of interest.[1, 2]. Most of the available studies however are experiments performed on animals with few studies investigating the effects on human reproductive endocrine function. We conducted research therefore on the reproductive endocrine function and fertility of male adults in areas that were severely affected by endemic fluorosis in November, 1995. The results are as follows.

1. Materials and Method

1.1 Investigation Subjects

Based on an epidemiological survey, Lijia village of Gaomi with 4.03-4.09mg/L fluoride in drinking water (and without a water improvement program) was chosen. Among the villagers, 31 male adults, ages 20 to 55 years old, were randomly selected and investigated to analyze their reproductive endocrine function and fertility. The subjects had been drinking high fluoride water for 20-55 years with an average of 45 years. Another 26 male adults of good health from a nearby non-high fluoride village ([F] in water <1.0 mg/L) were chosen as the control group. They shared a similar livelihood and were of the same age as the subjects from the fluorosis area.

1.2 Investigations and Methods

1.2.1 Collect venous blood, separate serum, and put it in-20 degree conditions. Determine the serum luteinizing hormone (LH), follicle-stimulating hormone (FSH), and

serum level of testosterone (T) through radioimmunoassay.

1.2.2 Fertility investigation: Ask each subject how many children he has.

1.2.3 Determine the fluoride in subjects' immediate urine through the ion selective electrode method.

1.2.4 Dental fluorosis investigation: Inspect subjects' teeth for dental fluorosis using the Dean method.

2. Results

2.1 Dental fluorosis rates and urine fluoride levels

Dental fluorosis rates in the high fluoride area were 100% and the subjects' urine fluoride was 5.75 ± 3.60 mg/L, significantly higher than that of the control group who had a urinary fluoride level of 0.88 ± 0.46 mg/L and no early signs of dental fluorosis.

2.2 Fertility

There was no dramatic difference in the number of children per subject in the high fluoride and normal regions.

2.3 Determination results of LH, FSH, and T in the serum

The results are listed in Table 1.

As the following table shows, the levels of serum LH and FSH (secreted by hypophysis) in the subjects from the high fluoride area were remarkably higher than that of the control group ($P<0.001$). By contrast, the serum T level was significantly lower than the control group. The difference in T was obvious. ($P<0.01$).

Table 1 - Determination Results of Serum Sex Hormone of Subjects in High Fluoride Area and Control Group				
Group	Cases	LH miu/mL	FSH miu/mL	T ng/dL
Fluorosis area	31	5.589 ±2.656	6.203 ±3.846	545.02 ±183.65△
Control group	26	2.741 ±1.631	3.244 ±1.990	724.91 ±312.19
* Compared with that of control group P<0.001; △P<0.01				

3. Discussion

In recent years, the damaging effects of high fluoride exposure on reproductive function has been reported by both domestic and foreign journals. For example, Chinoy et al[3] fed adult lab rats with 10mg NaF/kg·d and 20mg NaF/kg·d and found that the serum T level of the rats fed with fluoride was 40% lower than that of the control group. Zhen Jiong et al[4] fed Wistar rats with 100mg/L and 250mg/L fluorinated water for 3 months and found that their serum T level was remarkably reduced, microvilli of the testicular interstitial cell were reduced under electron microscopic evaluation, and the mitochondria were decreased and damaged. Yuan Shude et al[5] found that the serum level of LH in rats suffering from subacute fluorosis rose dramatically while their T went down. Narayana et al[6] reported that after being fed with 10mg/kg NaF for 50 days, Charles River rats' serum level of T declined and testicular interstitial cell and nucleus diameter shrank (P<0.01). This present study examined the reproductive endocrine of 20-to-55 year old male adults in areas that were severely affected by endemic fluorosis (water fluoride: 4.03-4.90mg/L). The results showed that the serum level of T was significantly lower than that of the control group (P<0.01) while the LH and FSH were higher (P<0.001). Since testosterone is secreted by testicular interstitial cells, the decrease of testosterone indicates that high fluoride has a damaging effect on testicular interstitial cells and their secretion function, which is in line with the study of Zhen Jiong and Narayana et al. As for the increase of LH and FSH, the authors believe it was probably because the decrease in serum T led to a compensatory rise in secretion of LH and

FSH from the hypophysis. Both the previous experiments on animal models and this survey show that high fluoride exposure can damage gonadal interstitial cells and eventually affect their secretion function. The mechanism, especially the effect on the human sexual glands, needs to be further investigated.

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Financially assisted by Research Foundation of Shandong Ministry of Health.

Translated from Chinese into English by FoxTranslate, courtesy of the Fluoride Action Network (2012). For more translations of Chinese research on fluoride toxicity, see www.fluoridealert.org/researchers/translations/