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Klebsilla: In Drinking Water

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ABSTRACT: *A total of 116 drinking water samples from Government hand pump (32 samples), Municipal tap water (58 samples) and Water cooler (26 samples) collected aseptically in sterilized container. Over a period of nine month September to May 2012.Most probable number (MPN) test was done to detect the coliforms in drinking water samples. Percentage occurrence of the isolates was Klebsiella spp. (15%), along with Pseudomonas aeruginosa (25%), Escherichia coli (28%). The pH of the water samples ranged from 5.9 to 7.45, temperature ranged from 26.58ºC to 30.13ºC. Therefore the need for the provision of reliable potable water to the local dwellers by government is highly recommended to prevent health hazards.*

KEYWORDS*: Drinking water sample, MPN count, Coliforms*

I. INTRODUCTION

Water is the most abundant chemical in the human body and plays a central role in the regulation of nutrient transport, toxic waste removal, thermal regulation and digestion, organ functioning and metabolic activities. However, if water is fecally polluted it spreads diseases in consumers to a great number of people[1]. World health organization estimated in 2000 assessment that there are four billion cases of diarrhea each year in addition to millions to other cases of illness associated with the lack of access of clean water [2]. It is well established that infectious diseases are transmitted primarily through water supplies contaminated with human and animal excreta particularly faeces[3].Out breaks of water borne diseases continue to occur throughout the world but are especially serious in developing countries[4-5]. The human pathogens that present serious risk of disease whenever present in drinking water include *Salmonella species, Shigella species, pathogenic Escherichia coli, Vibrio cholerae, Yersinia entercolitica, Campylobacter* species, various viruses such as *Hepatitis A, Hepatitis E, Rota* virus and parasites such as *Entamoeba histolytica* and *Giardia* species and so on[5-7].Public and environmental health protection requires safe drinking water, which means that it must be free of pathogenic bacteria.

II. CHARACTERISTICS

Klebsiella spp. is Gram-negative, nonmotile, usually encapsulated rod-shaped bacteria, belonging to the family Enterobacteriaceae [8-9].These bacteria produce lysine decarboxylase but not ornithine decarboxylase and are generally positive in the Voges-Proskauer test. Members of the Enterobacteriaceae family are generally facultatively anaerobic, and range from 0.3 to 1.0 mm in width and 0.6 to 6.0 mm in length [9]. *Klebsiella* spp. often occurs in mucoid colonies [8-9]. The genus consists of 77 capsular antigens (K antigens), leading to different serogroups.

III. EPIDEMIOLOGY

Klebsiella spp. occur worldwide, particularly in tropical and subtropical regions, and are ubiquitous, including forest environments, vegetation soil, water, and mucosal membranes of host species[8]. Although they are common pathogens for community-acquired pneumonias and bacteremias, the majority of the infections are nosocomial (hospital-acquired; ~56% of all *Klebsiella* infections).*Klebsiella* spp. are considered endemic in neonatal wards and nosocomial outbreaks, particularly in neonatal wards, are common. Adult males are more susceptible to infection with *Klebsiella* spp. than adult females [8]. however, *Klebsiella* spp. demonstrate higher colonization rates among neonates that may survive up to months as compared to a few days to weeks in adults. Risk of infection and carriage rates of *Klebsiella* spp. increases with increase in duration of stay within a hospital; 11% to 42% increase in carriage rate within 14 days of hospitalization according to one study [8]. Infection and carriage rates also increase with antimicrobial use; this usually leads to the development of extended-spectrum beta-lactamase (ESBLs) which provide resistance against antibiotics [8-11].*K. pneumoniae* is most pathogenic to humans among all *Klebsiella* spp.,followedby *K.oxytoca. K.ozaenae* and *K.rhinoscleromatis* cause specific diseases in humans [11]. *K.granulomatis* and *K. variicola* have also been identified as being pathogenic to humans. *K. singaporensis* is still very novel and its pathogenicity to humans has yet to be determined. Although, the number of infections is lower than some other pathogens, infections by *Klebsiella* spp. demonstrate substantial morbidity and mortality. *K. pneumoniae* occurs in the nasopharynx and intestinal tract of humans, as a saprophyte [11]. It is one of the leading causes of community-

acquired pneumonia. It is important cause of primary liver abscess and of microbial fascial space infections among diabetic patients in Asia, predominantly in Taiwan [8]. It is commonly isolated from infections of burns and human bites. Recently, it has become an increasing cause of chronic diarrhoea in HIV infected adults in Africa. *K. pnuemoniae* and *K. oxytoca* are important causative agents of community-acquired meningitis and brain abscesses in Asia, predominantly in Taiwan. According to some reports, *Klebsiella* spp. is responsible for 16 to 43% of central nervous system (CNS) infections and brain abscesses. Environmental strains of *K. pneumoniae* have been shown to be equally virulent as clinical strains; however, whether this is true or not for othe r*Klebsiella* spp. has yet to be determined [12].

IV. PATHOGENICITY:

Klebsiella spp. has been identified as important common pathogens for nosocomial pneumonia (7 to 14% of all cases), septicaemia (4 to 15%), and urinary tract infection (UTIs; 6 to 17%), wound infections (2 to 4%), intensive care unit (ICU) infections (4 to 17%), and neonatal septicaemias (3 to 20%). *Klebsiella* spp. can also cause bacteremias and hepatic infections, and have been isolated from a number of unusual infections, including endocarditis, primary gas-containing mediastinal abscess, peritonitis, acute cholecystitis, crepitant myonecrosis, pyomyositis, necrotizing fasciitis, psoas muscle abscess, fascial space infections of the head and neck, and septic arthritis.They are also important opportunistic pathogens, particularly among the immunocompromised. Pathogenicity factors of *Klebsiella* spp. include adhesins, siderophores, capsular polysaccharides (CPLs), cell surface lipopolysaccharides (LPSs), and toxins, each of which plays a specific role in the pathogenesis of these species. Depending on the type of infection and the mode of infectivity, cells of *Klebsiella* spp. may adhere and attack upper respiratory tract epithelial cells, cells in gastrointestinal tract, endothelial cells, or uroepithelial cells, followed by colonization of mucosal membranes. Common underlying conditions include alcoholism, diabetes mellitus, chronic liver disease (cirrhosis), chronic renal failure, cancer, transplants, burns, and/or use of catheters [8].

V. MATERIALS AND METHODS:

A total of 116 drinking water samples were collected from each source according WHO guidelines for drinking water quality assessment [13], over a period of nine month September to May 2012.

VI. SAMPLE COLLECTION:

About 200ml water samples from Government hand pump, water cooler and Municipal tap water were collected, labeled and transported to the laboratory for bacteriological analysis.

VII. BACTERIOLOGICAL ANALYSIS:

Bacteriological analysis was carried out for indicator organisms i.e. total and fecal coliform (E.coli) by most probable number (MPN) method 9,10..Ten tubes of MacConkeys broth (Hi media Pvt. Ltd Mumbai) arranged in two rows with a 100 ml blood culture bottle. First row containing 10 ml double strength MacConkeys broth was inoculated with 10 ml of water sample and 50 ml double strength MacConky broth was inoculated with 50ml of water sample. Second row containing 1 ml single strength MacConkeys broth medium was inoculated with 1 ml water sample respectively. Were incubated in an incubator at 44°C for 24h. After incubation, the number of bottles in which lactose fermentation with acid and gas production has occurred was counted. Finally, by referring to probability table (Macrady table-2) the MPN of coliform in 100 ml water sample was been estimated (Cheesbrough, 2006). Analysis is usually performed using culture and biochemical test also.

VIII. RESULT AND OBSERVATION

A total of 116 drinking water samples were tested by MPN method. Out of which,
Total drinking water sample collected from Municipal Tap Water = 58 (50%)
Total drinking water sample collected from Government Hand Pump = 32 (28%).
Total drinking water sample collected from Water cooler = 26 (22%).
After determinant of MPN number of positive sample, for organism identification do the culture & biochemical test.

IX. CULTURE

From the 1 ml tube (single strength) of positive test, a loop full specimen was taken and streaked into the MacConkey agar plate and incubate at 37^0 C overnight.

X. INTERPRETATION

A mixed growth of either dry lactose fermenting, mucoid lactose fermenting and non-lactose fermenting growth appeared after the incubation (figure.1).
For Specification, the colonies were subcultured on other individual MacConkey agar plate from primary plate and incubate at 37^0C overnight.

After the incubation a pure, heavy growth was on MacConkey agar plate (figure. 2).

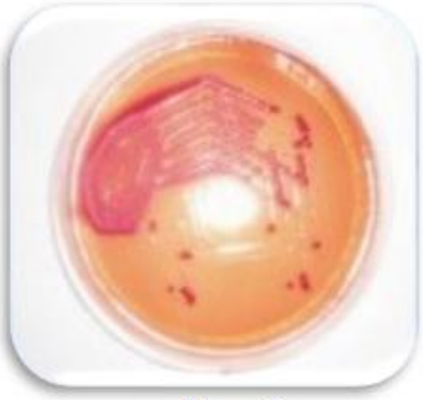

Figure-1

Figure-2

XI. BIOCHEMICAL TEST

For species identification the biochemical (IMViC) test as per WHO guideline was performed.

TABLE: 1 - Biochemical characterization.

Organism	MR	VP	Indole	Urease	Citrate
Escherichia coli	+	–	+	–	–
Klebsiella	+	–	–	+	+
Pseudomonas sp.	–	–	–	–	+

VP: Voges-Proskauer**, MR:** Methyl Red.

TABLE: 2 - Profile of Positive Sample (n=116).

Source of Water	Municipal Tap Water	Municipal Hand Pump	Water Cooler	Total No.
Positivity	58	32	26	116
Organism				
Escherichia coli	20	-	1	21
Klebsiella Sp.	**8**	**-**	**1**	**9**
Pseudomonas Sp.	-	5	15	20
Mix Sample	12	-	1	13

TABLE: 3 - Profile of Mix Sample (n=13) with reference to sample no.

No. of Sample	Organism			***Klebsiella Sp., Pseudomonas Sp.***
	Escherichia coli, Klebsiella Sp., Pseudomonas Sp.	***Escherichia coli, Klebsiella Sp.***	***Escherichia coli, Pseudomonas Sp.***	
3	+	-	-	-
5	-	-	+	-
4	-	+	-	-
1	-	-	-	+

TABLE: 4 - Profile of total positive sample (n=116)

Source of water sample	No. of Sample collected	No. of Unsatisfactory sample (%)	Organism grown		
			Escherichia coli	***Pseudomonas Sp.***	***Klebsiella Sp.***
Municipal Tap Water	58 (50%)	40 (69%)	32	8	**15**
Government Hand Pump	32 (27.59%)	5 (15.62%)	-	5	-
Water Cooler	26 (22.42%)	18 (70%)	1	16	**2**
Total	116	63 (54.31%)	33 (28.44%)	29 (25%)	**17 (14.65%)**

XII. DISCUUSION

According to the WHO, The lack of safe water supply and of adequate means of sanitation is blamed for as much as 80% of all diseases in developing countries. Sewage containing human excreta is the most dangerous material that pollutes water. The most important microbial diseases transmitted through water are Typhoid fever, Amoebic dysentery, bacillary dysentery, Cholera, Poliomyelitis and Infectious hepatitis [14].
The samples received from hostel over head tank showed mixed contamination of *Pseudomonas aeruginosa* and *Escherichia coli*. However when the sample was again received from the same site after treatment showed contamination with *Pseudomonas aeruginosa* only. The bacteriological examination of drinking water by MPN method is a sensitive method to assess its quality though it does not detect contamination with protozoa, virus and fungi. Enumeration of *Escherichia coli* forms has been recommended by the Indian council of medical research and has been the main method adopted by many workers [15].

This could be due to mixing of sewage water with drinking water as a result of leakage in the pipeline. A regular monitoring of the water quality for improvement not only prevents disease and hazards but also checks the water resources from going further polluted
The conservation of water sources is very important to provide safe water as far as possible, water sources must be protected from contamination by human and animal waste which can contain a variety of Bacterial, Viral, Protozoan and Helminthic Parasites.

The control of drinking water quality in distribution networks remain a major challenge. The protection of sources, treatment and distribution management are all critical strategies in maintaining and improving water supply.

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