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Assessment of Microbial Safety of Drinking Water Available at *Paani-puri* Stalls of Amravati District of Maharashtra State (India)

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ABSTRACT

The purpose of this study was to assess the microbial safety of drinking water of different *paani-puri stalls* of Amravati district. The study shows that poor hygienic conditions, improper handling, improper method of storage and serving practices of drinking water at these stalls of Amravati district leads to severe water born diseases. Microbial tests i.e. coliform counts were determined using standard procedure. 50 samples were collected, out of 50 samples, 42% were found non potable by MPN method. From the study it was concluded that quality of water can be improved by imparting water hygiene behavior, education to *paani-puri* stalls owners.

Keywords: *Paani-puri stalls*, Microbial safety, MPN count, drinking water, contamination of water.

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INTRODUCTION

According to Wikipedia *"*The golgappa (*paani-puri*) is a popular street snack which consists of a round, hollow puri, fried crisp and filled with a mixture of water ("*paani*"), tamarind, chili, *chaat-masala*, potato, onion and chickpeas". It is small enough to fit completely into one's mouth. It is a popular street food dish in Mumbai, Karachi, Lahore and Kolkata.

The street food is prepared on the streets and ready-to-eat, or prepared at home and consumed on the streets without further preparation. Street vended food not only appreciated for their unique flavors, convenience and the role which they play in the cultural and social heritage of societies, it also become important and essential for maintaining nutritional status of populations [1]. The Street foods provide a source of affordable nutrients to the majority of the people especially the low-income group in the developing countries[2]. However, street foods are frequently associated with diarrheal diseases due to their improper handling and serving practices [3]. Study reveals that '*paani-puri*' has been found to contain harmful bacteria, which not only cause severe intestinal disorders like gastroenteritis, but also has the potential to rupture blood vessels in the heart and brain, resulting in death[4].

Microbial contamination of ready-to-eat foods sold by street vendors and hawkers has become a major health problem. Street food vendors are mostly uninformed of good hygiene practices (GHP) and causes of diarrheal diseases[5], which can increase the risk of street food contamination[6-7]. From the initial contamination of raw foods with pathogenic bacteria to subsequent contamination by vendors during preparation. There are many factors that should be considered for the analyzing the hazards due to street foods[8-10]. The vendors can be carriers of pathogens like *E. coli, Salmonella, Shigella, Campylobacter* and *S. aureus* who eventually transfer these food borne hazards to consumers. In most cases, running water is not available at vending sites, hands and utensils washing are usually done in one or more buckets, and sometimes without soap. Wastewaters and garbage's are discarded nearby, providing nutrients for insects and rodents, which may carry food borne pathogens.

The aim of present study was to access the capacity of *paani-puri* stalls to provide better potable drinking water. The objective is reached by means of assessing water supplied in the hotels. The assessment is done by bacteriological evaluation of the drinking water and general survey of *Paani-puri* stalls of Amravati district.

Study district: Amravati of Maharashtra (India):

Amravati city is located in the East Maharashtra (India) on the altitude of $20^0$56' north and

$77^0$47'east. It is the main centre of west Vidharbha. It is surrounded by the district of Betul, Nagpur, Wardha, Yavatmal, Washim, Akola and Buldhana[11] (Figure1).

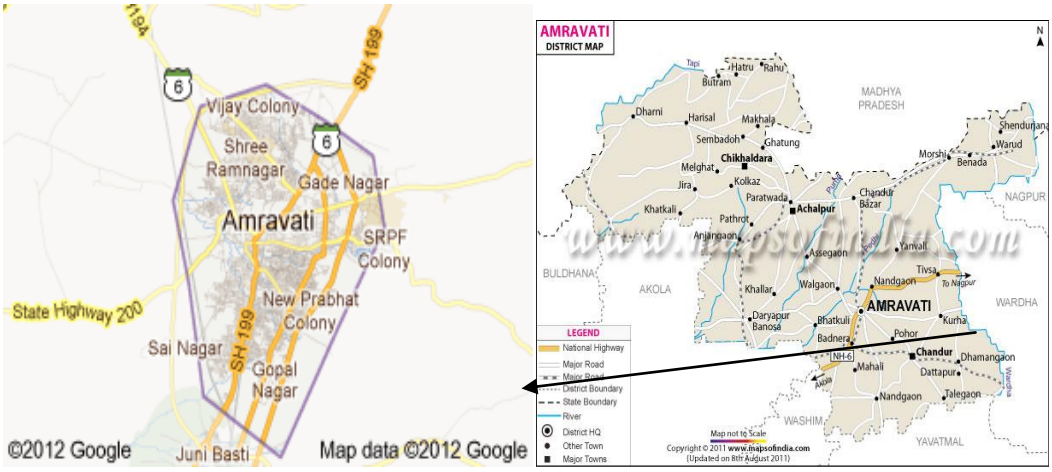


Figure 1: Amravati District map

MATERIALS AND METHODS

In proper Amravati district, different types of hotels, road side taprees (stalls), *Paani-puri* stalls and canteens are present. Drinking water was collected from Paani-puri stalls of different areas randomly. The microbial safety of these samples was assessed by bacteriological tests. Total 50 samples were collected from following areas (Table1).

Table 1. Sampling areas

Sr. no.	Name of area	No. of samples from each area
1	Gadge nagar	14
2	Rajkamal chawk	12
3	Rajapeth	08
4	Camp area	08
5	Sai nagar	02
6	Rukhmani nagar	06
	Total	50

The information regarding all the Paani-puri stalls was recorded on the basis of hygiene condition, method of storage of the drinking water etc. The data was recorded as follows (Table2).

50 samples were collected in sterile bottles from *Paani-puri* stalls from six different *paani-puri* stalls of Amravati district. Date, time, source was noted punctually and then samples were transported to laboratory. Bacteriological examination was performed within 5hrs of collection using multiple tube fermentation technique (MTFT) for determination of Most probable number(MPN), nine multiple tube dilution technique using double and single strength Mac Conkey broth which detect *E.coli* with the production of pale yellow color. The MPN index was

calculated from MPN table and index of water, more than 10 coliforms/dl is designated as polluted or unhealthy for drinking purpose or non-potable [12].

Table 2(figure a to e): Showing collected data of *paani-puri* stalls

Sr.no.	Category Under Study	Observations.	Percentage.
1	Class of *paani- puri* stalls	Good	5%
		Medium	55%
		Low	40%
2	Age of *paani- puri* stall owners	15-25	6.60%
		25-35	18.33%
		36-45	58.33%
		45-above	8.33%
3	Education of *paani-puri* stall owners	Secondary	3.33%
		HSC	55.00%
		Graduate	33.33%
		Post graduate	5.00%
		Illiterate	3.33%
4	Method of storage of drinking water	Plastic	16.66%
		drum(pvc)	41.66%
		Rajan	41.66%
5	Method of handling	By jug	58.33%
		By tap	28.33%
		By mug	13.33%

RESULT AND DISCUSSION

In order to find socio-economical status and overall hygienic behavior of *paani-puri* stalls owner both type of results have been discussed like on the basis of bacteriological test and on the basis of survey, so that we can correlate the hygienic conditions with microbiological effect. Because bad hygienic practices incorporate microorganisms in water and then their presence will be checked by MPN method.

A. **On the basis of bacteriological test**

Membrane filtration technique was used to isolate the microorganisms present in the water sample[13].The results are stated according to Mc Craday's potability which shows the most probable number (MPN) of coliform bacilli in 100 ml of water.

Reporting interpretation: (Presumptive coliform count) (Table 3)

A total of 50 samples of drinking water were analyzed from six different areas of Amravati district (Maharashtra) for potability of drinking water by standard method of water testing. By using membrane filtration technique and counting MPN, results shows that out of 50 samples of water 00% shows excellent result. 30% result are suspicious, 50% results shows MPN greater than 7, means this water cannot be used for drinking purposes.

Table 3.: Showing the Result of MPN Coliform Test

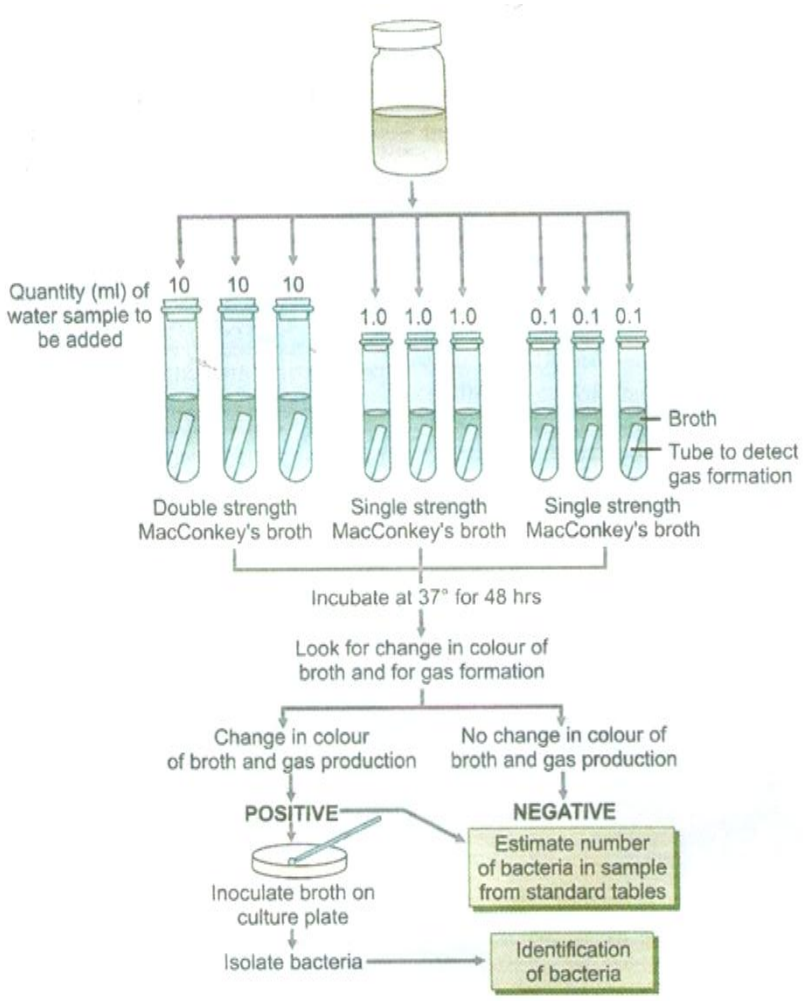
Class	Category	Coliform count/100ml	percentage
I	Excellent	0	00
II	Satisfactory	1 to3	(10samples)20.00%
III	Suspicious	4 to 6	(15 samples)30.00%
IV	unsatisfied	7 to 10	(25 samples)50.00%

Method for determining presumptive coliform count

Measured amount of single and double strength modified Macconkey's broth medium are sterilized in bottles containing a Durham tube for indicating gas production. The size of the bottle varies with the quantity of medium and water to be added to it.

With sterile graduated pipettes the following amounts of water are added.

1. One 50 ml quantity of water to 50ml double strength medium.
2. Five 10 ml quantities each to 10 ml double strength medium.
3. Five 1 ml quantities each to 5 ml single strength medium.
4. Five 0.1 ml quantities each to 5 ml single strength medium.



5. Method for determining coliform bacteria

This range of quantities may be altered according to the likely condition of the water examined for highly contaminated waters smaller volumes are tested.

The bottles are incubated at 37°C and examined after 18-24 hrs. Those that show acid and sufficient gas to fill the concavity at the top of the Durham tube are considered to be 'presumptive positive' as a result of the growth of coliform bacilli. Any remaining negative bottles are re-incubated for another 24 hrs and if acid and gas develop they too are regarded as being positive. In reporting the results of the presumptive test reference is now made to McCrady's probability tables. According to the various combinations of positive and negative results obtained the potable number of coliform bacilli in 100 ml of the water can be read. This is known as the 'presumptive colifom count' or the most probable number of coliforms (MPN).

As per above standard method for water portability test various water-samples from different sites as mentioned below are tested and their results are stated according to McCrady's probability table showing the probable number of coliform bacilli in 100 ml of water.

RESULT AND DISCUSSION

A. **ON THE BASIS OF BACTERIOLOGICAL TEST**

Membrane filtration technique was used to isolate the microorganisms present in the water sample[13].The results are stated according to Mc Craday's potability which shows the most probable number (MPN) of coliform bacilli in 100 ml of water.

Reporting interpretation: (Presumptive coliform count) (Table 3)

A total of 50 samples of drinking water were analyzed from six different areas of Amravati district (Maharashtra) for assessment of microbial safety of drinking water by standard method of water testing. Bacteriological test shows that out of 50 samples of water 00% shows excellent result. 30% result are suspicious, 50% results shows MPN greater than 7, means this water cannot be used for drinking purposes.

B. **ON THE BASIS OF SURVEY**

Following graph shows effect of socio-economical status and overall hygiene of *paani-puri* stall owners, indicating different parameters such as class of *paani-puri* stall owners, age of *paani-puri* stall owners, their qualification, method of storage of drinking water and method of handling of water.

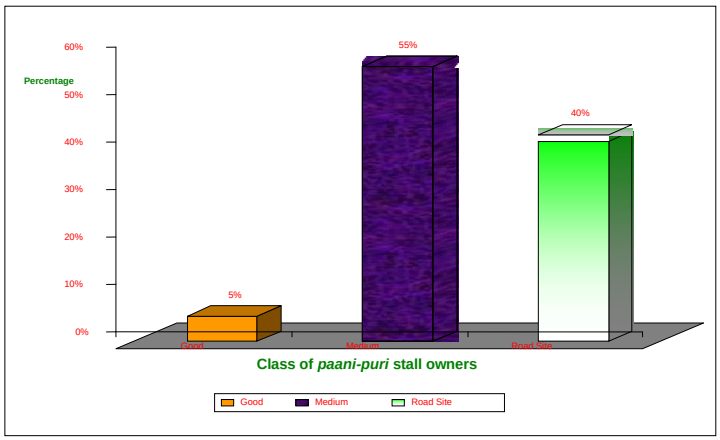


Figure 2(a): Indicating % of different category of *paani-puri* stalls under study.

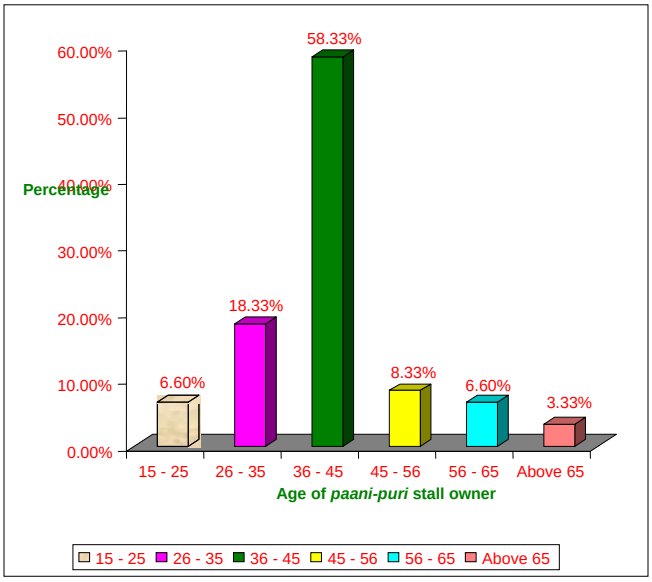


Figure 2(b): Indicating % of age of *paani-puri* stall-owners under study.

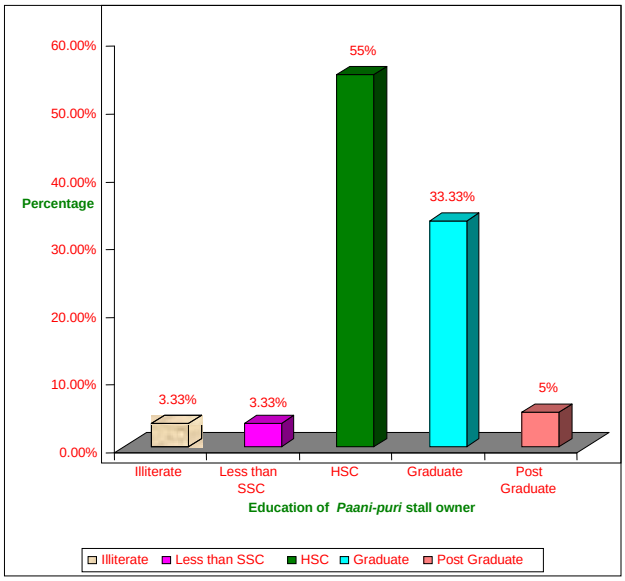


Figure 2(c): Indicating % of qualification of *paani-puri* stall –owners under study.

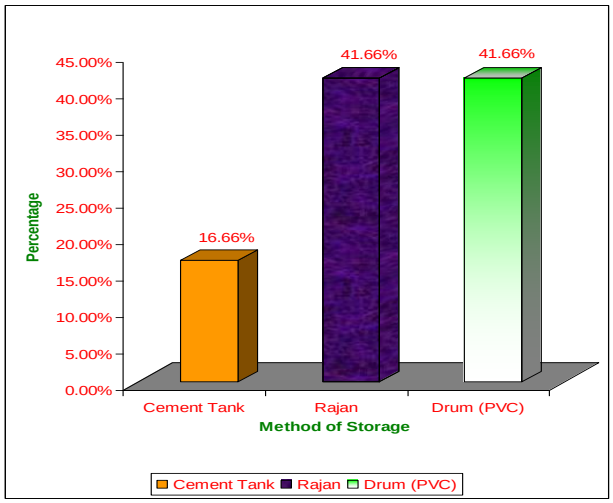


Figure 2(d): Indicating % of method of storage of drinking water used by stall-owners under study.

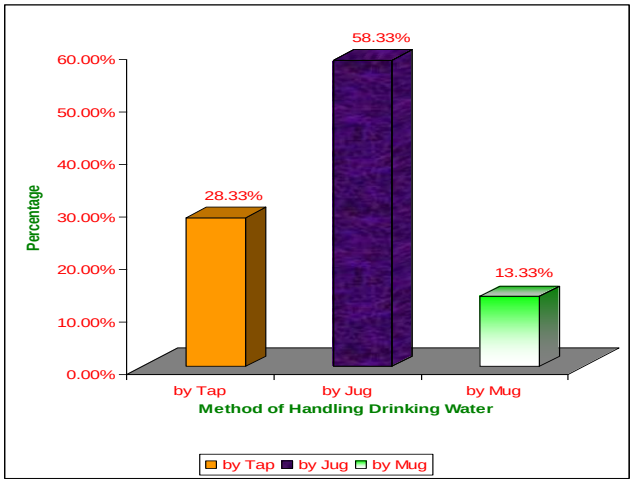


Figure 2(e): Indicating % of methods of handling water by stall-owners under study.

From the above graphs following conclusion can be drawn;

Figure 2(a): Indicates that medium class paani-puri stall owner are more i.e.55%. It means that good class or good quality *paani-pani* stalls are very less.

Figure 2(b): Indicates that the workers, works at paani-puri stalls are of different age. But workers having age between 36-45 are of maximum percentage i.e.58.33%, as compared to other age workers.

Figure 2(c): Indicates the education of workers who works on *paani-puri* stalls. They are not so much qualified. Maximum percentage is of H.Sc. qualified workers i.e. 55 %.

Figure 2(d): Indicates percentage of different method of storage of drinking water like cement tank, Rajan and PVC drums. Observation reveals that Rajan and PVC drum are common storage devices for drinking water i.e.41.66%.

Figure 2(e): Indicates there are different method for handling drinking water i.e. by jug, by tap and by mug. But the percentage of using jug for handling drinking water is more, it was 58.33% observed.

Thus, on an average percentage of middle class people living in Amravati district is high. Therefore their standard of living is low. High class hotels are too expensive to be afforded by these middle class people. People prefer road site paani-puri stalls for taking water or taking *paani-puri* water.

CONCLUSION

Pani-puri is very popular street food which is consumed by large amount of population of different age groups. *Pani-puri* is very tasty, cheap in cost and readily available and hence people like to eat *pani-puri* on large scale. For the contamination of street food, personal hygiene of vendor is also responsible. Vendors touch the floor, wash the utensils most of the time without using soap, handling of dish cloths and after all they touch food without glows for preparing and serving water without washing the hands, this may lead to cross contamination of bacterial pathogens. Findings show that the need for more respect of Good Manufacturing practices and Good Hygiene Practices to reduce street foods contamination. Study also reveals that good class and reasonably good quality *paani-puri* stalls maintains their hygienic condition. Improper method of storage and handling makes water more contaminated. Therefore Hotel owner and workers should maintain the hygienic conditions in order to avoid contamination of drinking water.

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