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Changes of the Prevalence of Endemic Fluorosis after Changing Water Sources in Two Villages in Guangdong, China

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According to the sources of fluoride to human body, the endemic fluorosis areas were mainly divided into three types: 1. the drinking water type, in which fluorosis was caused by drinking water with high fluoride content; 2. the coal-burnig-pollution type, in which fluorosis was caused by burning coal with high fluoride content for cooking and warming; and 3. the food-pollution type, in which fluorosis was caused by intake of food with high fluoride content (Dai 1985; Muramoto et al. 1990; Sun et al. 1991; Xu et al. 1990). It was an effctive preventive measure to change drink water from high fluoride content to low fluoride content in the drinking water type endemic fluorosis areas (Murray 1986; Meng et al. 1991). Anquan and Hubei Villages, Fenshun County, Guangdong Province, China, were serious endemic fluorosis areas of drinking water type. The economic level and living habits in two villages are similar. There were many underground hot springs with 14.0-20.0 mg/L of fluoride. The staple crop is rice. The populations were 800 in Anquan and 1331 in Hubei. The projects of changing drinking water sources were finished in 1984 in Hubei and in 1986 in Anquan. In this study, the water fluoride content and prevalence of endemic fluorosis of the two villages were investigated in 1984 and 1991, respectively, to evaluate the preventive effects of changing water supplies in the two villages.

MATERIALS AND METHODS

The fluoride content of water sources and tap water of households was analysed by the specific fluoride electrode. For the dental fluorosis assesment, all native-born children's teeth aged 8-12 years were examined and recorded by means of Dean's classification system (WHO 1984). For the diagnosis of skeletal fluorosis, the adults aged 16-65 years were randomly sampled to have roentgenograms taken in pelvis, 2/3 up part of right forearm with elbow joint, and 2/3 up part of right low leg with knee joint according

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to the rules of "A Handbook of Endemic Fluorosis Prevention and Control" published by the Ministry of Health of China (1991). The roentgenograms of two times were mixed to be diagnosed simultaneously. The fluoride content of urine randomly samples in children of 8-12 years old and adults of 16-65 years old of the two villages was analysed in 1991 by the specific fluoride electrode.

RESULTS AND DISCUSSION

In 1984 the water sources of two Villages were from artesian wells. Because many hot springs with high fluoride content gushed into the wells, the fluoride content of well water in Anquan and Hubei villages was 12.5 and 4.1 mg/L, respectively. In 1984 and 1986, the water sources have been changed to river water with 0.8 and 0.3 mg/L of fluoride in Hubei and Anquqn, respectively. Until 1991, villagers have drunk the water from the river for 5 years in Anquan, and 7 years in Hubei, respectively. However, the fluoride content of water source in Hubei was found to be 3.1 mg/L in 1991.

The fluoride content of tap water and prevalence rates of endemic fluorosis in the two villages were shown in Table 1. After 5 years of changing well water to river water in Anquan, the average fluoride content of tap water was 0.4 mg/L and met the hygienic standard of drinking water($\leq$1.0 mg/L). However, the water fluoride content in Hubei in 1991 was still 3.1 mg/L, with no significant difference campared with the fluoride content of water in 1984. By investigation, it was found that the walls of the well for storing water at the bottom of river bed and water pipe were damaged, the hot spring water with high fluoride content gushed into the well and pipe. Because there was no regular monitoring on the water fluoride after changing water sources, it was unclear when the water fluoride content increased in Hubei. This indicates that the fluoride content of water sources changed must be monitored regularly to assure the preventing effect in endemic fluorosis area.

The prevalence rates of dental fluorosis in children of 8-12 years old and skeletal fluorosis in adults of 16-65 declined significantly from 1984 to 1991 in Anquan ($p<0.01$, respectively). The prevalence rate of dental fluorosis of children declined($p<0.01$), but the prevalence rate of skeletal fluorosis of adults had no significant difference($p>0.05$) in Hubei. In 1984, there was a significant difference of prevalence rate of dental fluorosis of children between two villages($p<0.05$); but there were no significant diferences of tap water fluoride content and prevalence rate of skeletal fluorosis of adults between two villages. In 1991, the three items above in Anquan were found to be lower than those in Hubei ($p<0.01$, respectively; see Table 2).

Table 1. Comparisons of fluoride content of tap water and prevalence rates of endemic fluorosis between two villages in 1984 and 1991

Village	Study time	Fluoride content of tap water(mg/L) n mean ± SD	Prevalence rate of fluorosis Dental (%)	Skeletal (%)
Anquan	1984	6 5.5 ± 5.51**	96.0(97/101)**	82.1(23/28)**
	1991	10 0.4 ± 0.02	57.8(78/135)	46.0(23/50)
Hubei	1984	6 3.1 ± 1.37ns	100.0(211/211)**	71.1(81/114)ns
	1991	10 3.1 ± 1.05	83.7(128/153)	86.0(43/50)

Figures in parentheses mean the number of patients/examined persons; ** $p<0.01$ Student t- or Chi-square tests for the comparison of an identical village between 1984 and 1991; ns non-significant.

Table 2. Comparisons of tap water and urine fluoride contents(mg/L) between Anquan and Hubei Villages in 1991

Village	Tap water n Mean ± SD	Children of 8-12 years n GM ± SD	Adults of 16-65 years n GM ± SD
Anquan	10 0.4 ± 0.02** (0.3 - 0.4)	50 1.0 ± 1.91** (0.2 - 7.4)	41 1.9 ± 1.90** (0.5 - 6.2)
Hubei	10 3.1 ± 1.1 (2.9 - 3.3)	50 4.1 ± 1.8 (0.9 - 9.3)	39 3.1 ± 1.6 (1.0 - 8.0)

Figures in parentheses mean ranges; ** $p<0.01$ between two villages by Student t-test

The fluoride-to-creatinin ratios were not calculated to collaborate the urine volume in this study for there was no influence on the conclusion in the group study (Murry 1986). It was reported that on a group basis, the correlation between the fluoride contents in urine and that in drinking water is excellent (WHO 1984). In this study in 1991, the average water fluoride content was 0.4 mg/L in Anquan, and the urine fluoride content was 1.0 mg/L for children and 1.9 for adults; the water fluoride content was 3.1 mg/L in Hubei, and the urine fluoride content was 4.1 mg/L for children and 3.1 for adults. Similarly, the prevalence rates of dental fluorosis of children and skeletal fluorosis of adults in Anquan were lower than those in

Hubei.

It was concluded that changing water sources from high fluoride content to optimal fluoride content is an effective intervention to control endemic fluorosis.

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