

SALMONELLAE IN THE SURFACE WATERS OF CSONGRÁD COUNTY

MÁRIA HEGEDŰS, PIROSKA KISS and L. BERÉNYI

Public Health Station of Csongrád county, H-6701 Szeged, Hungary

(Received November 10, 1978)

Abstract

Authors studied obligate and facultative fecal bacteria in the surface waters of Csongrád county from 1976 to 1977. Samples were taken monthly in general. In this paper, however, only the *Salmonella* pollution of the Tisza and its tributaries are reported. From June, 1976 to December, 1977, 317 water samples were enriched for the purpose of *Salmonella* examinations.

During 1976, 173 *Salmonella* strains were isolated and found to belong to 26 serotypes.

In 1977, 295 *Salmonella* strains were isolated and these belonged to 30 serotypes.

The *Salmonella* infection of the surface waters of Csongrád county as well as the spatial and time distribution of isolated *Salmonella* serotypes are demonstrated in figures and tables.

Introduction

In the previous years new tasks have become evident concerning evaluation and comparative analysis of the quality of surface waters. Besides the quantitative demand for water supply, water quality has become the minimum factor of water use. In the case of water utilizations, that require the judgement of the health organs, the quantitative and qualitative determination of obligate fecal indicator bacteria is indispensable.

According to our present knowledge (DEÁK 1977), the obligate fecal indicators of surface waters are the following: fecal coliforms, *Streptococcus faecalis* resp. *faecal streptococci*, the so called "enteral phages" which dissolve the intestinal bacteria, and finally pathogenic bacteria as salmonellas.

In this paper only the *Salmonella* infection of water bodies in Csongrád county will be discussed.

The *Salmonella* infection of the reach of the Tisza in Csongrád county as well as its tributaries was reported by DEÁK and SCHIEFNER (1975). They have stated that in Csongrád the *Salmonella* positivity of the Tisza has only in the area of Algyő and Szeged approached a value of 60%. The water quality of the Maros and Hármas-Körös was found by them favourable.

Materials and Methods

Between June, 1976 and December, 1977, 317 samples collected from the surface waters of Csongrád county were enriched for *Salmonella* examinations.

Water samples were usually taken in each month at the following sampling places: (Fig. 1).

Table 1. *Salmonella* serotypes occurring in the water-body of the Tisza in Csongrád county during 1976

Sampling place	July	Aug	Sept	Oct	Nov	Dec	Number of strains	Serotypes
Csongrád	—	—	—	—	<i>S. meleagridis</i> 3	<i>S. brandenburg</i> 8	11	2
Szentes	—	—	<i>S. london</i> 4	—	<i>S. agona</i> 1 <i>S. derby</i> 1	<i>S. java</i> 4	10	4
Mindszent	—	—	<i>S. derby</i> 4	<i>S. derby</i> 1 <i>S. brandenburg</i> 2 <i>S. livingstone</i> 2	<i>S. agona</i> 2 <i>S. essen</i> 2	—	13	—
Tápé	—	—	—	<i>S. abony</i> 1 <i>S. brandenburg</i> 1 <i>S. london</i> 1	—	—	3	3
Szeged strand	—	<i>S. bovis-morbificans</i> 3 <i>S. westhamp-ton</i> 2	<i>S. typhimurium</i> 1	<i>S. london</i> 2 <i>S. abony</i> 4 <i>S. java</i> 1	<i>S. london</i> 4	—	17 17	6 6
Tiszasziget frontier	—	<i>S. derby</i> 12 <i>S. infantis</i> 9 <i>S. give</i> 2 <i>S. london</i> 2 <i>S. westhamp-ton</i> 2 <i>S. senften</i> 1 <i>S. stanley</i> 1	<i>S. london</i> 1 <i>S. anatum</i> 2	<i>S. abony</i> 5 <i>S. java</i> 1	<i>S. enteritidis</i> 2	<i>S. london</i> 9	49	11
Total	—	34 serotypes	12 serotypes	21 serotypes	6 serotypes	15 serotypes	103	16 serotypes

The longitudinal section of the Tisza was sampled between 246.0–162.5 riv km (riv km=river kilometer). Sampling places were as follows: Csongrád, pontoon-bridge 246.0 riv km; Szentes, railway-bridge 242.0 riv km; Mindszent, ferry 216.2 riv km; Tápé 177.5 riv km; Szeged strand and Tiszasziget; Hungarian–Yugoslavian frontier region 162.5 riv km.

The two major tributaries of the Tisza were sampled, too. The river Hármas-Körös was sampled at its mouth, at 2 riv km. Maros was sampled at three places, in its reach above Makó, i. e. at the strand, at the bridge below the town (30 riv km) and at 2 riv km before its discharge into the Tisza. The water of Kurca canal was sampled above and below Szentes. It is this canal of little flow volume that collects both purified and nonpurified sewage of the town Szentes and discharges into the Tisza.

Szárászér canal and Élővíz canal flow into the frontier section of the Maros. In the period of water utilization, samples were also taken from these canals, just for the sake of orientation, during 1977. Because of the Tisza regulation, more than one back-water is to be found in Csongrád county. Samples were collected from four of these stagnant waters at the following localities: Csongrád-Serházuzzi, Mártély, Körtevényes and Atka.

For the purpose of Salmonella studies, 1000 ml water sample was collected at about 20 cm below surface from the current (in the case of rivers).

The standing waters, i. e. stagnant waters were sampled from the molo or a boat. During transportation to the laboratory, the samples were kept cold and worked up on the day of sampling, or within 24 hours at the latest. For the purpose of Salmonella examinations, 1000 ml water sample was filtered through 0.45 µm membrane filter and placed either into Preuss enrichment media containing potassium tetrathionate or Rappaport enrichment media and was incubated there at 37 °C for 16–18 h.

Samples taken from the enrichment media following an incubation period of 24 resp. 48 h, were plated by using brilliant green-, bismuth sulfite- and deoxicholate citrate-containing media. Differentiating and selective solid media were incubated at 37 °C for 24 h. Colonies suspicious of *Salmonella* were isolated on Russel media. Strains belonging to Salmonella were identified by the usual biochemical and serological tests.

Results

Results of *Salmonella* examinations during 1976: Number and serotypes of *Salmonella* strains isolated along the longitudinal section of the Tisza between Csongrád and Tiszasziget frontiers are illustrated according to sampling places and in monthly distribution (Table 1). As seen from the table, only three *Salmonella* strains were isolated in the area of Tápé, which, however, belonged to three different serotypes. The Csongrád water area of the Tisza became only in November salmonella-positive. From the sampling place at Csongrád in November only *S. meleagridis*, in December only *S. brandenburg* could be isolated. *S. meleagridis* was collected only at 246.0 riv km from the Tisza in Csongrád. As shown in Table 1, the Szeged strand and the frontier area at Tiszasziget were the "richest" in salmonellas, particularly during August, when 34 *Salmonella* strains, belonging to 8 serotypes, were isolated from the water samples collected in these two sampling places. It could be also stated, that the majority of *Salmonella* strains and serotypes were isolated from these two sampling places in the half year period. It must be mentioned, that the trialoperation of the dam weir at Ó-Becsé was started in the Yugoslavian reach of the Tisza at the end of July — at the beginning of August, 1976. Because of the impoundment, the flow rate of the Tisza considerably decreased at Szeged. The effect produced by this circumstance on the microbiological conditions in the river was unfavourable in every respect. This is supported by studies on other bacteriological parameters, too. (The results of these studies will be reported in another paper.)

In the next table (Table 2) numbers and serotypes of salmonellas isolated along the longitudinal section of the Csongrád reach of the Tisza are seen in the order of their frequency.

From June, 1976 to December 1976, *Salmonella london* was the most frequent serotype, followed by *S. derby*, *brandenburg*, *abony*. In Hungary this great frequency

Table 2. Numbers and serotypes of *Salmonella* strains isolated from the water body of the Tisza from July, 1976

		<i>Salmonella</i> strains	
		Serotypes	Number
1.	<i>S. london</i>		23
2.	<i>S. derby</i>		18
3.	<i>S. brandenburg</i>		11
4.	<i>S. abony</i>		10
5.	<i>S. infantis</i>		9
6.	<i>S. java</i>		6
7.	<i>S. westhampton</i>		4
8.	<i>S. agona</i>		3
9.	<i>S. bovis-morbificans</i>		3
10.	<i>S. meleagridis</i>		3
11.	<i>S. anatum</i>		2
12.	<i>S. enteritidis</i>		2
13.	<i>S. essen</i>		2
14.	<i>S. give</i>		2
15.	<i>S. livingstone</i>		2
16.	<i>S. senftenberg</i>		1
17.	<i>S. stanley</i>		1
18.	<i>S. typhi-murium</i>		1
Total:			113

of *S. london* was only restricted to Csongrád county. Concerning the *S. london* epidemic, we may say the following. In Hungary the *S. london* serotype was first isolated from human material in 1963. In Csongrád county this serotype was recovered in 1972, and subsequently there were three positive cases also from human material in 1975. The first case of the great epidemic in Szeged was isolated in the Laboratory of Enteric Bacteriae on July 30, 1976. Thereafter, there were no positive cases for about two weeks. From the middle of August, 1976, the number of the cases caused by *S. london* in Szeged increased considerably. The *S. london* serotype was isolated from foodstuff at the Laboratory of Food Bacteriology on August 16. One day later, on August 17, 1976, *S. london* was also isolated in the Laboratory of Water Biology from water samples taken from the current of the Tisza, the frontier region of Tiszasziget.

It is known that the sewage of Szeged is discharged unpurified into the swiftest part of the Tisza, below the city, at about 2–3 riv km above our sampling place. Since there was an increase in *S. london* positive cases in human material, isolations from water samples taken from the Tisza were continued in the second half of the year, as well. Since Szeged and its attraction area was the center of the *S. london* epidemic, most *S. london* strains were isolated from the Szeged reach of the Tisza.

Along the longitudinal section of the Tisza seldom occurring serotypes were found: *S. senftenberg*, *S. stanley* and *S. typhi-murium*. *S. typhi-murium* (Tabl. 1) was isolated only once, in the area of Szeged strand, despite the fact that it was the second place where it was isolated from by the Laboratory of Enteric Bacteriae in 1976. Next table (Table 3) shows *Salmonella* strains found in and isolated from the longitudinal section of the Csongrád reach of the Maros, in monthly distribution and according to sampling places. During half a year 56 *Salmonella* strains were isolated from three sampling places. All the three sampling places were positive for *Salmonella* during October and November. Serial examinations showed *Salmonella* positivity to be 53.5% in the water of the Maros river.

Table 3. Numbers and serotypes of *Salmonella* strains isolated in the longitudinal section of the Maros river in 1976

Sampling place	June	July	Aug	Sept	Oct	Nov	Dec	Number of <i>Salmonella</i> strains
Maros and Makó strand	<i>S. enteritidis</i> 3	—	—	<i>S. manchester</i> 6	<i>S. derby</i> 1 <i>S. agona</i> 4 <i>S. manchester</i> 1 <i>S. java</i> 1	<i>S. derby</i> 3 <i>S. agona</i> 1 <i>S. manchester</i> 1 <i>S. give</i> 2 <i>S. heidelberg</i> 1	<i>S. senftenberg</i> 3	28
	<i>S. typhimurium</i> 1	—	—	—	—	—	—	
		—	—	—	—	—	—	
Makó and Maros bridge	<i>S. reading</i> 3	—	—	<i>S. manchester</i> 5 <i>S. bredeney</i> 1	<i>S. derby</i> 2 <i>S. agona</i> 2 <i>S. essen</i> 2	<i>S. manchester</i> 1 <i>S. heidelberg</i> 1	—	17
		—	—	—	—	—	—	
		—	—	—	—	—	—	
Maros 2 riv km	—	—	—	<i>S. heidelberg</i> 1	<i>S. derby</i> 2 <i>S. abony</i> 1 <i>S. java</i> 2 <i>S. heidelberg</i> 1 <i>S. brandenburg</i> 1	<i>S. anatum</i> 3	—	11
		—	—	—	—	—	—	
		—	—	—	—	—	—	
	7	—	—	13	20	13	3	56

The serotypes, *S. manchester* and *S. heidelberg* could be continuously isolated from the water of the Maros, from September to November. Similarly to the Tisza, *S. typhi-murium* was isolated only on one occasion, namely from the sampling place at Makó strand.

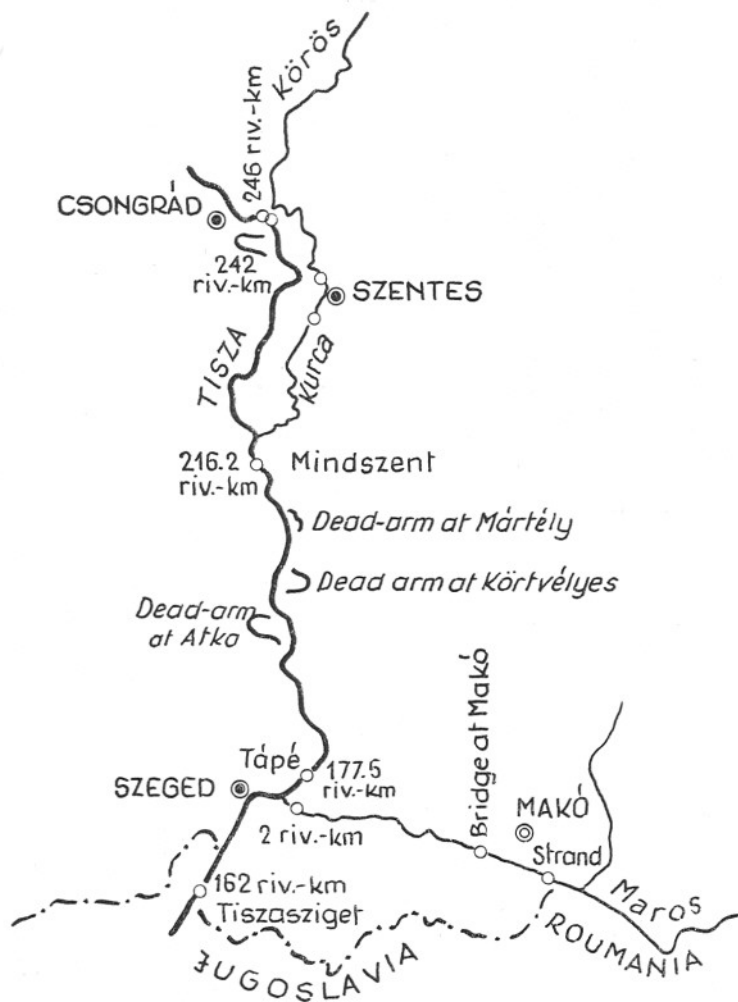


Fig. 1. Surface waters of Csongrád county with the sampling places.

In Table 4 *Salmonella* serotypes isolated along the Csongrád reach of the Maros are summarized in the order of their frequencies and occurrences. *Salmonella manchester* proved to be the most frequent serotype. It was isolated from the Maros in 1976. The *S. london* serotype was not isolated from the Maros during 1976.

In 1976, the Kurca canal was only tentatively sampled, since it is the recipient of the effluent discharged from the Central Sewage Treatment Plant of Szentes. The effluent is discharged into Kurca canal below the town. The water in Kurca canal

was Salmonella-positive at both sampling places. The following serotypes were isolated from above Szentes: *S. derby*, *S. senftenberg*, *S. saint-paul*. Below Szentes *S. reading* (O_5 deficiency), *S. derby* (O_5 deficiency) serotypes were isolated from the canal. The effluent of the sewage purification plant was also examined for Salmonella

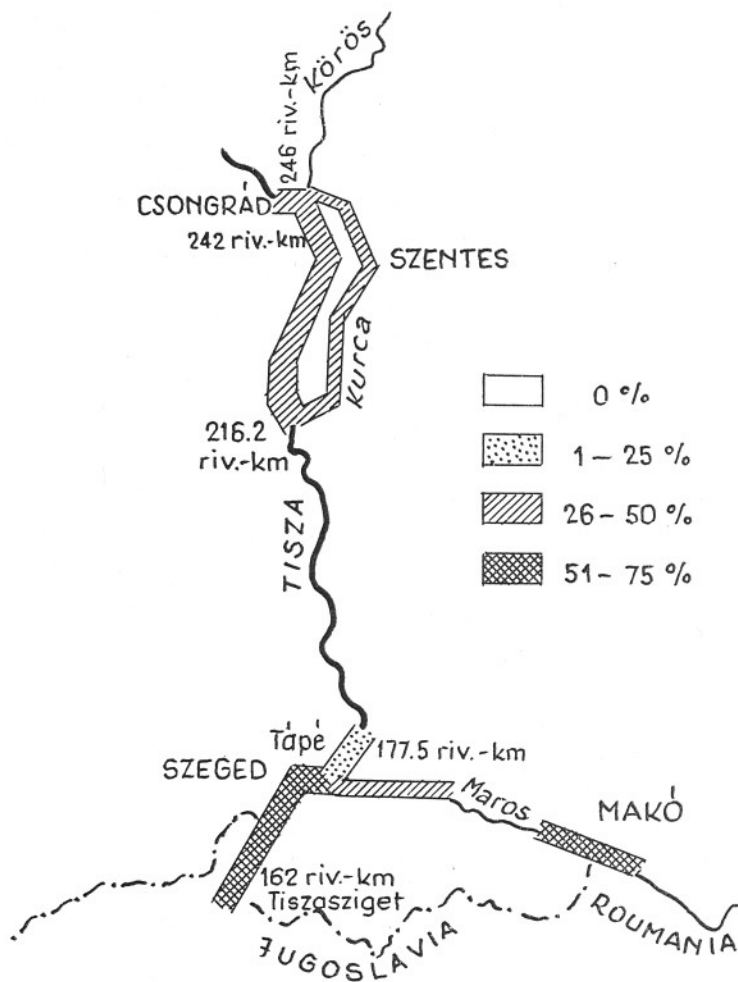


Fig. 2. Occurrence of salmonellas in the Tisza and its tributaries.

simultaneously. O_5 antigen-deficient Salmonella reading was isolated from the effluent, too. During 1976, only back-waters of the Tisza at Körtvélyes and Mártély were sampled. The following serotypes were isolated from the back-water of the Tisza at Körtvélyes: *S. reading* (O_5 -positive), *S. schleissheim*, *S. arizonae* (38; r; z.).

Only on one occasion was salmonella isolated from the backwater of the Tisza at Mártély during 1976. The species was *S. agona*.

The percentual frequency of salmonellae are illustrated on the basis of serial examinations performed in the surface waters of Csongrád county (Fig. 2).

On no occasion were salmonellas isolated from the 1000 ml samples taken from the water of the Hármas-Körös (2 riv km) during the half year in 1976. In the longitudinal section of the Tisza Salmonella-positivity was most favourable in the water region of Tápé. The other reaches of the Tisza, as well as the Maros and the Kurca were heavily infected by Salmonella. This fact is all the more remarkable, because along the longitudinal sections of the two rivers, open-air baths are functioning and recreation areas have been established. The Plan of Sectorial Normalization contains guide lines concerning utilization of surface waters and determines the limiting value of *Salmonella*-positivity, too, by stating, that "... in surface waters of I. and II. order, water quality may be suitable if in the 1000 ml samples taken from defined and characteristic place or places, and conforming to other bacteriological limiting values upon the evidence of serial examinations performed in the period of water utilization, the frequency of salmonellas is less than 33 %".

The results of Salmonella examinations during 1977 were the following:

Numbers and serotypes of *Salmonella* strains isolated from the longitudinal section of the Tisza in Csongrád county are shown in Table 5, in monthly distribution and according to sampling places.

From the 1000 ml water samples collected along the longitudinal section of the Tisza no *Salmonella* strains could be isolated in March and October. In 1977, *Salmonella* positivity was the highest in the Csongrád and Mindszent region of the Tisza. Compared to 1976, *Salmonella* infection took an unfavourable turn in the Tápé reach of the Tisza. In comparison to the 16.6% positivity of the preceding year, the positivity of this water region increased to 33.3% during 1977. The deterioration of water quality at this sampling place is also supported by other bacteriological parameters. During 1977, *Salmonella* positivity was 49.3% in average, and at each sampling place, except Tápé, exceeded the limiting value of 33.3%. *Salmonella* strains isolated from the longitudinal section of the Tisza in Csongrád county during 1977 are illustrated in Table 6 in the order of their frequencies.

Along the longitudinal section of the Tisza the following *Salmonella* serotypes were the most frequent ones: *S. derby*, *S. give*, *S. agona*. Among the *S. derby* serotypes O₅-positive and O₅-antigen deficient serotypes equally occurred.

Table 4. Numbers and serotypes of *Salmonella* strains isolated from the longitudinal section of the river Maros, in the order of their occurrences and frequencies (1976)

Salmonella strains		Number
	Serotypes	
1.	<i>S. manchester</i>	15
2.	<i>S. derby</i>	8
3.	<i>S. agona</i>	7
4.	<i>S. heidelberg</i>	4
5.	<i>S. anatum</i>	3
6.	<i>S. enteritidis</i>	3
7.	<i>S. java</i>	3
8.	<i>S. reading</i>	3
9.	<i>S. senftenberg</i>	3
10.	<i>S. essen</i>	2
11.	<i>S. abony</i>	1
12.	<i>S. brandenburg</i>	1
13.	<i>S. bredeney</i>	1
14.	<i>S. give</i>	1
15.	<i>S. typhi-murium</i>	1
Total:		56

Table 5. Special and time distribution of *Salmonella* strains isolated in the longitudinal section of the Tisza in Csongrád county in 1977

Sampling places	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Csongrád 246.0 riv km	<i>S. derby</i> 1	—	—	<i>S. derby</i> 1	<i>S. derby</i> 3	<i>S. derby</i> 3	<i>S. give</i> 7	—	—	<i>S. derby</i> 2 <i>S. hadar</i> 2	<i>S. panama</i> 2
Szentes	<i>S. enteritidis</i> 2 <i>S. typhimurium</i> 4	—	—	<i>S. derby</i> 6	<i>S. reeding</i> 2	<i>S. derby</i> 6	<i>S. derby</i> 1	<i>S. typhimurium</i> 2	—	—	—
Mindszent 216.2 riv km	<i>S. java</i> 2	—	<i>S. westhampton</i> 3	<i>S. typhimurium</i> 1 <i>ry</i> 1	—	<i>S. derby</i> 2 <i>S. give</i> 1	<i>S. agona</i> 2	—	—	<i>S. derby</i> 1 <i>S. london</i> 1	—
Tápé 172.5 riv km	<i>S. brandenburg</i> 5 <i>S. give</i> 2 <i>S. abony</i> 1	—	—	<i>S. derby</i> 1	—	—	<i>S. derby</i> 5 <i>S. agona</i> 3	—	—	<i>S. derby</i> 5 <i>S. hadar</i> 1	<i>S. anatum</i> 3
Szeged strand	—	—	—	<i>S. heidelberg</i> 9	—	—	—	<i>S. agona</i> 2	—	<i>S. agona</i> 2	<i>S. Newport</i> 1
Tiszasziget frontier 162.5 riv km	<i>S. derby</i> 3 <i>S. enteritidis</i> 3	—	—	—	<i>S. derby</i> 1	<i>S. westhampton</i> 1 <i>S. solt</i> 1	—	<i>S. westhampton</i> 1	—	—	—
	24	—	3	19	6	14	18	5	—	14	6
											109

Serotypes that were isolated for the first time from the longitudinal section of the Tisza in Csongrád are the following: *S. hadar*, *S. newport* and *S. solt*.

In 1976, the frequency of *S. london* was the highest in the Tisza region, owing to the *S. london* epidemic. In 1977, however, it was found among the seldom occurring serotypes. *S. london* was only once isolated from the Tisza, i. e. in November, at the sampling place at Mindszent (Table 5). In 1977, 79 salmonellas, belonging to 17 serotypes, were isolated from samples collected along the longitudinal section of the Maros (Table 7).

On the basis of serial examinations, *Salmonella*-positivity of the Maros averaged 57.9% in 1977. From water samples of 1000 ml from the sampling place at the bridge of Makó, *Salmonella* was only missing in October.

From the reach examined, *S. panama* was isolated in greatest number, and its outburst fell on January and February. In January, the isolated *Salmonella panama* strains were dulcitate negative, in February dulcitate-positive biochemical variants. From water samples collected from the Maros, *S. agona* was also isolated in great numbers and the presence of this serotype persisted in the river water for a long time, from February to November. *S. mapo* was the new *Salmonella* serotype which was first isolated in Csongrád county.

In Kurca canal the water was unfavourable in 1977. During 1977, Kurca canal was sampled monthly, at both sampling places, and on the basis of serial examinations *Salmonella*-positivity proved to be 54.2%. 52 *Salmonella* strains, belonging to 9 serotypes were isolated from the two sampling places. Numbers and serotypes of the isolated *Salmonella* strains are illustrated in Table 8.

In water samples from Kurca canal above Szentes, the O_5 -positive and O_5 -antigen deficient variants of *S. derby* occurred with the greatest frequency. The O_5 -positive variants of *S. bareilly*, *S. give*, *S. typhi-murium* and *S. reading* were less frequent serotypes in this sampling place. *S. langensalza* serotype was isolated from this sampling place for the first time. From the section of the canal below Szentes only the *S. panama* serotype was isolated. This was a dulcitate-negative biochemical variant. From Juni to November, however, only *S. hadar* was typified from the water samples and it was also dulcitate-negative.

Numbers and serotypes of *Salmonella* strains isolated from the Élővíz and Szárazér canals are shown in Table 8.

From the two samples taken from Élővíz canal 7 salmonellas belonging to four serotypes, were isolated. Only two samples were taken from the water of the Szárazér canal, and from them 18 *Salmonella* strains were isolated, which belonged to 8 serotypes. In Csongrád county the *S. isangi* serotype was first isolated from the Szárazér canal during October (6. 7; d; 1, 5), and a month later it was also typified from the Élővíz canal.

Analyzing the *Salmonella* infection in the backwaters of the Tisza, it could be stated that in no instance were positivities in the water regions in excess of the 33.3% limiting value. A comparative table (Table 8) illustrates numbers and serotypes of the isolated *Salmonella* strains.

Most salmonellas were isolated from samples taken from the back-water of the Tisza at Csongrád-Serházzugi. Serial examinations during 1977 showed *Salmonella*-positivity to be 33.3% in average. The serotype *S. hadar* was isolated in greatest number. It was first isolated in Csongrád county in the Laboratory for Water Bacteriology from a water sample taken from the back-water of the Tisza on June 30, 1977. A week later the same serotype was isolated from patients in the Laboratory of Enteric Bacteriae. The *S. hadar* serotype showed an increased frequency in the surface waters

Table 6. Numbers and serotypes of *Salmonella* strains isolated from water of the Tisza in the order of their frequencies in 1977

Salmonella strains		Number
Serotypes		
1.	<i>S. derby</i>	42
2.	<i>S. give</i>	10
3.	<i>S. agona</i>	9
4.	<i>S. heidelberg</i>	9
5.	<i>S. typhi-murium</i>	8
6.	<i>S. brandenburg</i>	5
7.	<i>S. enteritidis</i>	5
8.	<i>S. westhampton</i>	5
9.	<i>S. anatum</i>	3
10.	<i>S. hadar</i>	3
11.	<i>S. java</i>	2
12.	<i>S. panama</i>	2
13.	<i>S. reading</i>	2
14.	<i>S. abony</i>	1
15.	<i>S. london</i>	1
16.	<i>S. newport</i>	1
17.	<i>S. solt</i>	1
Total:		109

of Csongrád county in the second half of the year. The serotype *S. hadar* was also isolated from the longitudinal section of the Tisza, and from the Kurca canal below Szentes.

In 1977, *Salmonella*-positivity was 16.6% in the back-waters of the Tisza at

Table 7. Numbers and serotypes of *Salmonella* strains isolated from the longitudinal section of the Maros river, in the order of their frequencies in 1977

Salmonella strains		Number
Serotypes		
1.	<i>S. panama</i>	19
2.	<i>S. agona</i>	16
3.	<i>S. anatum</i>	8
4.	<i>S. java</i>	6
5.	<i>S. manchester</i>	6
6.	<i>S. westhampton</i>	5
7.	<i>S. thompson</i>	4
8.	<i>S. derby</i>	3
9.	<i>S. enteritidis</i>	2
10.	<i>S. livingstone</i>	2
11.	<i>S. typhi-murium</i>	2
12.	<i>S. bovis-morbificans</i>	1
13.	<i>S. essen</i>	1
14.	<i>S. kapemba</i>	1
15.	<i>S. london</i>	1
16.	<i>S. mapo</i>	1
17.	<i>S. meleagridis</i>	1
Total:		79

Mártély and Körtvélyes. A comparative table illustrates numbers and serotypes of salmonellas isolated from the two back-waters (Fig. 8).

Water samples taken from the back-water of the Tisza at Mártély in February and November were *Salmonella*-positive. In both cases *S. typhi-murium* strains were isolated, which differed in phage and biotype. The phage type of the strains isolated in February was not to be determined, they belonged to biotype 3. The *S. typhi-murium* strains isolated from the Tisza in the same period showed the same phage type and biotype. The *S. typhi-murium* strains isolated from the back-water of the Tisza at Mártély belonged to phage type 1a var. 1d and biotype 2.

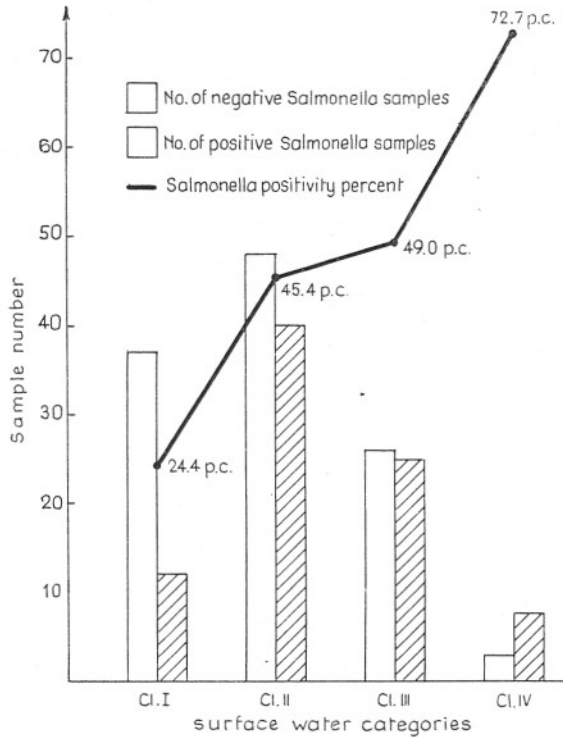


Fig. 3. *Salmonella*-positivity in surface waters of different categories.

From the back-water of the Tisza at Körtvélyes also only *S. typhi-murium* could be isolated. These isolates had O_5 -deficient antigenic structure.

The back-water of the Tisza at Atka is a water region which is intensively populated with fish. Its water was never *Salmonella*-positive during the one year period. Then, at the end of July, the serotype *S. gallinarum-pullorum*, not isolated yet in serotype was also isolated in the Laboratory of Enteric Bacteriae from humans, subsequent to isolation from water.

In Csongrád county, the frequency of *Salmonella*-positivity in surface waters of different categories were also examined (Fig. 3). In the determination of water

quality three bacteriological parameters were considered, according to the following limiting values:

Classes of water quality	I	II	III	IV
Number of coliforms pro ml	0—10	10—100	100—1000	above 1000
Number of fecal coliforms pro ml	0—1	1—10	10—100	above 100
Number of fecal streptotocci pro ml	0—1	1—10	10—100	above 100

Table 8. *Salmonella* strains isolated from the surface waters in Csongrád county in 1977

	Tisza	Hármas Körös	Kurca	Maros	Élővíz	Szárászér	Mártély dead-arm	Körtvélyes dead-arm	Serházzúg dead-arm	Atka dead-arm	
1. <i>S. derby</i>	42	—	9	3	—	4	—	—	—	—	58
2. <i>S. panama</i>	2	—	13	19	—	4	—	—	—	—	34
3. <i>S. agona</i>	9	—	3	16	2	2	—	—	—	—	32
4. <i>S. typhi-murium</i>	8	5	2	2	3	—	6	5	1	—	32
5. <i>S. hadar</i>	3	—	15	—	—	—	—	—	6	—	24
6. <i>S. anatum</i>	3	—	3	8	—	2	—	—	—	—	16
7. <i>S. give</i>	10	—	2	—	—	—	—	—	—	—	12
8. <i>S. infantis</i>	—	4	—	—	—	5	—	—	1	—	10
9. <i>S. westhampton</i>	5	—	—	5	—	—	—	—	—	—	10
10. <i>S. heidelberg</i>	9	—	—	—	—	—	—	—	—	—	9
11. <i>S. java</i>	2	—	—	6	—	—	—	—	—	—	8
12. <i>S. enteritidis</i>	5	—	—	2	—	—	—	—	—	—	7
13. <i>S. manchester</i>	—	—	—	6	—	—	—	—	—	—	6
14. <i>S. brandenburg</i>	5	—	—	—	—	—	—	—	—	—	5
15. <i>S. reading</i>	2	—	3	—	—	—	—	—	—	—	5
16. <i>S. livingstone</i>	—	—	—	2	—	2	—	—	—	—	4
17. <i>S. thompson</i>	—	—	—	4	—	—	—	—	—	—	4
18. <i>S. kapemba</i>	—	—	—	1	—	2	—	—	—	—	3
19. <i>S. london</i>	1	1	—	1	—	—	—	—	—	—	3
20. <i>S. isangi</i>	—	—	—	—	1	1	—	—	—	—	2
21. <i>S. meleagridis</i>	—	—	—	1	1	—	—	—	—	—	2
22. <i>S. abony</i>	1	—	—	—	—	—	—	—	—	—	1
23. <i>S. bareilly</i>	—	—	1	—	—	—	—	—	—	—	1
24. <i>S. bovis-morbificans</i>	—	—	—	1	—	—	—	—	—	—	1
25. <i>S. essen</i>	—	—	—	1	—	—	—	—	—	—	1
26. <i>S. gallinarum-pullorum</i>	—	—	—	—	—	—	—	—	—	1	1
27. <i>S. langensalsa</i>	—	—	1	—	—	—	—	—	—	—	1
28. <i>S. mapo</i>	—	—	—	1	—	—	—	—	—	—	1
29. <i>S. newport</i>	1	—	—	—	—	—	—	—	—	—	1
30. <i>S. solt</i>	1	—	—	—	—	—	—	—	—	—	1
Total:	109	10	52	79	7	18	6	5	8	1	295

It is seen in Fig. 3 that in surface waters of pure quality belonging to the first class, the frequency of *Salmonellas* was 24.4%. Evidently, in surface waters of the IV. class was *Salmonella*-positivity the highest, i.e. 72.7% in our case. In waters of

he II. and III. category, *Salmonella*-positivity of the samples was nearly identical, i.e. in waters of the II. category 45.4% of the samples were positive, in those of the III. category 49.0% of the samples.

References

- DEÁK, Zs., SCHIEFNER, K. (1975): Higiénés mikrobiológiai vizsgálatok a Tiszán és jelentősebb mellékfolyóin (Hygienic microbiological investigations in the Tisza and its major tributaries). — Magy. Hig. publ. of itinerary Congr. 19, 220—228. Budapest.
- DEÁK, Zs. (1977): Bakteriológiai vizsgálatok a Duna Rajka—Budapest közötti szakaszán (Bacteriological studies in the reach of the Duna between Rajka and Budapest). — Hidr. Közlöny 2, 79—82.
- EÜ. M.—OVH. (1972): Ágazati Szabványtervezet a Felszíni vizek minősítésének osztályozására (Plan of Sectoral Normalization for Classifying the Surface Water Qualification). — EÜSZ — OVHSZ 141 T (72. VIII). Budapest.
- Ivóvíz bakteriológiai vizsgálata. (Bacteriological investigation of the drinking-water). — MSZ 22 901 — 71.

Salmonella baktériumok előfordulása Csongrád megye felszíni vizeiben

HEGEDŰS MÁRIA, PIROSKA KISS—BERÉNYI L.

Közegészségügyi—Járványügyi Állomás, Szeged

Kivonat

A Szerzők Csongrád megye felszíni vizeiből 1976—1977. években általában havi gyakorisággal elvégezték az obligát és fakultatív faecal indikátor baktériumok meghatározását. Jelen közleményükben azonban csak a Tisza és mellékvizeinek *Salmonella* szennyezettségéről tájékoztatnak. 1976. júniusától 1977. decemberéig 317 vízmintát dúsítottak be a *Salmonella* vizsgálatok céljára.

1976-ban 173 salmonella törzset izoláltak és ezek 26 szerotípusba tartoztak.

1977-ben 295 salmonella törzset tudtak izolálni és ezek 30 szerotípusba tartoztak.

A szerzők ábrákon és táblázatokon mutatják be Csongrád megye felszíni vizeinek salmonella fertőzöttségét, valamint az izolált salmonella szerotípusok térbeli és időbeli megoszlását.

Nalaz bakterija Salmonella u površinskim vodama županije Csongrád

MÁRIA HEGEDŰS, PIROSKA KISS i L. BERÉNYI

Narodna zdravstvena stanica županije Csongrád, Szeged

Abstract

Autori su u toku 1976—1977. godine, uglavnom u mesečnim intervalima, izvršili odredjivanje obligatnih i fakultativnih idikatora fekalnog zagadjenja u površinskim vodama županije Csongrád. U ovom radu se iznose rezultati istraživanja samo na zagadjenost Salmonellom reke Tise i njenih pritoka.

Od juna 1976. do dec. 1977. je pripremljeno 317 proba u cilju ispitivanja na Salmonellu. U 1976. god. izolovano je 173 Salmonella tipa koji spadaju u 26 serotipa a u 1977. godini, izolovano je 295 Salmonella tipa pripadnika 30 serotipa.

Autori zagadjenost površinskih voda Salmonellom, kao i njihovu vremensku i prostornu distribuciju ilustruju crtežima i tabelama.

Распространённость бактерий *Salmonella* в поверхностных водах области Чонград

М. Хегедюш—П. Кишш—Л. Берени

Станция санитарной службы обл. Чонград, Н—6701, Сегед, Венгрия

В 1976—1977 гг. в основном периодически раз в месяц авторами проводилось определение содержания обязательных и факультативных индикаторных бактерий faecal

Настоящее сообщение даёт информацию лишь относительно засорённостью (поражённостью)

С июля 1976 г. по декабрь 1977 г. было проведено обогащение 317 водных проб с целью анализа *Salmonella*.

В 1976 г. изолировали 173 группы *Salmonella*, из которых 26 относились к серотипу.

В 1977 г. было выделено 295 групп *Salmonella*, из которых 30 относились к серотипу.

Авторы демонстрируют заражённость поверхностных вод *Salmonella* с помощью таблиц и рисунков, а также приводят деление изолированных серотипов *Salmonella* в зависимости от поверхности и времени.