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Microbiological Analysis of Street Vended Food in West Delhi

KEYWORDS: Street food, Microbial analysis, *E.coli*, Food hygiene

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ABSTRACT *Street food vending has become an important public health issue and a great concern to everybody. The present study was aimed to investigate the hygienic conditions of the vendors and microbial quality of street foods. It was found that their food handling practices were very poor. For microbial analysis, 5 street foods and 5 franchise's food products were taken from most popular shops. In local street foods, the bacterial load in veg-momos (130±2.1- 34.5±1.5 CFU/g) and non-veg momos (360±2.55-4±0.60 CFU/g) was high than the other samples. In branded food product samples, burger (362.5±2.55 CFU/g), non-veg momos (262.5±2.41-2.0±0.30 CFU/g), veg-momos (85.0±1.92-9.0±0.95 CFU/g), gol-gappa (237.5±2.37- 8±0.90 CFU/g) were assessed. The presence of coliform indicated faecal contamination of the processing water as well as the prevailing unhygienic conditions related to the location of food preparation. It is suggested that proper hygienic and sanitary conditions should be maintained both personally and institutionally to avoid any food-borne pathogenic outbreaks in India, especially in the children and young who are tempted to such food. Therefore, the critical control points should be taken as safe limit by the Government/ authorities to reduce the cases of food contamination.*

INTRODUCTION

During the last few decades, the street food sector has expanded rapidly in urban areas of low and middle-income groups, both in terms of providing access to a diversity of inexpensive foods for low-income households [1] and in offering job opportunities for many urban residents. The street food sector also contributes to the economy of an urban and pre-urban agricultural sector [2]. In India, the National Policy for Urban Street Vendors/ Hawkers stated that street vendors constitute approximately 2% of the population of a metropolis [3].

"Street foods are ready-to-eat foods and beverages, prepared and sold by vendors and hawkers on the streets, other public places, including tourist sites" [4]. Due to its low cost and convenience, an estimated 2.5 billion people worldwide consume street food each day. A study in Kolkata, India, found that an average street meal contain about 30 grams of protein, 15 grams of fat and 180 grams of carbohydrates [5].

With this positive development, there are also some public health challenges for the urban population [1] because street foods are readily contaminated from different sources and it will increase the risk of food borne diseases [6]. World Health Organization [7] stated that millions of people fall sick or die because of eating unsafe food. Food safety has emerged as an important global issue with international trade and public health implications. Food safety is "assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use" [8]. In India, the period of 1984-89, there were 721 food-borne outbreaks and 1,199 sporadic cases of food-borne disease recorded in the cities of Hyderabad and Secunderabad alone [9].

Further, WHO reports that 20% of deaths among children under five are caused by diarrheal disease [10] and UNICEF estimates that about 1,000 children below the age of five die every day in India, due to diarrhea [11]. In a national study, 37% of adults and 42% of children reported consuming fast food on one or both days of the survey [12]. Food borne bacterial pathogens commonly detected in street vended foods are *Bacillus cereus* causes vomiting and diarrhea, *Clostridium perfringens* causes abdominal cramps and diarrhea, *Staphylococcus aureus* causes vomiting, diarrhea, loss of appetite, severe abdominal cramps and mild fever and *Salmonella* species causes typhoid, food poisoning and irritation and inflammation in the gastrointestinal tract [13]. Studies by [14] [15] [16] [17] have revealed frequent contamination of street food in different parts of India.

The present study was therefore undertaken to evaluate the microbial quality and safety of consumption of different street foods sold in West Delhi Markets.

MATERIALS AND METHODS

The present study was conducted at Institute of Hotel Management, Catering & Nutrition, Pusa, New Delhi, India. All media and kits that were used during this study wereobtained from Hi-Media Laboratories Pvt. Ltd., Mumbai, India.

Sample collection

The present study was conducted to analyze and observe the microbial load in street foods in New Delhi and the food safety aspects. It was carried with the consumer survey in which 100 subjects were taken regarding their commonly consumed street food. Five locations in West Delhi were chosen for the collection of samples, where the sale was maximum per day. Food samples (samosa, gol-gappa, burger, vegetarian momos and non-vegetarian momos) were collected twice from local street shops and franchise's outlets at one month interval. All the samples were aseptically collected in sterile containers, stored at 4°C and analyzed within an hour of procurement.

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Isolation and enumeration of microorganisms
All the samples were aseptically collected in sterile containers, stored at 4°C. Ten gram of sample was weighted under aseptic condition and properly homogenized by using a sterile pestle and mortar. Ten gram of homogenated sample was added to 90 ml of sterile 0.85% saline water in a test tube and diluted serially upto 10^{-5} dilution was obtained.

For bacterial isolation 0.1 ml of dilution from each tube was aseptically pipette out and plate onto different nutrient agar media using spread plate technique. The plating was done in the laminar flow to maintain aseptic conditions. All the plates were placed in an incubator at 37°C for 24 to 48 h in an inverted position. For bacterial enumeration the plates were used to determine the number of colony forming units (CFU) per gram of food sample.

Test for Coliform bacteria detection in food samples:
Coliform detection in food sample was enumerated by the Most Probable Number (MPN) method. Three serial dilutions (0.1, 1.0 and 10 ml) were inoculated in Lactose broth in test tubes and then incubated at 37°C for 24 to 48 h. Positive tubes (acid and gas production) were observed and plated by using spread plate technique on molten Violet Red Bile agar. *E. coli* culture was taken as a positive control. After solidification, incubate the plates at 37°C for 24 to 48 h. The coliform colonies were counted in sample plates. The coliform (CFU/gram) was determined by considering the countable plates by using standard protocols [18].

Test for Coliform detection in water sample:
Three serial dilutions (0.1, 1.0 and 10 ml) were inoculated in Lactose broth and incubated the tubes at 37°C for 24 to 48 h. Positive tubes (acid and gas production) were streaked on Eosin Methylene Blue Agar plates and incubated at 37°C for 24 to 48 h. Appearance of typical *E. coli* colonies with dark centre and metallic sheen indicated positive confirmed test. For confirmation typical *E. coli* colonies were transferred to tube containing lactose broth for acid and gas production and nutrient agar slant for gram reaction and cell morphology [19]. Tubes and slants were incubated at 37°C for 24 to 48 h.

Determination for *Salmonella* species in food samples by using "KB011 *HiSalmonella™*" Identification Kit
KB011 is a comprehensive test system that can be used for identification of gram-negative *Salmonella* species**.**

A. Preparation of Homogenate Sample
The food samples (1 gram each) were homogenized in a mortar pestle. One ml of homogenated sample was added to 9 ml of sterile 0.85% saline water in a test tube and diluted serially upto 10^{-5} dilution was obtained.

B. Preparation of Inoculums
Single well-isolated and purified colony was picked up and inoculated in a homogeneous suspension made in 2-3 ml sterile saline. The density of the suspension was adjusted to 0.1 OD at 620 nm or 0.5 **McFarland's standards.** All the inoculated samples were incubated at 35-37°C for 18-27 h.

C. Inoculation of the Kit
Each of the sample was inoculated with 50 µl of the inocula prepared.

For *Methyl Red Test* 1-2 drops of methyl red reagent was added.

For *Voges Proskauer* Test 2-3 drops of barritt's reagent A and 1 drop of barritt's reagent B were added.

For H_2S test, Triple Sugar Iron (TSI) agar was used to observe carbohydrate utilization pattern the medium contains 1% concentration of each of lactose and sucrose and 0.1% conc. of glucose. Acid base indicator was added to detect the production of acid during carbohydrate fermentation. The data was analyzed by using various statistical tests like Mean, Standard Error and Log-10.

RESULTS AND DISCUSSION
Hundred subjects were surveyed to find the commonly consumed street food, which were taken as the main samples for the microbial analysis. The hygienic level of the food handling and processing could be determine by using the Total Plate count analysis that is widely use. Post contamination could be used to know the bacterial count which reflect the amount of heating that goes into food production [20]. All vendors were observed working without any protective cover for food, the area of preparation was not cleaned, vending cart was not protected from sun, wind and dust and sale point was not free from animals, cooked food was not protected from sun and dust, dustbin was not covered and they did not washed their hands after serving or preparing the food of performing any work etc. Results depicted in Fig 1, 2, 3, 4 revealed that the selected food sample used for study, were contaminated with *E. coli*, coliform and *Salmonella*.

The presence of *E. coli*, Shigella dysenteriae, Streptococcus sp, Klebsiella, and Enterobacter represent fecal contamination. Some *E. coli* are harmless, however Enterotoxigenic *E. coli* (ETEC) is associated with traveler's diarrhea. Similarly, Shigella dysenteriae have been associated with severe bacillary dysenteriae, while Streptococcus sp, have been frequently associated with acute sore throat [21]. Due to washing of vegetables with contaminated water, it gets contaminated with *Salmonella* spp. Also pathogenic microorganisms are scatter through vegetables handling by infected workers, vendors and consumers in the market place. HACCP study revealed that raw vegetables themselves carried pathogens and since they were not washed they continued to be present at the time of consumption. [22]. Rather, the vendors should be sensitized and also issued some certificates so that they could be trusted and allowed to operate their business.

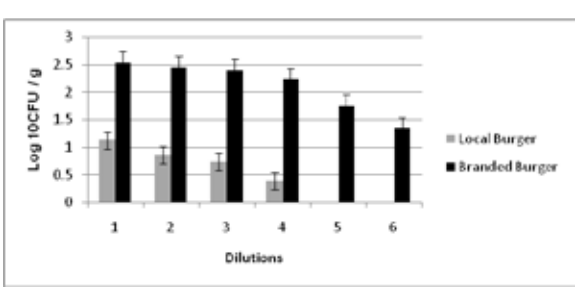

Fig.1 : Microbial load of local and branded burger

The result depicted in Fig 1 shows that the microbial load was more in branded burger then local burger because the bread of the local burger gets the heat treatement which reduce the microbial load.

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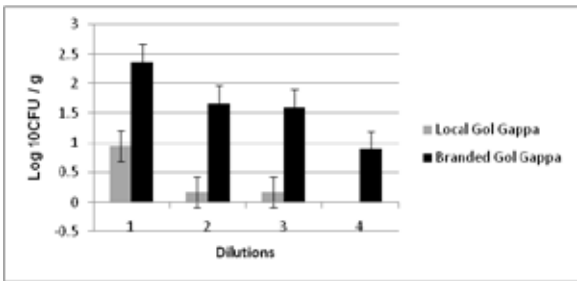

Fig.2 : Microbial load of local and branded gol-gappa

The result depicted in Fig 2 shows that the microbial load was more in branded gol-gappa as it was packed with preservation. The local gol-gappa however were made and consumed on same day without using any preservation techniques.

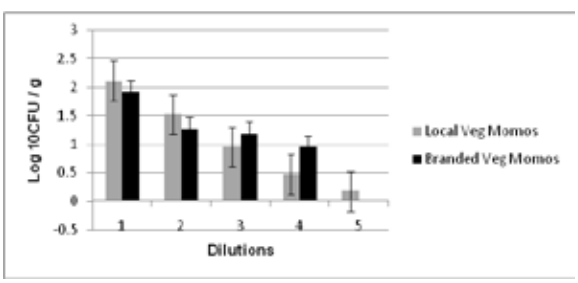

Fig.3 : Microbial load of local and branded veg momos.

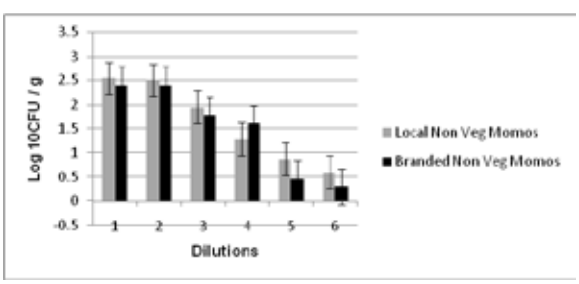

Fig.4 : Microbial load of local and branded non-veg momos.

Fig 3 and 4 depicts that the microbial load were high in the selected 4 food samples. The posssibility of food borne diseases is more when raw vegetables are consumed without any heat treatement and washing [23]. Both local and branded veg and non-veg momos were highly contaminated and unfit for the consumption.

In the coliform detection test, in water both samples of local and branded gol-gappa water, gas production was observed suggesting presence of *E. coli* and their MPN value was more than >2,400. The coliform detection test in food samples, branded burger, branded veg and non-veg momos and local non-veg momos were found positive. The poor hygiene meals raise the MPN value and cause typhoid, dysentery (infection in intestine by diarrhea) or cholera. Earlier, such findings were even reported by [24] on "Bacteriological Quality of Street-vended Um-Jinger: A Traditional Sudanese Food". The presence of coliform bacteria in food samples was might be due to water use for cooking and serving which was contaminated with fecal coliform [25].

In *Salmonella* species test methyl red, Voges Prokauer's and citrate utilization tests were negative but the H_2S production test was postive in branded and local non-vegetarian momos.

The *Salmonella* is the major pathogen found in raw vegetable. Its presence can be detected by several factors such as improper handling and processing, use of contaminated water during washing, cross contamination from other rotten vegetables or the use of dirty cooking utensils [22].

CONCLUSION

Based on our findings, it was concluded that the proper facilities and training for food handling should be given to the vendors. Street foods are defined as ready-to-eat foods and beverages prepared and sold by vendors and hawkers especially in street and other similar public places. However, the unhygienic conditions in which these foods are prepared, stored and served raise a question regarding their hygiene status and microbiological quality. Past studies on street foods indicated that these foods are not meeting the microbiological standards and are contaminated with various pathogens, *viz.*, *E. coli*, *Vibrio*, *Salmonella* etc. The present study was undertaken to investigate the hygiene and sanitation practices of street vendors and microbial quality of street food. The result showed that in local street foods, the initial microbial load in gol-gappa dilution was found to be 10^{-1} 9±0.95, which gradually reduced to 1.5± 0.17. No growth found in 10^{-4} to 10^{-6}. In veg-momos, 10^{-1} dilution the load was 130±2.1, which was reduced to 34.5±1.5 and in 10^{-3} to 10^{-6} no growth was observed. In non-veg momos, 10^{-2} to 10^{-3} the load was 325± 2.5 and 90± 1.9 but in 10^{-4} to 10^{-5} the load was lower than the permissible limit. In burger, the initial load in 10^{-1} to 10^{-4} was lower than the criteria limit, *i.e.* 13.5± 1.13 to 2.5± 0.39 and in 10^{-5}, 10^{-6} no growth was observed. In dilution, 10^{-1} of *samosa* the initial load found to be 1± 0, which was lower than limit and in other dilutions no growth was found.

In franchise food products, the initial load in gol-gappa dilution 10^{-1} was found to be 237.5 ±2.37 and reduced to 8 ±0.90. No growth was found in 10^{-5}, 10^{-6}. In veg-momos, the dilution 10^{-1} was 85 ±1.95, which was reduced to 19 ±1.27, 15.5 ±1.19, 9.0 ±0.95 and no growth was found.

It was found that the volume 10.0, 1.0 and 0.1 ml of both samples local gol-gappa and branded gol-gappa had colour change and gas was produced.. It was concluded that in both the samples *E. coli* was present. It shows that in local burger, Coliform CFU/g was 0.5. In branded burger, veg momos, non-veg momos and local non-veg momos, the Coliform CFU/g value was 0. In local veg momos, Coliform CFU/g was 2. In local and branded *samosa* Coliform CFU/g value was 0.125. Positive coliform test in food sample indicate the fecal contamination and high risk of diarrhea disease.

In *Salmonella* detection test, it was found that the methyl red, Voges Prokauer's and citrate utilization test were negative in all street food and franchises samples but only H_2S production test was positive in branded non-veg momos and local non-veg momos.

The preparation of food long before its consumption, storage at ambient temperature, inadequate cooling and reheating, contaminated processed food and undercooking were identified as the key factors in the food handling that contribute to food poisoning.

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Therefore to ensure the food safety, producers and hawkers must maintain clean environment, minimized contact with the food sample after production and also maintain a maximum personal hygiene. Also utensils should be clean at all stages of food production and food storage time should be as less as possible.

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