

## **A retrospective survey on the effect of Kaschin-Beck disease prophylaxis by a change of water sources**

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**Abstract**— In order to provide further references for studying on the causes of Kaschin-Beck disease (KBD) and measuring for its prevention and treatment from a macroscopic view, we analyzed the natural growth and decline of KBD and the effects of selenium and humic acid on its occurrence from an epidemiologic angle. In this article through a retrospective survey on the spots of disease areas by comparison between a change in water sources and that without. It was proved that a change in water sources was an effective measure for the prevention of KBD occurrence, and the pathogenic factor of KBD was one (or several kinds) of organic compounds or active radicals related to water.

**Keywords:** Kaschin-Beck disease; water sources; humic acid.

### **INTRODUCTION**

There have been many reports concerning the effect of KBD prophylaxis by a change in water sources (Wang, 1987). In order to further study the remote prophylactic effect of a change in water sources at Changqing Village, Huangsongdian Township, Jiaohe City, and Daixingchuan Village, Hongshi Township, Dunhua City, Jilin Province.

### **GENERAL STATUS**

#### **1. Changqing Village**

It was built in 1942, 60 kilometers south of Jiaohe City with an elevation of 800 meters, surrounded by mountains with lush growth of vegetation, and a frost-free period of 120 days. The inhabitants are mainly engaged in farming with an average year income of 200 RMB Yuan per capita, and food grain of 250 kg per capita, among which corn accounts for 70%, beans 15%, wheat 10%, and food grain other than wheat and rice 5%. Vegetables are rich in summer and autumn, and deficient in winter and spring. The amount of meat averages 2.5 kg per capita in a year with extreme rare sea food. Changqing Village has been divided into Changqing Village Proper and Changqing East Village, both with drinking water

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from earth well in the past. There was a change in water sources at Changqing Village Proper in 1959, but no change at the East Village. According to the review of the inhabitants, KBD has already occurred in the years before 1949.

2. Daixingchuan Village was built in 1943, 30 kilometers south to Dunhua City, located in U-shaped valley with a frost-free period of 100-110 days. The inhabitants are mainly engaged in farming with an average year income of 250 RMB Yuan per capita. Among the food grain, corn accounts for 70%, wheat 20%, others are cereal, beans and so on. The inhabitants' drinking water in the past was from earth well or river with a severe status of KBD. There was a change in water source to deep well in 1983 with a marked alleviation of disease status thereafter.

### THE COMPARISON OF KBD DETECTION RATES BEFORE AND AFTER A CHANGE IN WATER SOURCES

The clinical detection rate of KBD in inhabitants of Daixingchuan Village in 1982 (before a change in water sources) was 41.89%, while in 1990 it was 21.89%. There was a very significant difference between the detection rates before and after a change in water sources ( $X^2=51.61$ ,  $p<0.01$ , Table 1).

Table 1 Status of inhabitants' KBD clinical detection before and after a change in water sources

	No. of persons, examined	No. of persons, detected	Detection rate, %
1982	432	181	41.89
1990	720	151	21.81

It is clear from Table 1 that the clinical detection rate of KBD decreased markedly 8 years after a change of water source to deep well.

Table 2 status of children's X-ray detection before and after a change in water sources

	No. of person, examined	No. of person, detected	Detection rate, %	Activity index (disease state)	Severity index (disease state)
1982	85	77	90.59	108.38	102.28
1990	58	1	1.72	0.00	0.00

The status of children's X-ray detection before and after a change in water sources are shown in Table 2.

It is clear from Table 2 that 8 years after a change in water sources, there was a marked reduction of children's KBD detection rate, and a very significant difference as compared with that before the change in water sources ( $X^2=109.81$ ,  $p<0.01$ ). The activity index and severity index of disease state all dropped to zero.

The contents of KBD related humic acid and selenium in drinking water were determined separately before and after a change in water sources with the results are shown in Table 3.

Table 3 Comparisons of selenium and humic acid contents in drinking water before and after a change in water sources

	Selenium, $\mu\text{g/L}$			Humic acid, $\text{mg/L}$		
	small well water	river water	deep well water	small well water	river water	deep well water
1982	0.0381	0.0493	--	1.013	2.057	--
1990	--	--	0.073	--	--	0.135

It is clear from Table 3 that after the change in water sources the selenium content increased and the humic acid content decreased in drinking water.

The comparison between groups of inhabitants with and without a change in water sources.

The inhabitants both of Changqing Village Proper and of Changqing East Village live in the same ecological environment, the former having a change in water sources, while the latter having no change (Table 4).

Table 4 The status of KBD clinical detection in inhabitants of water change group and the control

	No. of persons examined	No. of persons detected	Disease degree			Detection rate, %
			I	II	III	
Village Proper(water change)	518	71	56	15	0	13.91
East Village(control)	100	10	6	4	0	10.00

The morbidity of water change group was higher than that of the control. This is mainly due to a more severe disease status previously in the water change group, and the result of elder patients, while in the East Village the patients were mainly younger ones.

It is clear from Table 5 that no patient was detected by X-ray examination in Changqing Village Proper, while 20.00% were detected in the East Village, among them the detection rate

of metaphysis type was 6.00%, indicating that the pathogenic factor of KBD is still existing in that village, and is still causing disease.

**Table 5 The status of X-ray detection in children of water change group and the control**

	Persons exam.	Persons detected	Disease type			Detection rate, %
			metaphysis	epiphysis	both	
Village Proper(water change)	50	0	0	0	0	0.00
East Village(control)	50	10	3	7	0	20.00

Table 6 shows that the selenium content in deep well water of Changqing Village Proper was evidently higher than that in the small well water of the East Village, while humic acid in deep well water was markedly lower than that in small well water.

**Table 6 The contents of selenium and humic acid in drinking water of the water change group and the control**

	Selenium, $\mu\text{g/L}$	Humic acid, $\text{mg/L}$
Village Proper (water change)	0.0715	0.00
East Village (control)	0.0310	0.74

## DISCUSSION

From the comparison in Jiahe City between Changqing Village Proper with a change in water sources and the East Village with no change in water sources, it was shown that they were located at the same ecological environment with no apparent difference in the pattern of production and life, the disease status of Changqing Village Proper were more severe previously than that of the East Village, and after a change in water sources to deep well water, although there was no significant difference in the total clinical detection rate of KBD in the inhabitants as compared with the East Village which has had no change in water sources, even slightly higher than that of the East Village, but as viewed from the statistics of examination and results, the severity of the patients in the East Village far exceeded that of the village proper (Table 4). As viewed from the monitoring data of the epidemic prevention station in Jilin City since 1986, no prevalence in children could be detected by X-ray examination in Changqing Village Proper since 1989. And also no prevalence was detected by our X-ray examination as shown in Table 5. Among the children in the East Village, however, there were still patients with metaphysis type KBD, indicating that the pathogenic factors

were still existing and causing disease.

At Daixingchuan Village, Dunhua City, the clinical detection rate of KBD in the inhabitants after a change in water sources decreased to nearly 50%, and the X-ray detection rate of the children decreased as much as 51 times. There was a very significant difference between the detection rate before and after the change in water sources (Table 1 and 2).

What was the reason responsible for such a marked decrease of KBD in these 2 villages within a short period of a few years? Researchers have noticed a natural decrease of KBD morbidity in recent years (natural decrease refers to a reduction of disease state induced by causes other than those which have been known to induce a change in disease state), but this natural decrease usually requires a period over 5–10 years to show a significance between the detection rates, and also more often there were still a few new attacks in children (Ding, 1989). It is apparent that the reduction in disease state in these 2 villages cannot be simply explained by natural decrease.

As viewed from items of water quality examination which are significant for comparison, the selenium content of deep well water at Changqing Village Proper was higher than that of the well water at the East Village, while the humic acid content could not be detected (Table 6). The humic acid contents of the small well and river water previously used at both the East Village and Daixingchuan Village were higher than the highest value in the non-disease area of KBD, 0.50 mg/L\*. (Table 3 and Table 6; \* The humic acid standard for KBD prophylaxis by water change in Jilin Province is less than 0.5 mg/L). The humic acid contents of the deep well water at these 2 villages were much lower than this value. The selenium contents of the small well and river water were also very low. This is another example indicating the KBD was related to low selenium and high humic acid in drinking water considering however, the main source of selenium intake of the human body from the food chain is not from water (Wang, 1989), then in evaluating the relative importance of selenium and humic acid contents in drinking water, it is thought by the author that selenium in water did not play an important role in the pathogenesis of KBD, and the pathogenic factor of KBD must be one or several kinds of organic compounds or chemically active groups related to water. The reason a change in water sources can be effective is that the removal of or a decrease in the concentration and virulence of the pathogenic factor by water change, resulted in an effect of KBD prophylaxis.

## REFERENCES

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