How safe is the safe water supply?

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Abstract

A total of 1200 drinking water samples from various water sources in Amritsar district, were analyzed to assess bacteriological quality of water. Presumptive coliform count by multiple tube test was done. The study revealed that 570 (47.5%) samples were unfit for human consumption. Of all the samples tested, 63/110(57.3%) samples from religious places, 28/56(50%) from hospitals, 25/50(50%) from bus stands/railway stations, 84/190(44.4%) from schools, 32/100(32%) from BSF checkposts, 5/19(26.5%) from hotels and 3/25(12%) from ice factories were found to be unsatisfactory. Out of the 570 unsatisfactory samples detected, 72% samples from submersible pumps,50% from hand pumps, 45.4% from taps,29.2% from tube wells and 28.5% from domestic tap supply were found to be contaminated. On Eijkman test 20/25(80%) of the suspicious samples turned out to be unsatisfactory. So, availability of safe drinking water still remains a much sought after commodity for majority of public in developing countries like India.

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INTRODUCTION

Water, the elixir of life is getting polluted due to rapidly increasing population, urbanization, construction of new buildings and deforestation. Water pollution is becoming a global problem threatening human existence .Water contamination occurs from human, animal and industrial wastes mixing into it. They contain a variety of bacterial, viral, protozoan pathogens and helminth parasites along with chemical pollutants. Consumption of such unsafe drinking water may expose a high proportion of the community to the risk of outbreaks of intestinal and other infectious diseases (1) .In fact, more people would die of consuming unsafe drinking water and unsanitary conditions by the year 2020 than from AIDS, if steps to improve water quality are not taken on war footing (2)

Ideally, drinking water should not contain any micro organisms which are known to be pathogenic. It should be free from bacteria indicative of faecal pollution. The primary bacterial indicator recommended for this purpose is the coliform group of organisms (3)

In themselves, coliforms are not dangerous but their presence indicates that the fecal matter has entered the water supply, and fecal bacteria have not been removed or killed by the purification processes. Therefore the water supply is liable to contamination with dangerous intestinal pathogens (4)

So, in the interest of public health water supplies (piped/unpiped) and samples from distribution sources must be checked from time to time to ensure that safe quality drinking water is supplied to the public (5). In fact, much of the ill health which affects humanity especially in developing countries can be traced back to lack of safe and wholesome water supply. There can be no state of positive health and well being without safe water (2). The present study was therefore undertaken to analyse the water samples from various sources for the presence of coliforms.

AIMS/OBJECTIVES

The present study was conducted with the objective of assessing the bacteriological quality of water in different drinking water sources in Amritsar District (India).

MATERIALS AND METHODS

A total of 1200 drinking water samples from taps of piped supply (550), hand pumps (380),submersible pumps (125),tube well(120) and ice factories (25)from various places in Amritsar district received during the period of Jan 2007 to Dec,2008 were analyzed in Microbiology Department of Govt. Medical College, Amritsar.

The samples were received in sterilized, standard, specified glass bottles of 230 cc capacity along with properly filled prescribed proforma. The samples were received, stored (in

case of delay) and processed in accordance with the guidelines described in standard methods (6). Presumptive coliform count test based on multiple tube fermentation method by Senior BW was used to estimate the most probable number of coliform organisms in 100 ml of water for diagnosis of bacteriological contamination .The test was carried out by inoculation of measured quantities of sample water viz. 1.0 ml, 10.0 ml and 50 mls into tubes of double and single strength MacConkey's Lactose Bile Salt Broth with inverted Durham's tube in it. The tubes were incubated at 37oCfor 48 hours. The tubes showing gas formation were taken as positive. The probable number of coliforms per 100 ml was then read out from Mc Crady's probability tables which are standard tables of presumptive coliform count (4, 7). Numbers of coliforms per 100 ml were interpreted as follows:

Figure 1

No. of coliforms	Inference
Zero	Excellent
1-3	Satisfactory
4-10	doubtful/suspicious
>10	Unsatisfactory

Differential coliform count (Eijkman'sTest) was performed on suspicious water samples. Subcultures from positive presumptive test were made into MacConkey broth and peptone water and incubated at 44OC in thermostatically controlled water bath for overnight. Presence of Esch.coli was confirmed by the production of gas from lactose at 44O C and indole from tryptophan.

OBSERVATIONS

The results obtained are tabulated as follows

Figure 2

Table 1. Showing results of presumptive coliform counts of total 1200 samples of water tested

Grade of Water sample	Presumptive coliform count/100ml	Number & percentage of water samples
Excellent	0	425(35.4%)
Satisfactory	1-3	200(16.6%)
Suspicious	4-10	25(2.0)
Unsatisfactory	>10	550(46.0)

After subjecting the samples to Eijkman test, 20 samples turned out to be unsatisfactory while 5 were satisfactory.

Figure 3

Table 2. Showing results of presumptive coliform count in relation to water source

S.No.	Source	No. of samples analyzed (n=1200)	Grade of water sample		
			Excellent	Satisfactory	Unsatisfactory
1	Taps	550(45.8%)	200(36.4%)	100(18.2%) [97+3*]	250(45.4%) [240+10*]
2.	Hand pumps	380(31.7%)	130(34.3%)	60(15.7%)	190(50.0%) [185+5*]
3.	Submersible pumps	125(10.4%)	25(20.0%)	10(8.0%)	90(72.0%) [85+5*]
4.	Tube wells	120(10.0%)	60(50.0%)	25(20.8%) [23+2*]	35(29.2%)
5.	Ice factories	25(2.1%)	10(40%)	10(40%)	5(20.0%)

* Indicates number of results after Eijkman test

Figure 4

Table 3.showing number of total and unsatisfactory samples collected from various places

S.No	*Source of collection	No. of samples collected	No. of unsatisfactory samples (%)
1	Domestic supply	650	185(28.5)
2	Schools	190	84(44.4)
3	Religious places	110	63(57.3)
4	BSF check posts	100	32(32.0)
5	Hospitals	56	28(50.0)
6	Railway /Bus stations	50	25(50.0)
7	Ice factories	25	3(12.0)
8	Hotels	19	5(26.5)

*Sources included municipal taps, handpumps, submersible pumps and tubewells in all these places

DISCUSSION

In current study, out of 1200 samples tested, 570(47.5%) were found to be unsatisfactory for human consumption. The percentage of samples tested by other workers has been as high as 81.3% (2). However, in a similar study done in this center in 1991, only 38.6% samples tested were found to be unsatisfactory (8).The increase in incidence of unsatisfactory samples in the present study could be due to the rapid growth of the city with a present population of about 2.5 million and reflecting an ailing sewerage system which has not been able to cope up with the growth of this holy city.

Another important observation in our study was that the coliform growth up to satisfactory levels was found only in 200 samples (33.3%). Out of the 25 suspicious samples tested, which could harbor other coliforms also, 5 samples (20%) turned out to be satisfactory which means no faecal contamination of the source with Esch.coli.

Shockingly 63/110(57.3%) samples from religious places, 28/56(50%) from hospitals, 25/50(50%) from bus stands and railway stations, 84/190(44.4%) from schools,32/100(32%) from BSF check posts, 5/19(26.5%) from hotels and 3/25(12.0%) from ice factories were found to be unsatisfactory. This is of grave concern as they may cause acute health hazard in the form of water borne diseases to the local as well as travelling population (Amritsar is a holy city)

Another startling finding in the study was that 250/550(45.5%) of the water samples supplied through municipal taps(presumed to be pre-treated) were also found to be unsatisfactory, whereas other workers have reported 20% of the treated water supply to be contaminated (5). Surprisingly,90/125(72%) of the samples from submersible pumps which are much in use in Punjab were also found to be unfit for human consumption and this calls for an early remedial intervention.

CONCLUSIONS

Thus, it is concluded from the present study that the alarmingly high percentage of unsatisfactory water samples from submersible pumps, taps and from places visited by common people like religious places, bus stands, railway stations, hospitals and schools calls for public awareness and an immediate attention by the authorities as well. Piped water supply from the source to the consumer has to be regularly monitored by the authorities to ensure the delivery of pure and germfree water.

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