

Hygienic bacteriological study of the Hungarian section of the Körös river system

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Introduction

People who are physically and mentally tired often go out in nature to relax, rest and refresh themselves. For people living on the Great Plain, natural waters and their environs are favourite holiday resorts as they are cheap and have easy access. There, blue rivers and the green setting make them relax and the peace and tranquillity make them comfortable. The pleasant environment, however, may represent dangers too. Namely, our surface waters directly influence the health of bathers, swimmers and sportsmen pursuing water sports.

Bathing in surface waters is often followed by symptoms such as rash, reddening of the skin, itching of the ear, nose, eye and mouth, swelling and inflammation. Sickness, vomiting, diarrhea, abdominal spasms and even more serious symptoms may also disturb the holiday-maker, depending on the extent of the pollution of the water. Concerning the protection of human health, it is very important not to have any health hazard at the holiday resorts. However, tourists at places where any health hazard is present must be informed about them. Because of the dangers mentioned above, we must know the hygienic bacteriological quality of our waters in order to protect human health. Bacteria, viruses, worm eggs, algae etc. in waters may cause allergy, purulent rashes, enteral diseases, inflammation of the skin, nose, eye, ear and mouth.

Materials and methods

The hygienic bacteriological study of the condition of surface waters, which is very important regarding human health, was started in the 1950s, all over the country, by the Department of Water Hygiene of the National Public Health Institute (OKI). In the 1960s and 70s the spectrum of the studies of surface waters was widened, processing the data,

sampling and sampling locations were standardised and a standard evaluation of laboratory results was worked out. (3,4)

Since the mid-1970s the County Public Health Stations have done the samplings all over the country, according to the Methodological Guide of OKI. Laboratories send their results to OKI, where they are arranged, and for some years they have been annually published in Egészségtudomány (Health Science) (5,6,7).

The hygienic bacteriological evaluation of surface waters is based on the delectability and quantity of bacteria indicating pollution and infection with respect to human health.

Waters in Classes I (clean) and II (slightly polluted) are suitable for bathing, doing water sports, relaxation and vacationing; while in water in Classes III (polluted) and IV (heavily polluted) bathing is dangerous because it may be harmful to human health. The more polluted the water is, the higher the health hazard of the people bathing in it. Classification, to evaluate surface waters with respect to public health, is based on the bacteriological component providing the worst value. Classification is based on the figures shown in Table 1. according to the components listed. In 1993, it was not part of the examinations to determine the clostridium number.

Processing, evaluation and qualification of the samples were done according to the standards and regulations in force. (3,4)

In our present review we analyse the results of the 1991, '92 and '93 examinations conducted by the laboratories of the County Public Health Stations on the Hármas-Körös River and its tributaries. Data were collected from Egészségtudomány, where the arithmetic mean value of samples taken (usually every two months) and the annual peak value are given. (5,6,7)

The sampling site of the Hármas-Körös River in Csongrád County is at Magyartés. The water samples taken there are analysed in detail.

Table 1 Hygienic classification of the surface waters

Parameters	I. Class clean	II. Class slightly polluted	III. Class polluted	IV Class heavily polluted
Coliform- number / ml	<10	10.1- 100	100.1- 1000	>1000
Faecal coliform -number /ml	<1	1.1- 10	10.1-100	>100
Faecal streptococcus -number /ml	<1	1 1- 5	5 1-50	>50
Clostridium - number /ml	<10	11-50	>50	>50
Salmonella / l	negative	positive*	positive **	positive **

* frequency of the positive samples no more than 33% vs total samples

** frequency of the positive samples more than 33% vs total samples

The water quality of the Körös Rivers and the Berettyó River

From the waters of the Körös Rivers (the Fehér-, the Fekete- and the Sebes-Körös) and the Berettyó River samples for bacteriological processing were taken at 17 sites in 1991 and 1992, and at 7 sites in 1993.

The quality of surface waters varied considerably from site to site, which can be seen in Table 2. The analysis according to the bacteriological components is the following:

Based on the delectability of bacteria belonging to the *Salmonella* group, which is the most dangerous to human health, water quality was "clean" (Class I) at Gyula, Sarkad and Gyomaendrod each year. It was "slightly polluted" (Class II) at Pocsaj in 1991 and 1993, at Berettyóújfalú in 1991 and at Kunszentmárton in 1992. It was "polluted" (Class III) at Pocsaj in 1992, at Berettyóújfalú in 1991 and in 1993, and at Kunszentmárton in 1991 and 1993. It was not "heavily polluted" (Class IV) anywhere.

Coliform bacteria, which indicate pollution, were abundant. Therefore, water quality was not "clean" (Class I) at any sampling sites, in any year. Half of the examination units in the table could be classified as "slightly polluted" (Class II), 5 instances (Sarkad 1993, Pocsaj 1991, 1992, 1993 and Gyomaendrod 1993) of "polluted" (Class III), and as "heavily polluted" (Class IV) at Berettyóújfalú each year and at Kunszentmárton in 1993.

Because of the *Faecal coliform number* and the *Faecal streptococcus number* indicating faecal pollution, water quality was "clean" or "slightly polluted" (Classes I and II) in 20 instances, while it was "polluted" (Class III) in 15 instances and "heavily polluted" at Berettyóújfalú in 1991.

Table 2 Bacteriological results of the Rivers Körös and Berettyó in 1991-1992

Sampling sites	Coliform number/ml			Faecal coliform number/ml			Faecal streptococcus - number/ml			Salmonella pos. samples/ total samples 1000 ml		
	1991	1992	1993	1991	1992	1993	1991	1992	1993	1991	1992	1993
Fehér-Körös <i>Gyula</i>	99	18	46	6,1	4,5	6,1	22,1	1,6	3,7	1/6	0/5	1/26
Fekete-Körös <i>Sarkad</i>	85	46	210	9,2	21	10	24,3	2,7	20	0/6	0/6	4/26
Berettyó <i>Pocsaj</i>	204	240	230	47,9	9,4	25	7,1	2	7,2	2/6	4/6	1/5
<i>Berettyóújfalú</i>	2961	3850	2414	183	57,1	63	16,6	19	10	2/6	3/6	2/5
Hármas-Körös <i>Gyomaendrőd</i>	23,3	11	113	2,9	0,7	14	2,5	1,5	4	1/6	0/4	1/25
<i>Kunszentmárton</i>	15,3	10,5	1598	2,7	3,5	4,2	1,2	0,5	0,4	4/6	0/5	3/6
<i>Magyartés</i>	see text											

I Class --- II Class ____ III Class _____ IV Class

Based on the presence of 4 bacterium groups, which were examined from the viewpoint of human health and considering the worst result in each river, the qualification at different sites is the following:

The *Fehér-Körös* at Gyula was “clean” and “slightly polluted” in 1992 and in 1993, while it was “polluted” in 1991 because of the number of Faecal streptococcus.

The *Fekete-Körös* at Sarkad was “polluted” each year (in 1991 because of the Faecal streptococcus number, in 1992 because of the Faecal coliform number and in 1993 because of the Coliform, the Faecal coliform and the Faecal streptococcus number).

The *Berettyó* at Pocsaj was “polluted” in each year and at Berettyóújfalu it was “heavily polluted”

The *Hármas-Körös* at Gyomaendrod was “clean” and “slightly polluted” in 1991 and in 1992, and “polluted” in 1993 (because of the high number of Coliform and Faecal coliform bacteria). At Kunszentmárton it was “polluted” in 1991 because of the positive samples of Salmonella. It was “slightly polluted” in 1992 and “heavily polluted” in 1993 because of the Coliform number.

Water quality of the Hármas-Körös River at Magyartés

We have paid considerable attention to the bacteriological quality of the surface waters in Csongrád County since the 1970s (8,9,10,11,12,13,14,15). According to the standard coming into force in 1993, (16) classification of surface waters is changed. Thus, we have summed up and analysed Csongrád County’s surface-water quality in the 6 years before the new classification came into force (1988-1993). (17,18)

During the 6 years the bacteriological results of a total of 68 samples taken at Magyartés were evaluated. In the period examined the Coliform number varied considerably. 23 % of the samples were higher than the hygienic limit, which can be read in Figure 1. (Hygienic limit: 100/ml)

40 % of the samples did not meet the requirements because of the Coliform number, 19 % because of the Faecal streptococcus number (Hygienic limit: 10 and 5/ml)

In the period examined the samples taken show a decrease in the number of Faecal coliform, and an increase in the number of Faecal streptococcus.

Salmonella was found in 20 samples (30%). Because of the data mentioned above, water quality was not “clean” (Class I) in any of the samples taken at Magyartés: 35% of the samples were “slightly polluted” (Class II), 60 % “polluted” (Class III) and 4% “heavily polluted” (Class IV).

As far as human health is concerned, only “clean” and “slightly polluted” (Classes I and II) natural surface waters are suitable for bathing, water sports, relaxation and

Három-Körös River, at Magyar-tés

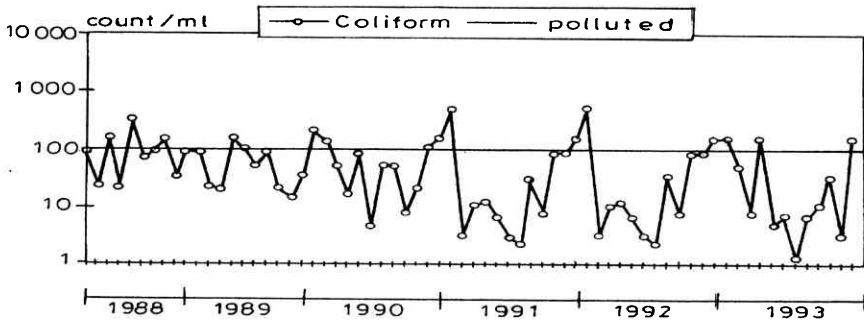


Figure 1.

Három-Körös River, at Magyar-tés

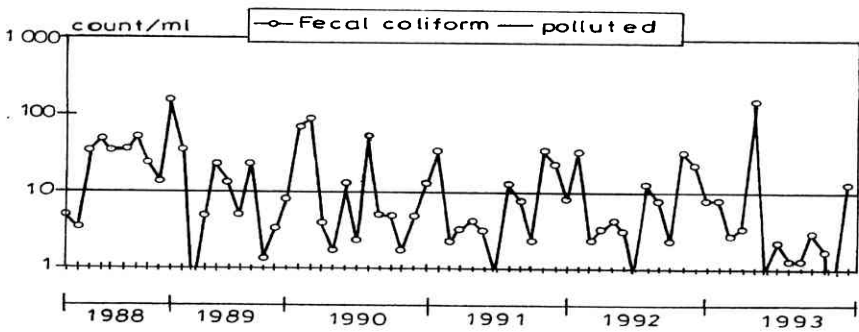


Figure 2.

Három-Körös River, at Magyar-tés

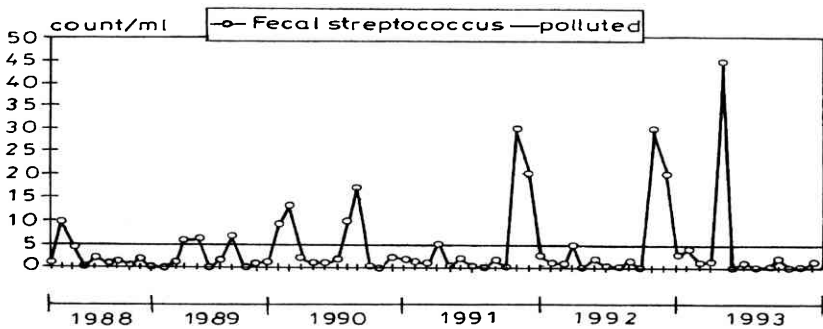


Figure 3.

vacationing. Preserving the purity of these waters and reducing further pollution are very important. By collecting and purifying sewage we could improve the quality of surface waters and make it more suitable for those seeking relaxation and refreshment.

Determining the quality of surface waters according to bacteriological data is just one part of analysis. It goes without saying that the evaluation of chemical, biological, ecotoxicological etc. data are also very important in the judgement of water quality. The greater the number of components of water quality and the more sophisticated the system of qualifying it, the safer the evaluation of water quality (19). The new standard (16) and the joint examinations by the Advisory Board for Environmental Protection and the County Public Health Stations in 1994 hopefully will help to provide an objective ecological evaluation of the water resources.

Summary

The authors examined the hygienic quality of the surface waters.

The hygienic bacteriological evaluation of surface waters is based on the delectability and quantity of bacteria indicating pollution and infection with respect to human health. The authors describe the history of these examinations from the time they came into force to the present day. Published in *Egészségtudomány*, the examinations conducted at sampling sites selected according to uniform criteria, and the subsequent collection, processing and evaluation, allow us to check water quality of different rivers in Hungary. The authors show the bacteriological results of water samples taken by the laboratories of the County Public Health Stations from the Körös Rivers and the Berettyó River through a period of 3 years (1991—1993). They analyse the pollution of the waters from a bacteriological perspective. They also publish water quality data for the Fehér-, Fekete-, and Hármas-Körös Rivers as well as the Berettyó River. 6 years of data was analysed from the Csongrád County sampling site.

As far as human health is concerned, only “clean” and “slightly polluted” waters can be used for bathing and water sports.

Attention is drawn to improving the quality of surface waters.

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