BACTERIOLOGICAL EXAMINATION OF DRINKING WATER WITH SPECIAL REFERENCE TO ORGANISMS OF PUBLIC HEALTH SIGNIFICANCE IN BIKANER AND ITS SUBURBS

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ABSTRACT

In the present study microbiological analysis of water was conducted in Bikaner city and its suburbs. The water samples collected from different sources were assessed for their bacteriological quality and isolates of *Staphylococcus aureus* and *Escherichia coli* were evaluated for antibiogram patterns. Results of antibiotic sensitivity test revealed that among 6 antibiotics maximum resistance was obtained against cloxacillin and all the isolates showed multiple antibiotics resistance.

***Key words*:** Public health, *Staphylococcus aureus, Escherichia coli,* antibiotics resistance

Introduction

Pure drinking water free from microbial contamination should be made available for consumption of human beings as well as animals. Large numbers of disease outbreaks have been reported due to polluted water throughout the globe. It becomes worrisome if antibiotic resistant organisms from any source contaminate drinking water in the environment causing infections among the human population. The pattern of drug-resistance continues to change in a particular area depending upon various epidemiological factors and indiscriminate use of antibiotics (Kaushik *et al*., 2015).

Materials and Methods

A total of 100 water samples were from different sources in Bikaner city and its suburbs *viz*. Gangashahar, Karmisar, Udasar and Beechwal for bacteriological examination. 66 samples were collected from water sources of human use (26 samples from Bikaner city and 10 samples each, from its suburbs) and 34 samples were collected from water sources of animal use (10 samples from Bikaner city and 6 samples each from its suburbs). All the water samples were screened for presence of *Staphylococcus* spp. and *Escherichia coli.* Isolation of *Staphylococcus* spp. was done by surface spread method of Nordic Committee on food analysis (NCFA, 1968) using SM-110 media and further confirmation for *Staphylococcus spp*. was done by Gram's reaction, catalase test, oxidase test and oxidation fermentation test. Identified colonies were further subjected to coagulase test described by Cowan and Steel (1993). Isolation of *Escherichia coli* was done by surface spread method as prescribed by American Public Health Association (1975) using EMB (Eosin Methylene blue agar).

Typical colonies showing greenish metallic sheen on EMB were picked up and subjected to Gram's staining as per the standard protocols. Antibiotic sensitivity test was conducted by using method as described by Kirby *et al.*(1966) using six antibiotic discs *viz*., ampicillin, chloramphenicol, cloxacillin, erythromycin, streptomycin and tetracycline. Zone of inhibition was observed around the antibiotic disc which is effective for the particular bacterium.

Results and Discussion

All the 34 samples of water collected from different sources used by animals were positive for *Escherichia coli* and 32 samples were positive for *Staphylococcus* spp. Out of 66 samples investigated from different sources used by human populations for consumption, 16 and 9 samples were positive for *Escherichia coli* and *Staphylococcus* spp., respectively (Table1).

According to National Standards for bacteriological quality of drinking water, Government of India (1997) water intended for drinking must not have *Escherichia coli* and *Staphylococcus* spp., Jain (1997) also found the water samples from the animal water troughs, positive for *Escherichia coli,* while Ram (2002) reported 50% water samples from animal water troughs positive for *Escherichia coli*. Similar findings were also reported by Edberg *et al.* (2000) and Odeyemi *et al.* (2011). Ali *et al.* (2011) found 18% samples from different water reservoirs at 19 school of district Peshawar positive for *Escherichia coli.* Likewise 26.4% isolation rate of *Escherichia coli* was reported by Tista *et al.* (2007) from 132 drinking water samples of Kathmandu valley. Jain (1997) conducted the same study on water of different animal houses and found 70% samples positive for *Staphylococcus* spp. while Ram (2002) found 52% samples to have presence of *Staphylococci* and Amaral *et al.* (1995) observed 4% samples to be positive for *Staphylococcus* spp.These findings were lower than the observation of present study.

The result of these 50 isolates of *Escherichia coli* and 41 isolates of *Staphylococcus* spp. against 6 antibiotics are presented in Table 2. It was observed that isolates of *Escherichia coli* and *Staphylococcus* spp. were most sensitive to Streptomycin with 72% and 78.05% sensitivity, respectively and none of the isolates were sensitive to Ampicillin. Individually, *Escherichia coli* and *Staphylococcus* spp. showed almost same resistance pattern with some variation. *Staphylococcus* spp. isolates were most resistant to cloxacillin (97.56%) followed by erythromycin, chloramphenicol, ampicillin,

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streptomycin and tetracyclin. *Escherichia coli* isolates were most resistant to cloxacillin followed by erythromycin, ampicillin, chloramphenicol, tetracycline and streptomycin. Similar findings were also reported by Abrha (2000) who examined 150 water samples in Bareilly and obtained similar antibiotic sensitivity pattern for *Escherichia coli* isolates. Sokari *et al.* (1988) examined 133 isolates of *Escherichia coli* from municipal waste water, river and wells in and around host craft and reported that 83.3% of *Escherichia coli* isolates were resistance to at least one antibiotic. Al-Jebouri and Al-Meshhandani (1985) reported that 77% isolates of *Escherichia coli* from healthy human adults, raw sewage and sewage polluted Tigris river in Mosul were showing multiple antibiotic resistance. Sharma *et al*. (2015) showed satisfactory level of sensitivity of antibiotics of fluoroquinoles group agains *Escherichia coli*. Similar to present study, Jain (1997) reported most of the isolates of *Staphylococcus* spp. sensitive to streptomycin and tetracycline while Saradhi (2002) found 76.2% isolates sensitive to ampicillin and 63.7% isolates sensitive to chloramphenicol from the samples of different sources.

Multiple antibiotic resistances of isolates from different drinking water sources has been reported by Jazrawi *et al.* (1988) in Baghdad city and Shears *et al.* (1995) in rural Bangladesh. Subedi and Aryal (2010) performed antibiotic sensitivity test on 117 isolates from the 52 drinking water jars of Kathmandu and found that all were sensitive to antibiotic ciprofloxacin and resistant to ampicillin. In India Singh (2008) analyzed 44 water samples from Gangotri to Tehri for antibiogram in terms of sensitive (s), intermediate (I), resistance (R) and in Gangotri, co-trimoxazole, ciprofloxacin, cephotaxime, enrofloxacin, erythromysin, norfloxacin and refampicin were found 100% sensitive. In Bhairo Ghati, amikacin, co-trimoxazole, ciprofloxacin, enrofloxacin, norfloxacin, and polymyxin B were completely sensitive. In Uttar Kashi only co-trimoxazole was found 100% sensitive and maximum of the antibiotics were showed 50 to 75% sensitivity in samples and no any antibiotics was found 100% sensitive in water samples from Tehri. The prevalence of resistant strains of *E. coli* is a reflection of the use and misuse of antibiotics in the society (Sharma *et al.,* 2014). *Staphylococcus aureus* acquires antibiotic resistance with remarkable proficiency and this organism is responsible for causing many different ailments in humans as well (Khichar and Kataria, 2015).

The public health implication of this investigation is that antimicrobial resistant strains of pathogenic bacteria may colonize the human population and this would lead to failures of chemotherapy among the human consumers of any of these products (Nema *et al*., 2015). Presence of these organisms in humans as well as in animals drinking water indicated alarming situation. The consumption of drinking water contaminated with pathogenic microbes of faecal origin presents significant risk to humans and animal health. The presence of *Staphylococcus* spp. in the present study indicates that the management of watering troughs needs strict hygienic measure to avoid microbial contamination. Efficient and proper sanitary check on drinking water supplies has to be executed regularly.

Table 1: Details of Isolates

S. No	Place	No. of isolates of *Escherichia coli*		No. of isolates *of Staphylococcus* spp.		Total No. of isolates
		From Sources of human use (n = 66)	From Sources of animal use (n = 34)	From Sources of human use (n = 66)	From Sources of animal use (n = 34)	
1.	Bikaner city	8	10	3	10	31
2.	Beechwal	4	6	2	6	18
3.	Gangashahar	2	6	1	6	15
4.	Karmisar	1	6	2	4	13
5.	Udasar	1	6	1	6	14
	Total	16	34	9	32	91

Table 2 : Result of antibiotic sensitivity test against *Escherichia coli* and *Staphylococcus* isolates (in per cent)

Bacteria	*Escherichia coli (n=50)*			*Staphylococcus* spp. (n=41)		
Antibiotics	S	I	R	S	I	R
Ampicillin	-	28.00	72.00	-	39.02	60.98
Chloramphenicol	4.00	30.00	66.00	2.44	14.63	82.93
Cloxacillin	-	14.00	86.00	2.44	-	97.56
Erythromycin	6.00	16.00	78.00	4.88	9.76	85.37
Streptomycin	72.00	16.00	12.00	78.05	-	21.95
Tetracycline	26.00	32.00	42.00	65.85	19.51	14.63

S = Sensitive I = Intermediate R=Resistant

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