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Microbiology

MICROBIOLOGICAL QUALITY OF COMMONLY CONSUMED STREET FOODS AVAILABLE IN GONDIA DISTRICT OF MAHARASHTRA, INDIA

Dr. Sandhya Tambekar Wanjari Department of Microbiology, Dhote Bandhu Science College, Gondia – 441614, Maharashtra, India.

ABSTRACT The street food industry plays an important role in meeting the food requirements of urban dwellers in cities and towns of developing countries. This industry feeds millions of people daily with a wide variety of foods that are relatively cheap and easily accessible. The traditional processing methods that are used in the preparation, inappropriate holding temperatures, and poor personal hygiene of food handlers are some of the main causes of contamination of street-vended food. This study aimed to assess the microbiological quality and safety of street food sold in the main streets and informal markets of the Gondia district of Maharashtra, India. A high proportion of unsatisfactory food samples were found in both traditional hot and cold street foods. These results, showing that street food sold in the Gondia district of Maharashtra requires adequate sanitary conditions for its preparation and sale, contribute to the development of good manufacturing practices (GMP) for street food. It is suggested that regular monitoring of the quality of street foods must be practiced to avoid any food-borne infection in the future and used appropriate frying medium concerning the health of customers.

KEYWORDS : Street vended foods, microbiological quality, hygienic practices, bacterial contamination, food safety.

INTRODUCTION

In developing countries, one of the main challenges is to ensure food security, i.e. to provide a sufficient amount of food for the entire population. (Paudyal *et al.*, 2017). More than 200 types of diseases are estimated to be caused or spread by food, occasionally causing long-term health problems in vulnerable groups such as the elderly, pregnant women, children, and immunocompromised people (Lie *et al*, 2014). Thus, it is important to ensure food safety, as a public health measure toward reducing the mortality rate (Paudyal *et al.*, 2017). Street vended food is not only appreciated for its unique flavors, convenience, and the role which they play in the cultural and social heritage of societies, it also becomes essential for maintaining the nutritional status of populations (Dardano, 2003). Street food appeals to tourists looking for cuisine culture and different tastes and this supports a country's tourism which plays an important role with local cuisine in preserving cultural and social heritage. As they provide income to the sellers, they are also important in generating employment. These foods are highly demanded both by the sellers and consumers because of their tastes, availability, low cost, cultural and social heritage connection, and being nutritional. Nowadays, street food is becoming popular and is in demand because it saves one's time and energy as one eats (Choudhary *et al,* 2011). Street foods provide a good source of nutrients to the major population those who are in the low-income group in the developing countries (Muzaffar *et al*, 2009).

"Street foods" basically describes as a wide range of ready-to-eat foods and sometimes prepared in public places, notably streets. Foods and beverages which are prepared and sold by the sellers on places like streets, festival areas, and consumed by the consumers on the run are known as street food. These foods are alternatives to homemade food and are more affordable when compared with the food supplied at the restaurants (Muzaffar *et al.* 2009). The final preparation of street foods occurs when the customer orders the meal which can be consumed where it is purchased or taken away, like fast foods. Street foods and fast foods are low in cost compared with restaurant meals and offer an attractive alternative to home-cooked food. Despite these similarities, street food and fast food enterprises differ in variety, environment, marketing, and ownership (Gawande *et al*, 2013).

Ready-to-eat street foods are subjected to cross-contamination from various sources such as utensils, knives, raw foodstuffs, flies that sporadically landing on the foods, vendor's bare hand serving, and occasional food handling by consumers. In most cases, tap water is not available for washing hands and utensils at vending sites; hand and utensil washing is usually done in one or more buckets-sometimes without soap. Wastewater and garbage are therefore discarded nearby, providing nutrients for insects and other household rodents, which may carry foodborne pathogens (Tambekar *et al*, 2008). Thus, potential health risks are associated with contamination of food by *Escherichia coli, Salmonella typhi, Pseudomonas* species, *Staphylococcus aureus, Proteus* species, and other species during preparation, post-cooking, and various handling stages. Though preparation and sale of food on street is an old practice in developing countries and urbanization has increased the habit of consuming street food. These affordable foods are popular among the person who have limited time and wants to save money for surviving in the town or a city (Muyanja *et al*, 2011). Unhygienic preparation and handling, selling the foods roadside, an insufficient supply of water for cleaning purposes make street food one of the major sources of foodborne illness (Das *et al,* 2010).

Food poisoning is globally important, as they result in considerable morbidity, mortality, and economic costs. Food poisoning infections or irritations of the gastrointestinal (GI) tract are caused by eating contaminated food. Infectious microorganisms or their toxins can contaminate food at any point of processing, production, growing, harvesting, storing, shipping, or preparing (Kirk *et al,* 2015). The majority of street food vendors are not aware of good hygiene practices (GHP), which poses an increased risk of contamination for most of the food products involved. In most parts of the world, food-borne disease incidences are more commonly associated with *Salmonella serotype enteritidis* (SE), *Vibrio cholera, Escherichia coli* serotype 0157:H7, *Listeria monocytogenes,* and food-borne trematodes. The emergence of the above-mentioned disease outbreaks is mainly linked to the globalization of food supply that introduces pathogens into new geographical areas, exposure of travelers, refugees, and immigrants to unfamiliar foodborne hazards, mutations in microorganisms, changes in the human population, and changes in peoples' lifestyles (Mugampoza *et al*, 2013).

Under such circumstances, some different infectious pathogens and some exclusive or predominant pathogens are contracted from the consumption of food products. The recognized food-borne pathogens include bacteria, viruses, multicellular animal parasites, protozoa, fungi, and possibly prions. Raw foods including meat, poultry, fish and shellfish, eggs, unpasteurized milk, and dairy products often contain microorganisms that cause food poisoning. The street food industry which provides street food in ready-to-eat form is prepared and sold by vendors and hawkers in the street and other public places including schools, markets, parks, etc. is a major source of foodborne diseases. A street food vendor is defined as a person who offers food for sale to the public without a permanent built-up structure but a temporary static or mobile stall (Nurudeen *et al,* 2014).

Vendors-sold foods usually make use of simple facilities like wheelbarrows, trays, mats, tables, and make-shift stalls, thus further increasing the risk of food contamination. Contamination from raw materials and types of equipment, additional processing conditions, improper handling, and prevalence of unhygienic conditions contribute substantially to the entry of bacterial pathogens (Mahale *et al,* 2008). Food can serve as an ideal culture medium for the growth of microorganisms which can cause decomposition, spoilage, and vehicle for transmission of food-borne illness. Food-borne infection involves the ingestion of the pathogen, followed by growth and multiplication in the host including tissue invasion and /or the release of toxins (Frazier *et al*, 2000).

Foodborne illness is a major universal health problem in developing countries due to difficulties in safeguarding food from cross-contamination. Low-income countries face the highest burden of diarrhoeal and other food-borne diseases associated with the consumption of contaminated food. Transmission of enteropathogenic bacteria occurs through fecal contamination of food, water, nails, fingers indicating the significance of the fecal-oral route of transmission (Zeru *et al*, 2002). 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. Many times, the 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 are discarded nearby, providing nutrients for insects and rodents, which may carry food-borne pathogens (Tambekar *et al*, 2009). The serving utensils used at the vending site are often contaminated with bacteria (studies found, *Staphylococcus sp.*) which may originate from the vendor's hands when they touch the food preparation areas, dishcloths, and the water during dishwashing and handwashing which indicates cross-contamination between dishwater, food preparation surfaces, and the food itself; consequently, perceive a major public health risk (Mensah *et al*, 2002). The present study deals with the microbiological analysis of the collected street food items, assesses the preparation, storage, and handling practices of the street food, safety aspects, and public awareness about street food consumption.

MATERIALS AND METHODS

The present study was carried out under three steps i.e., survey, sample collection, and analysis of samples, which was followed by statistical analysis and interpretation of results. Total 50 samples of different types of street food like Aloo bhajia, Aloo Bonda, Aloo chat, Bhel, Bread pakoda, Chat, Kachori, Kanda bhajia, Kanda vada, Mirchi Bhajia, Moong vada, Moongodi, Palak vada, Pani puri, Poha, Samosa Vada were collected from different street shops of Gondia, Maharashtra. Packing was thoroughly cleaned externally by spraying or swabbing with 70% alcohol. Packing was opened in the aseptic condition in laminar in front of the flame. 1g sample was taken out from the container with the help of a sterile stainless steel spatula and added aseptically in a test tube containing 10mL MacConkey Broth Purple with inverted Durham's tube. The solution was steered well and was kept for incubation at 37°C for 24 Hrs. After incubation, tubes were observed for the development of acid and gas in Durham's tube. 1mL culture from positive tubes (A+G, A) was inoculated in plates containing CLED medium by using the spread plate method. Plates containing inoculated CLED medium were incubated at 37°C for 24 to 48 Hr. After incubation, characteristic colonies were selected. Take out a portion of the isolated colony and inoculated it in a Nutrient broth tube for further tests. It was kept for incubation at 37° for 24 hr. After incubation, culture was processed with cultural, morphological, and biochemical tests to identify microorganisms from collected street food samples. Cultural characteristics of microorganisms were noted by observing the size, shape, and color of colonies formed on CLED Agar plates.

RESULT AND DISCUSSION

In the present study, a total of 50 street food samples were collected from different shops in Gondia City to isolate pathogenic bacteria. Total 39 organisms were isolated from street food samples collected.

Table 1: Total Positive And Negative Samples

Samples	No. of Sample	Percent of Contamination
Positive	34	68.0
Negative	16	32.0
Total	50	100

Above Table. 1. illustrates information, about several positive and negative street food samples collected from the Gondia city market. A total of seven popular street foods were selected for collection of street food samples which shows 68% contamination with pathogenic bacteria. It is evident that out of a total of 50 samples 34 (68.0%) samples indicated the presence of pathogenic microorganisms, whereas 16 samples (32.0%) did not show the presence of pathogenic organisms in it.

Table.2. shows information about type-wise positive and negative street food samples collected from shops in Gondia city. It is apparent that out of a total of 50 samples 34 samples were positive whereas 16 samples were negative concerning the presence of bacteria.

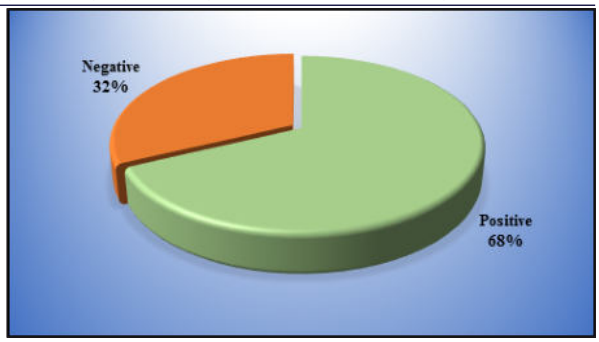

Fig. 1: Total Positive And Negative Samples.

Table. 2: Type Wise Positive And Negative Samples

Type	Number of samples	Positive	Negative
Aloo bhajia	3	3	-
Aloo Bonda	3	2	1
Aloo chaat	1	-	1
Bhel	1	1	-
Bread pakoda	5	3	2
Chaat	1	1	-
Kachori	4	2	2
Kanda bhajia	3	1	2
Kanda vada	4	3	1
Mirchi Bhajia	1	1	-
Moong vada	1	1	-
Moongodi	3	1	2
Palak vada	1	1	-
Pani puri	3	2	1
Poha	6	5	1
Samosa	7	4	3
Vada	3	3	-
Total	50	34	16

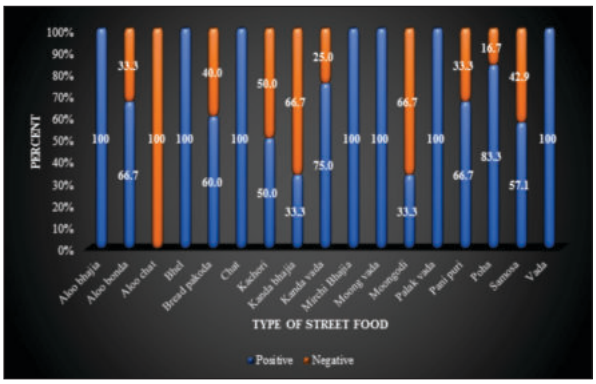

Fig.2: Type Wise Positive And Negative Samples

The street food which is found positive for the presence of bacteria is from the local market and it is being prepared on daily basis well-known, their demand and supply are very high. The demand for street food now a day increased rapidly because it is an easy way to fulfill the demand for food, is cost-effective, and saves money. It is also becoming an important source of income for many people who are vending street food in different markets. Only the quality is an important and big concern for selling and having street food, because knowing, unknowing the unhygienic practices leads to the contamination of harmful pathogens in it which are proposing health risk in the society who are regular depends on the street food. Based on the morphological, cultural, and biochemical characteristics, the isolated from street food samples were identified as *Escherichia coli in 23 samples*, *Staphylococcus aureus in 6 samples, Enterobacter aerogenes in 5 samples*, *Enterococcus faecalis in 2 samples, and Streptococcus pyogenes in 3 samples*. In the present study, 68 percent of total (34 of 50 nos.) analyzed street food samples found positive and five bacterial species are identified viz., *E. coli, Staphylococci aureus, Enterobacter aerogenes, Enterococcus faecalis* and *Streptococcus pyogenes*. *E. coli* are not harmful but some of the strain such as *E. coli* O157:H7, can cause intestinal infection including diarrhea, abdominal pain, fever, and sometimes vomiting and the species of *Staphylococcus*

aureus is the most pathogenic, it typically causes skin infections and sometimes pneumonia, endocarditis, and osteomyelitis. It commonly leads to swelling formation. Likewise, *Enterococcus faecalis* may cause abdominal and pelvic, infections, urinary tract infections, oral infections, particularly with root canals, septicemia, or blood poisoning, wound infections, etc. Similarly, Streptococcus *pyogenes* causes numerous infections in humans including pharyngitis, tonsillitis, scarlet fever, cellulitis, erysipelas, rheumatic fever, post-streptococcal glomerulonephritis, necrotizing fasciitis, myonecrosis and lymphangitis.

CONCLUSION

Street food though it is budget food, tasty, variety of food items, still it is a matter of hygienic practices and human health. The present study concluded that even though the street food is in high demand, the quality of it was not even satisfactory as it observed pathogenic microorganisms in street foods like Aloo bhajia, Aloo Bonda, Aloo chaat, Bhel, Bread pakoda, Chaat, Kachori, Kanda bhajia, Kanda vada, Mirchi Bhajia, Moong vada, Moongodi, Palak vada, Pani puri, Poha, Samosa, and Vada. The results observed in the present study are alarming and raise doubt on the preparation and handling of the food that is prepared in the local stores. In many countries (particularly in developing countries), street foods are an important contribution to employment, household revenue, food security, and help to meet the challenge of feeding urban populations. Dietary habits and traditional meal patterns change when people move from rural to urban environments, and cities offer access to a variety of foods outside the home, including street foods, restaurants, etc. As an 'informal' sector of the food business street foods often escape formal inspection and control. They can therefore both be the source of food safety problems and contribute to the deterioration of environmental hygiene. Street foods and require a comprehensive policy to ensure that food is safe and wholesome.

Recommendations

Though the street food is being prepared on daily basis and in some cases its preparation in hot oil may decontaminate the food (equals to sterilization) and could be safe for consumption but the improper handling and unhygienic practices may lead to the contamination of pathogenic bacterial which are harmful to the consumer. From the present study, it was recommended that Bring your own/homemade food, Choose a clean and hygienic place (hotel, restaurant, vendor) for having street food, Avoid street food in the rainy season or choose a safe place only, Venders must adopt the good handling practices, Local government or the respective authorities must check the quality of street food from time to time and warn venders to maintain it.

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