Study on assessment of bacterial load in street foods at Bhubaneswar city of Odisha

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ABSTRACT

Street foods are becoming most popular among the consumers of any age group due to its taste, readily available and cheap in cost. In developing countries, millions of people consume a wide range of various foods sold by the street vendors (Khan et al., 2015). Now-a-days wide spread of food born diseases become an important public health concerns. Major sources of food born diseases are due to microbial contamination . Contamination of food products can result in many health problems ranging from vomiting, stomachache, mild bloating and gas to serious incidents of Diarrhea, Peptic Ulcer etc. There are various studies have identified presence of different microorganisms like Bacillus, Staphylococcus, Clostridium, Vibrio, Campylo-bacter, Ecoli, Salmonella. etc. on panipuri (Gupchup/Golgoppa), dahi vada and alloodum, chat etc. as street foods but till there is no research paper found on bacteriological quality assessment of street food.The present study revealed that dahivada Aloodum and this is one of the most important street food of Odisha, found in rural as well as urban area. So The present study was undertaken to investigate the Total Viable Count(TVC) and identification of microorganism present on water sample used in street foods like Gupchup(Khata Pani) and Dahivada Aloodum (Curd water). Twenty Samples (Each food sample from ten different vendors) were collected from five different locations of Bhubaneswar and the result depicts that presence of E.Coli and staphylococci bacteria in all the food samples.

Key words: Street food, Gupchup, Dahivada aloodum, Hygiene, Media

INTRODUCTION

Urbanization and spreading of population in many countries are influenced the development of street food. Street foods are defined as ready to eat foods and beverages sold by vendors and hawkers especially in the streets and other similar places (FAO, 2000). These foods are being prepared and sold at crowded places like main streets, schools, stations, bus stands, Theaters and festival areas. These areas usually provided with limited sanitary facilities.

The mishandling and unhygienic practices by the vendors may help the pathogenic bacteria to come in contact with food and in some cases survive and multiply to sufficient numbers and causes illness.

Preparing and selling food on the streets provides a constant income for millions of uneducated people or we can say street food provides a good job opportunity and income for sellers with small capitals. The street food industry plays an important role in meeting the food requirements of urban consumers. This industry feeds millions of people daily with a wide variety of foods that are relatively cheap and easily accessible. Due to the busy schedule and women preferred to work outside the home the changes taking place in people's life styles and it causes the habit of eating outside. The street food sellers were divided into three categories based on their method of sales (WHO, 1992): (i) mobile food sellers (MS) are those that prepare food at home and then carry around for sale; (ii) stationary food sellers without shelter (SWS) prepare their foods in the open air under the tree or by the roadside and sell at the spot; (iii) stationary food sellers without shelter (SS) are those that own stalls where they prepare full meals in the open and serve on tables in stalls as in restaurants.

Safety of street foods is always a matter of concern as in most cases they are prepared under unsanitary conditions by the vendors who are illiterate and do not practice hygiene. The chances of contamination of these foods increase due to the poor environmental conditions in which the preparation is done and sold (Sheth, 2005). Street foods are the cause of several types of food - borne diseases. The water used for drinking and cleaning purposes is often contaminated due to unhygienic storage and handling. Proper garbage removal facilities are also not available, thus leading to poor environmental condition (Chakravarthy, 2003).

The street food of Odisha has a distinct appeal. Some of them may have common counterparts in other states, but their distinct flavour and preparation makes them unique to Odisha. Bhubaneswar being capital of Odisha is dominated by street foods like Dahivada aloo dum, Gupchup (Panipuri),Vada, Piyaji, Samosa, Ghuguni, Idli, Dosa, Sambar, Chutney, Chakuli Dalma, Momos, Biriyani, Sandwitch, Chicken Pakoda etc. Most of the People prefer to take Dahivada aloodum and Gupchup as these two foods are comparatively cheap and mouth watering. Other food items are mostly serve in hot condition but these items are prepared at home and served by the vendor in the crowded place or their known streets. Here the water used in Dahivada as well as in Gupchup seems unhygienic and causes food borne diseases. So this study is conducted with the objective of knowing the viable count of microorganisms and also type of microbes present on both the food samples are tested. The study was conducted on ten different vendors of Gupchup, Dahivada and Aloodum from five different locations and analyzed for bacteriological contamination.

MATERIALS AND METHODS

Study Area:

Bhubaneswar is the capital city of Odisha. It is situated in the eastern part of Odisha. This city is well known as "Temple city". Total population is around 8,85,363 according to 2011 census. This city is also famous for IT hub, educational hub and also business center. Bhubaneswar is also declared as Smart city in the year 2019. People from different parts of Odisha are migrate here for their job, business ,work or education.

Sample Selection :

In order to determine the microbial load of street foods, simple random sampling technique is used to collect street food from five different locations of Bhubaneswar city and a survey was conducted. The water samples of Dahivada Aloodum & Gupchup were collected from Ten(10) vendors of five different locations in Bhubaneswar i.e. Market Building area (L1)), Near Siripur Area(L2),Fire Station area(L3),Forest park Area(L4), Near Ganganagar(L5).

Food Samples:

Gupchup: Gupchup is also known as Golgappa or Panipuri in different states of India is a popular street food. It comprises three different components: i)Gupchup/Puri , ii) filling or masala, iii) spicy water or pani. Refined Wheat flour,wheat flour and semolina is used to make Puri. In Masala, boiled or mashed potatoes mixed with spices, peas, ground nuts and onion are used. The water is soured water to which spices like salt, pepper, mango powder, jaljeera, tamarind, a fine paste of coriander, mint leaves and green chillies   etc. are added. In every Puri, Masala are added after making a hole in it and then spicy water is filled in this Puri and served to the consumers in plate (Saxena and Agarwal, 2013).

Dahivada Aloodum: Both Dahivada and aloo dum is prepared separately. Dahivada is prepared from ground paste of soaked urad dal and it is deep fried then soaked in watery curd or Dahi. Aloodum is prepared from boiled potato and different spices are used as such in curry preparation. Then both items are served in plate by garnishing with onion, sev, chilli paste etc.

Sample Processing

A.   Microbiological analysis

All the samples were collected aspetically

using sterile instruments and transferred to appropriate screened glass bottle and transported to laboratory within 1Hr . For the bacteriological analysis Nutrient agar, Eosine Methylene BlueAgar(EMB), Mannitol salt agar were used as solid media The commercial media were prepared according to the instruction of manufacturer and non commercial media were prepared in laboratory. Total of twenty samples were collected from the vendors of various locations of Bhubaneswar.

Enumeration Total Viable count(TVC):

In a conical flask distilled water , Nutrient broth and agar powder were mixed thoroughly. Media, test tubes, Petriplates and micropipette tips were sterilized in autoclave at 121°C for 15mins in 15lb Pressure. After sterilization of media , it was poured on petriplates in Laminar air flow. In a sterilized test tube 1ml of sample with 9ml of distilled water was taken and it is named as10^{-1}. From the 1st test tube, 1ml solution was transferred to the next 2nd test tube and named 10^{-2}. The process was continued up to 10^{-10} named serial dilution . The petriplates were named 1st, 2nd …10th to 10^{-1},10^{-2}…10^{-10} respectively. From each test tube 0.1ml solution was taken by micropipette and dropped on media and spread over the plates by spreader. Then petriplates were kept in incubator for 24 hrs. After incubation plates were observed and counted properly. The average number of colonies in particular dilution was multiplied by the dilution and divided by the volume of samples transferred on plates to obtain the Total Viable Count(TVC). The TVC was calculated according to ISO (1995).The result of the total bacterial count were expressed as the number of Colony Forming Units (CFU)per gram of food samples.

CFU=(No. of Colonies X Reciprocal of dilution factor) ÷ amount of inoculation

Isolation of bacteria :

All the isolates were first differentiated by colony morphology and Gram‚s staining reaction. They were further identified by an array of biochemical tests Homogenizewd samples are enriched into nutrient broth by overnight incubation at 37°C. Overnight cultured sample was streaked duplicate into mannitol salt(MS)agar, EM Bagar and incubated at 37°C for 24 Hrs. Identification of bacteria was performed on the basis of colony morphology, Gram's staining reaction. Colony characteristics such as shape, size ,surface texture, edge and elevation, colour and opacity developed on various selective media after 24hrs of incubation at 37°C was recorded.

Gram's Staining:

Gram's staining of the pure culture was performed according to method described by Cheesbrough (1985). Briefly a single colony was picked up with a bacteriological loop, smeared on separate glass slide and fixed by gentle heating. Crystal violet was then applied on each smear to stain for two minutes and then washed with running tap water. Few drops of Gram's Iodine added for few seconds. After washing with water, safran in was added as counter stain and allowed to stain for 45 seconds. The slides were then washed with water, blotted and dried in air and then examined by a light microscope (400X).

Maintenance of stock culture:

Stock culture was prepared by adding 1mlof 80% sterilized glycerol in 1 ml of pure culture in nutrient broth and it was stored at -20°C for further use.

Results And Discussion:

Food borne Diseases are caused by wide spectrum of pathogenic microbes and chemical contamination of food which has been recognized as major health problem. Major cause for the rapid increase in the occurrence of Food borne infections is the Street Foods which is easily affordable by poor people. Food poisoning can be the result of either chemical or the ingestion of toxicant. This may be an attempt to make aware common people regarding microbial contamination of street vended food.

Total Viable Count (TVC):

Samples		Gupchup (Panipuri)	Dahivada Aloodum
TVC (Mean Log CFU ± SD/g)	Location-1	5.03±0.69	3.91±0.23
	Location-2	4.50±0.17	2.56±0.67
	Location-3	3.23±0.15	3.0±0.10
	Location-4	4.66±0.19	3.13±0.77
	Location-5	3.61±0.76	3.21±0.76

In the present study it was found that the total viable count was highest in Gupchup at location-1, (5.03±0.69) Followed by location -4 (4.66±0.19),then location-2(4.50±0.17) ,location-5(3.61±0.76) and least in location-3(3.23±0.15) Similarly a study was conducted in Amravati city, India to analyze the microbiological quality of panipuri revealed that 93% of panipuri water samples had high loads of bacterial pathogens such as Escherichia coli (41%), Staphylococcus aureus (31%), Klebsiella sp. (20%), Pseudomonas sp. (5%) and yeast (3%). Subhashini *et al.* (2014) in Tamil Nadu, India, showed that Pani was highly contaminated by S. aureus and Bacillus species. Another study was conducted by Adi *et al.* (2018) for bacteriological Quality of water sample of Street Vended Food panipuri and found that all the samples contain pathogens like E.Coli and S. aureus. So this study is also follow the presence of E.coli and Staphyllococci in the water sample of Gupchup. Similar work is carried out by Khadke *et al.* (2018) that the most frequent contaminating bacteria in Panipuri was S. aureus (16.6%) and about 20.0 per cent of Puri was contaminated by S. aureus.

For Dahivada aloodum, TVC count was highest in location-1(3.91±0.23), followed by location-5(3.21±0.76),then location-4 (3.13±0.77), location -3 was (3.0±0.10) and least microbial load found in location -2 (2.56±0.67). Madueke *et al.* (2014)studied on different street foods such as fried yam, fried potato, fried plantain akara, fish and suya of Lokoja in Nigeria ranged from 5.0x104 cfu/g(akara) to 2.08x107cfu/g (fish). Titus (2011) stated in her article that foods that are sold by street vendors are considered unsafe in the Philippines and should not be purchased. As noted by Center for Disease Control and Prevention (2012), street vendors often do not comply with safe and hygienic food handling practices, leading to a greater risk of a range of food-borne illnesses. So from the findings of other studies it is concluded that the street foods contain microbes due to improper handling and preparation of food. Hence this study is also proved that presence of bacteria in the street foods that may be due to unhygienic practice of vendors and lead to food born diseases among consumers.

Table 2

Identification and Biochemical characterization of Isolates

Bacterial Isolates	Staphylococous Spp.	E.Coli
Selective media	MS agar	EMB agar
Colony Charactreistics	Small whitish/Yello ish colony	Metallic (greenish black colony)
Shape	Cocci in shape	Short plump rods
Arrangements	Arranged in grapes like cluster	Single,paired or in short chain
Gram's staining reaction	(+)ve	(-)ve

Two genera of bacteria such as staphylococcus and Escheria were identified from Gupchup and Dahivada samples. Staphyllo cocci shows positive to gram's staining reaction. MS agar media is used for identification. Its colony characteristic is small whitish or yellowish in colour. Where as E.Coli shows metallic shin or greenish black colony. EMB agar is used for E.Coli identification and it shows negative to Gram's staining reaction.

Similarly a study was conducted by Veena et al. on bacteriological quality assessment of street vended Panipuri and fruit juice and they found that E. coli and S. aureus colonies were present on both the food sample. They used CLED agar plate for differentiation of their colonies. Hence this study is also focused on the presence of E.Coli and Staphyllo coccus sp. in food samples like Gupchup and Dahivada aloodum.

Table 3
Age of Consumers preferred street foods

Age of the consumer	No(%)
6-12 years	3 (3.07)
13-19 years	29 (29.59)
20-26years	39 (39.79)
27-33years	21 (21.43)
⩾ 34years	6 (6.12)
Total	98 (100.0)

*: Figures in the parentheses indicate percentage value

Table No-4 indicated that maximum consumer preferred to take street foods were between the age of 20-26 years (39.79%) followed by 13-19 years (29.59%) and 27-33years (21.43%) of age where as children were the least consumers(3.07%).

Table 3
Education of Consumers preferred street foods

Education of the consumer	No(%)
Below matriculate	11 (11.22)
Intermediate	15 (15.31)
Graduate	58 (59.18)
Post graduate and above	14 (14.29)
Total	98 (100.0)

From the above table it was found that maximum graduate students (59.18%) were fond of street foods because of tasty and readily available as and when required. Minimum consumers (11.22%) were below matriculate. It was also observed that graduate were the students residing in hostels habituated with the street foods.

CONCLUSION

Today the street food trade is a growing sector in developing countries. Its expansion is linked with urbanization and the need of the urban people for both employment and food. But now this street food concept is also expanded to rural areas. Studies have shown that about 2.5 billion people consumes street foods daily. The presence of Staphyllococci and E.Coli in Street foods i.e. (Gupchup and Dahivada aloodum) in the present study was of much concern. That may cause fecal contamination and food borne illness among food eaters.It was observed that graduate students between the age 20-26 years preferred street foods due to its taste and readily available as and when required. But there should be rule and regulations for the street venders. Hence the government should take necessary steps for the venders to follow rules and regulations regarding safety of these street foods.

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