

# Report of Investigations on Adult Hand Osteoarthritis in Fengjiabao Village, Asuo Village, and Qiancheng Village

## —Epidemiological Observations on the Relationship between Fluorosis and Osteoarthritis

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**[Abstract] Objective** To understand the relationship between fluorosis and adult osteoarthritis through the investigation of fluorosis-afflicted villages. **Methods** X-ray radiography of right hands was performed on 227 adults over the age of 40 from fluorosis-afflicted villages, and adult osteoarthritis was diagnosed using accumulated scores based on the obtained results. **Results** The identification rate of osteoarthritis in fluorosis-afflicted regions was 59.03%, and the mean accumulated score was 3.85, both significantly higher than those for the control population (identification rate was 23.6%, mean accumulated score was 0.72); patients with osteoarthritis caused by fluorosis accounted for a considerable portion of the osteoarthritis population. **Conclusions** Fluorosis may lead to osteoarthritis, and also acts as a confounding factor of adult Kashin-Beck disease (KBD) in a portion of patients.

**[Key words]** Osteoarthritis, fluorosis, confounding factor

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The “Adult Kashin-Beck Disease” research group at our institute had previously conducted investigations throughout China on the detectable level of adult osteoarthritis by X-ray<sup>[1]</sup>, in which the results obtained by analysis on three fluorosis-afflicted villages were generally consistent with the reports in [related] literature<sup>[2]</sup>. Now we report our results below.

## 1 Materials and methods

**1.1 Objects of investigation** Adult villagers over the age of 40 who lived in the following fluorosis-afflicted regions: Fengjiabao Village, Huanghua City, Hebei Province; Asuo Village, Guiyang City, Guizhou Province; Qiancheng Village, Zhaodong City, Heilongjiang Province.

**1.2 Indicators and methods of investigation** X-ray radiography was performed on the right hands of adults over the age of 40, and the obtained results were used to make diagnoses of adult osteoarthritis based on the accumulated scores<sup>[3]</sup>.

## 2 Results

### 2.1 Status of osteoarthritis in fluorosis-afflicted regions

Those examined included 84 adults from Qiancheng Village, Zhaodong City, Heilongjiang Province; 57 adults from Fengjiabao Village, Huanghua City, Hebei Province; and 86 adults from Asuo Village, Guiyang City, Guizhou Province, totaling 227 adults. Of these, 134 adults were found to have osteoarthritis; the incidence [of osteoarthritis] was 59.03%, and the mean accumulated score was 3.85.

**2.2 Comparisons** The following three control sites were set up: (1) Nationwide Kashin-Beck disease (KBD) regions; (2) Nationwide non-KBD regions; (3) Villages that were nearer the aforesaid fluorosis-afflicted villages and that were free of fluorosis<sup>[1]</sup> were selected as the third controls based on the data of the nationwide investigation.

This method aimed to compare the results of investigations on the fluorosis-afflicted villages against the conditions for the aforesaid three control sites in order to probe into the effects of fluorosis in the fluorosis-afflicted villages on osteoarthritis. See Table 1, Fig. 1 and Fig. 2.

**Table 1** Comparisons among four groups of data

Site	Identification rate by X-ray (%)	Mean accumulated score	Mean standard error	Median	Range
Nationwide KBD regions	64.81	9.23	0.36	5.00	24
Nationwide non-KBD regions	24.40	1.63	0.11	0	24
Fluorosis-afflicted regions	59.03	3.85	0.36	2.00	24
Control sites	23.60	0.72	0.094	0	9

### 2.2.1 Comparisons between fluorosis-afflicted regions and nationwide KBD regions

Identification rate by X-ray (59.03%), mean accumulated score (3.85) and median (2.00) for fluorosis-afflicted regions were all remarkably lower than corresponding indicators for [nationwide] KBD regions.

### 2.2.2 Comparisons between fluorosis-afflicted regions and nationwide non-KBD regions

All indicators for fluorosis-afflicted regions were remarkably higher than the corresponding values for nationwide non-KBD regions (identification rate was 24.4%, mean accumulated score was 1.63, and median was 0).

### 2.2.3 Comparisons between the three selected control sites (Pixian, Xushui, Shuangcheng) and nationwide non-KBD regions

The three indicators did not differ significantly; and the indicators for fluorosis-afflicted regions were all significantly higher than [those of] the selected control sites.

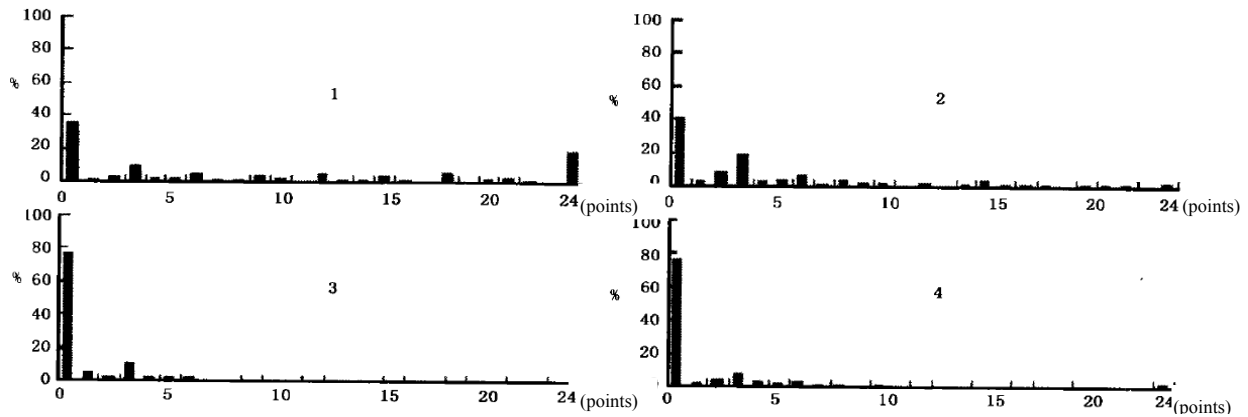
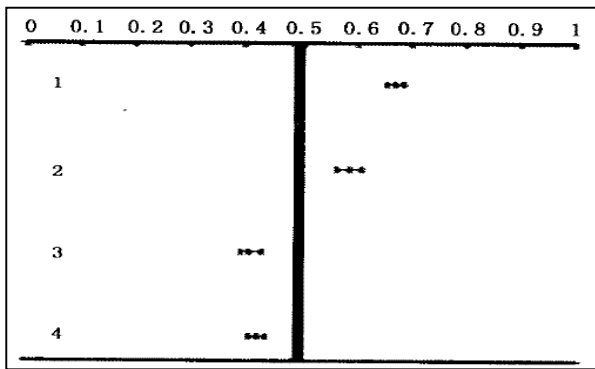


Fig. 1 Frequency distributions of the accumulated scores of adult osteoarthritis in fluorosis-afflicted regions and other sites under examination (Note: In Fig. 1, 1 refers to nationwide KBD regions, 2 refers to fluorosis-afflicted regions, 3 refers to control sites, and 4 refers to nationwide non-KBD regions)



95% confidence level for Ridit index

Fig. 2 Ridit index analysis of accumulated scores of adult osteoarthritis in fluorosis-afflicted regions and other sites under examination

(Note: In Fig. 2, 1 refers to nationwide KBD regions, 2 refers to fluorosis-afflicted regions, 3 refers to control sites, and 4 refers to nationwide non-KBD regions)

### 3 Discussion

**3.1 Fluorosis and osteoarthritis** Domestic and overseas literature on the subject of the relationship between fluorosis and hand osteoarthritis is very rare. The authors retrieved only two such articles from among more than ten thousand documents, and we believe that omitted articles of this type, if any, would not be many. As to the diagnosis of osteoarthritis, one of the aforesaid two articles utilized X-ray radiography of hands [2], which was basically consistent with our present discussion; another article utilized statistical analyses of symptoms, and lacked any definite diagnosis. In consideration of required comparability, reference is made to the first article in the present text. Under our present investigations, Fengjiabao Village is a village severely afflicted by fluorosis due to [high fluoride content of] drinking water, Asuo Village is a village severely afflicted by fluorosis due to coal flue gas, and Qiancheng Village is a village severely afflicted by fluorosis due to drinking water, while there was mild prevalence of KBD in the last of these villages. From the geographic distribution of adult osteoarthritis in China, the characteristic identification rate and degree of severity of osteoarthritis in fluorosis-afflicted regions, can be more clearly seen. That is, these two indicators for fluorosis-afflicted regions were lower than those for nationwide KBD regions, but were higher than those for ordinary regions, and the differences are very obvious. Of multiple conceivable factors, fluorosis is a specific factor stipulated by the investigational design, which is a basic fact. Therefore, we may make a rational deduction that if fluoride levels were lowered, after several decades, we would see the level of osteoarthritis occurrence becoming the same as those seen in the control sites.

**3.2 Etiology of osteoarthritis** Until now, this etiological topic has been discussed very infrequently. In the literature, age is most emphasized as a predisposing factor, and other factors such as gender, weight, labor, trauma and genetics have been reported. These non-specific factors may be used to explain individual cases, and also explain the low and nearly identical identification rates of osteoarthritis for non-KBD control regions and selected control sites, as is cited by the current article; however, they cannot explain peculiar phenomena such as the high identification rate for KBD regions and fluorosis-afflicted regions. Based on the observations of the authors' institution on KBD, adult KBD and adult osteoarthritis over many years, the conclusion derived is that the specific intra- and extra-environmental substances leading to osteoarthritis do exist.

T-2 toxin: KDB caused by T-2 toxin is a specific type of osteoarthritis, of which severe cases are easily distinguished from ordinary osteoarthritis, but moderate and less severe cases are very difficult or even unable to be distinguished from ordinary osteoarthritis.

Fluorosis: Osteoarthritis mentioned in this investigational report was prevalent in fluorosis-afflicted regions, and was caused by fluorosis. The osteoarthritis caused by fluorosis is milder than KBD, yet more severe compared with ordinary osteoarthritis. The osteoarthritis caused by fluorosis differs from ordinary osteoarthritis in severity rather than in nature.

Osteoporosis: An investigational report by a postgraduate student in our institution gave the following results: The incidence of osteoporosis exceeded 30% in middle-aged and elderly persons over the age of 40, and osteoporosis may increase in incidence and severity along with increased age; the same holds true for osteoarthritis. A certain essential link may exist between these two diseases, and the basis of this link must be a certain intra- and extra-environmental substance, perhaps calcium.

#### [References]

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