Birzeit University
Community Health Unit

Bacterial Quality of Drinking-Water in Eight Villages in the Jordan Valley

Occasional Papers

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1. Introduction

The following paper summarises an interim report published in September 1984 by the Community Health Unit, describing its water quality research in the Jordan Valley. The work was conducted in co-operation with the Union of Medical Relief Committees.

The objective of the study was to carry out a simple sanitary survey in eight villages of the Valley north of Jericho, with the aim of evaluating the extent of faecal pollution of drinking-water. The final report was meant to stimulate the initiation of practical projects for improving the quality of drinking-water in the villages.

2. Methods

In each village the following procedure was carried out, in accordance with the methods recommended by the World Health Organization (WHO).

1. On arriving at the village, short interviews were conducted with key village members, usually the extended family head (mukhtar) and a teacher, to obtain the following information relating to water consumption:

a. approximate population and number of households;
b. sources of drinking-water;
c. methods of collecting water;
d. methods of storing water.

2. Samples of water were then collected from the water sources and from the storage vessels in a number of randomly selected households. Sterile collection methods were used. Each sample was taken in duplicates of 100ml each.

3. Bottles were then transported to the Birzeit laboratory in ice-cooled containers. The samples were filtered within 24 hours.

4. In order to measure the faecal coliform concentrations, the standard method recommended by WHO (1) and the American Public Health Association (APHA) (2) was applied: membrane filtration followed by incubation on endobroth at 44.5°C, after which the number of dark red colonies was counted.

The results were then expressed as the mean number of faecal coliforms per 100ml of water (i.e. the mean of two samples). Plates with more than 500 colonies were recorded as "too numerous too count" (TNTC).

5. In six of the villages repeat visits were made to obtain more samples from the water sources, so that the initial result could be double-checked. Samples were diluted before filtration in order for levels up to 2000 FC/100ml to be counted. The results are summarised in Tables 1 and 2.

In interpreting the data it should be noted that current WHO guidelines suggest that 0 FC/100ml is the acceptable level for drinking-water (3).

By this standard none of the villages has water of acceptable quality.

Perhaps the most useful index for comparing villages is the

percentage of samples with FC/100ml higher than 100. The results vary from 100% ('Ain al-Dyuk) to 22% (Bardala).

In addition, the springs which feed 'Ain al-Dyuk, al-Nwei'meh and al-'Awja were sampled at source, and showed 5, 18, and 0 FC/100ml respectively. It was also found that an open sewer from Nablus city feeds into the irrigation canal from which the Jiftlik villagers collect their drinking-water.

Table 1. Water Sources

Village	Source	Number of Samples with Colonies TNTC	Mean FC/100ml of Countable Samples	Total Number of Samples
'Ain al-Dyuk al-Tahta	Irrigation canal	2	-	2
al-Nwei'meh (above village)	Irrigation canal	0	222	4
al-Nwei'meh (below village)	Irrigation canal	0	1,091	4
al-'Awja	Irrigation canal	1	665	4
Jiftlik	Canal	4	-	4
Zbeidat	Tubewell	3	117	9
Marj Na'jeh	Tubewell	1	141	4
Bardala	Taps	2	116	7
	Tubewell	0	0	1
'Ain al-Beida	Tubewell	0	0	1
	Taps	0	0	4

Table 2. Stored Water*

Village	Number of Households Sampled	% TNTC	Mean FC/100ml of Countable Samples	% Sample greater than 100 FC/100ml
'Ain al-Dyuk	16	100	-	100
al-Nwei'meh	19	26	42	53
al-'Awja	13	0	110	46
Jiftlik	8	25	266	88
Zbeidat	8	25	279	100
Marj Na'jeh	5**	80	98	80
Bardala	9	11	59	22
'Ain al-Beida	10	30	104	60

* Most villagers stored their water in an unglazed earthenware jar (zir).
** Samples taken from taps

3. Discussion

The study showed that water of unacceptable quality was being consumed in all eight villages. A variety of schemes have been recommended to improve this situation:

1. In 'Ain al-Dyuk, al-Nwei'meh, and al-'Awja, the ideal solution is to connect the villages to the spring via a piped drinking-water system. While this remains impossible, a variety of purification systems in the villages could be investigated, including sand filters, ceramic filters or chlorination. The possibility that canal water which is stored for several days will partially purify itself of harmful bacteria should also be investigated.

2. The Jiftlik canal is perhaps the most unhealthy water source, as raw human sewage is polluting the canal. In the absence of a piped potable water source, purification options should be considered. Alternatively, a tanker delivery system of clean water from tubewells in the area could be considered.

3. In both Zbeidat and Marj Na'jeh, a tubewell pumps water from about 35 m below ground surface. In both villages latrine pits or septic tanks are situated only a few metres from the well. The bedrock is fissured chalk/limestone (advat group). In this situation there is a high risk of sewage seeping through the bedrock fissures into the water table, and hence into the drinking-water. This is the simplest explanation for the pollution levels measured.

An easy solution for both villages is to construct a closed-joint piped sewage system for the houses within 50m of the tubewell, with the sewage running into a septic tank and drainage field over 100m away.

4. In Bardala and 'Ain al-Beida, the water supply itself is clean, but significant levels of pollution during storage were measured. Assuming that this is caused by the removal of water from the containers by dirty cups, a solution could be to introduce containers with taps for water storage.

It can be concluded that the methodology applied in this survey provides a fast and useful system for evaluating drinking-water quality. The information can be used to suggest ways of making improvements, which, if implemented, can be evaluated according to the same method.

References

(1) World Health Organization, Guidelines for Drinking-Water Quality, Vol. 1: Recommendations, Geneva: World Health Organization, 1984, pp. 26-27.

(2) American Public Health Association, American Water Works Association, Water Pollution Control Federation, Standard Methods for Examination of Water and Wastewater, 15th, rev. ed., Washington: American Public Health Association, 1981, pp. 814-815.

(3) WHO, op. cit., p. 19.

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