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Total viable microbial count of the selected street foods obtained from Palampur, India

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ABSTRACT

The present study was undertaken to evaluate the total viable microbial count of selected street foods i.e Samosa, Pakoda, Tikki, Momo, Spring rolls and Veggie burger in Palampur city of Himachal Pradesh, India. Samples of each street food were collected from 3 different locations and named as street vended samples. The samples prepared in the food laboratory by using traditional recipes were named as control samples and the samples prepared by using locally available healthy and more nutritious ingredients were named as value added samples. The samples were prepared for microbial analysis as per standard protocol. During the comparison, a significant ($p \leq 0.05$) difference existed in the viable count of street vended samples when compared to control and value-added samples. Poor hygienic conditions during processing and handling might be responsible for the higher microbial load. Common Indian street foods namely Samosa, Pakoda and Tikki had less colony count in comparison to the Moms, Spring rolls and burgers.

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1. Introduction

Indian food specialty lies in its comforting street food which offers a variety of flavours with almost every corner of the streets. Easy availability of these foods near school, colleges, and other public places make them an inseparable part of diet. Street vended foods are defined as foods which are prepared and/or sold by vendors in streets and other public places for immediate or later consumption without further processing or preparation (1).

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Every person once in a while prefer to have a bite of street foods as a snack with tea or coffee or for the purpose of satisfying their cravings. Due to their popularity among every part of society safety is always a matter of concern as in most of the 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 (2). Street foods are the cause of several types of food borne disease. 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 (3).

In many developing countries, such as India, street-food vending is a common part of urban lifestyle due to high unemployment and limited work opportunities. Vendors usually congregate in overcrowded areas where there are high numbers of potential customers. Such areas usually provide limited access to basic sanitary facilities (4). Street foods are the cause of several types of food - borne disease. The water used for drinking and cleaning purposes is often contaminated due to unhygienic storage and handling. Moreover, use of artificial colours, like metanil yellow, has led to serious health hazards. Proper garbage removal facilities are also not available, thus leading to poor environmental condition (5).

Irrespective of its health effects, people consume street foods in day-to-day life which are sold in the streets, public places, busy market places, school areas, near college campuses, and taxi stands, etc. Although, there are scanty studies on street foods in India, some studies have revealed that as many as 20-30% of foods are consumed as street foods in India (6). In another study it is seen that although the food sold in the open area may not be produced and sold under appropriate conditions, people cannot give up consuming them. Especially, it is seen that students think that food sold in the open area are unhealthy and nutrition wise low, but that they prefer them because they are cheap and quickly served. It is also determined that there is a positive correlation between the frequency of eating outside and consuming food sold in the open area (7). So far, in India only very few organized attempts have been made to study urban street foods. Although, sporadic attempts have been made to find out the pattern of street foods available in major Indian cities, detailed studies on the availability, consumption pattern and food safety aspects of street food remain unexplored (8).

In the present study an attempt has been made to get aware of the microbiological status of the six selected street foods which are very commonly sold by street vendor of Palampur namely Samosa, Pakoda, Aloo Tikki, Momo, Burger and Spring Rolls. Out of the total, the first three can be termed as Indian street foods and the rest of the three are termed as exotic street food because of their origin of distant foreign country.

2. Materials and methods

2.1. Sample Collection

The study was conducted by taking three treatments i.e. control street vended and value added samples. The street vended samples for each food (i.e. *Samosa, Pakoda, AlooTikki, Momo, Burger* and *Spring Rolls*) were collected from 3 different street food vendors in Palampur city of Himachal Pradesh.

2.2. Samples Preparation

The samples prepared in the food lab were named as control and value added samples. Both differentiate from each other by means of raw ingredients used. The control samples were prepared by using the traditional recipe as well as traditional ingredients for preparation. However, the value added sample varied from control by means of raw ingredients used for preparation whereas the preparation procedure is same as control. table 1 gives the individual description of the selected street foods.

2.3. Microbiological analysis

2.3.1. Preparation of Media

The media were prepared by using nutrient agar. Twenty eight grams of nutrient agar was dissolved in one litre of distilled water and then autoclaved at 15 lbs. pressure (121^{o}C) for 1h. Sterilized plates were prepared in laminar air flow chamber by pouring the agar in the plates. The plates were cooled until the media set in the plate.

2.3.2. Total viable count

For the microbiological analysis of food sample, each sample was thoroughly mixed. Serial dilutions of samples were prepared for further analysis. One gram of finely ground fresh sample was weighed and dissolved in 100 mL of water. For each sample two dilutions were made. Using aseptic technique, 0.1 mL of the diluted sample was pipetted out into the petri plate. Flamed the spreader and gently liquid was spread around the plate. Plating was done in triplicates. It was allowed to dry and then incubated at 37^{o}C for 24 h. Total viable colonies were counted manually and expressed in cfu/mL (4).

2.3.3. Statistical analysis

The attained data were possessed to Analysis of Variance (ANOVA) using OP stat software and were interpreted at 5 % level of significance ($p \leq 0.05$).

Table 1. Description of the selected street foods

Street Food	Description	Method of Preparation
Samosa	Samosa is a fried or baked dish with a savoury filling, such as spiced potatoes, onions, peas, meat, or lentils. It may take different forms, including triangular, cone, or half-moon shapes, depending on the region.	Deep frying
Pakoda	Pakoda also called *pakoda, pakodi, fakkura, bhajiya, bhajji, bhajiorponako* is a fried snack (fritters), originating from the Indian subcontinent. It is prepared by mixing onions, potatoes or other vegetables and spices with bengol gram flour prior to frying.	Deep frying
Tikki	It is prepared by blending boiled potatoes, peas, and spices together and converted into round shape.	Shallow frying
Momo	Momos is a traditional food of Nepal and Tibet. Momo is a steamed dumpling made from refined flour and stuffed with minced vegetables, spices and herbs.	Steaming
Spring rolls	These are savoury rolls with cabbage and other vegetable fillings inside a thinly wrapped cylindrical pastry.	Deep frying
Veggie Burger	A savoury cake resembling a hamburger but made with vegetable protein, soya, etc., instead of meat.	Shallow frying

The ingredients used for the value addition of the selected street food has been given in table 2.

Table 2. Ingredients used for value addition

Street food	Ingredients used for value addition	Proportion used
Samosa	Whole wheat flour + rice flour	50+50
Pakoda	Gram flour + rice flour	75+25
Tikki	Bengol gram sprouts + green gram sprouts	35+35
Momo	Whole wheat flour (for wrapping)	50
	Bengol gram sprouts + green gram sprouts + green peas*	25+25+25
Spring rolls	Whole wheat flour + gram flour + rice flour (for wrapping)	50+25+25
	Bengal gram sprouts + green gram sprouts*	5+10
	Peas + carrot*	5+5
	Soya granules*	15
Veggie Burger	maize flour + wheat flour + bengol gram formaking bun)	15+75+10
	tofu+ value added *tikki**	50+1

(* for stuffing)

3. Results

3.1. Samosa

According to the data depicted in table 3, the total viable count of control, street vendor and value added samples of *Samosa* was 24×10², 146×10² and 3×10 cfu/g respectively. There was a significant (p≤0.05) difference in the total viable count of all of the three samples when compared with each other.

3.2. Pakoda

In case of control, street vendor and value added sample of *Pakoda*, the total viable count was 16×10², 97×10² and 8×10² cfu/g, respectively. The total viable count of sample procured from street vendor differed significantly (p≤0.05) from control and value added *Pakoda* when compared with each other.

Table 3. Total viable count in selected street foods

Samples	Control	Street vendor	Value added	CD(p≤0.05)
Samosa	24 ×10²	146×10²	3×10²	4.12
Pakodas	16×10²	97×10²	8×10²	2.25
Tikki	11×10²	252×10²	26×10²	2.40
Momos	186×10²	379×10²	177×10²	8.10
Spring roll	114×10²	458×10²	155×10²	13.20
Burger	180×10²	375×10²	153×10²	8.99

3.3. Tikki

As far as the total viable count of control, street vendor and value added samples of Tikki was concerned, there was a significant (p≤0.05) variation in the total viable count of all the three samples when compared with each other. However, the control, street vendor and value added sample of *Tikki* had a total viable count of 11×10², 252×10² and 26×10² cfu/g respectively.

3.4. Momo

Total viable count of all of the three samples of *Momo* was 186×10², 379×10² and 177×10² cfu/g respectively. The total viable count was maximum in the street vendor sample however it was minimum in the value added sample. A significant (p≤0.05) variation was also there in the total viable count of control, street vendor and value added sample of *Momo* when compared with each other.

3.5. Spring rolls

The control, street vendor and value added sample of Spring roll had total viable count of 114×10², 458×10² and 155×10² cfu/g respectively. There was a significant (p≤0.05) difference in the total viable count of control, street vendor and value added samples of *Spring roll* when compared with each other.

3.6. Burger

The total viable count of control, street vendor and value added samples of *Burger* were 180×10², 375×10² and 153×10² cfu/g, respectively. The data in table 3 showed that the total viable count in all of the three samples of the *Burger* differed significantly (p≤0.05) when compared with each other. However, it was maximum in the sample procured from street vendor and observed minimum in the value added sample.

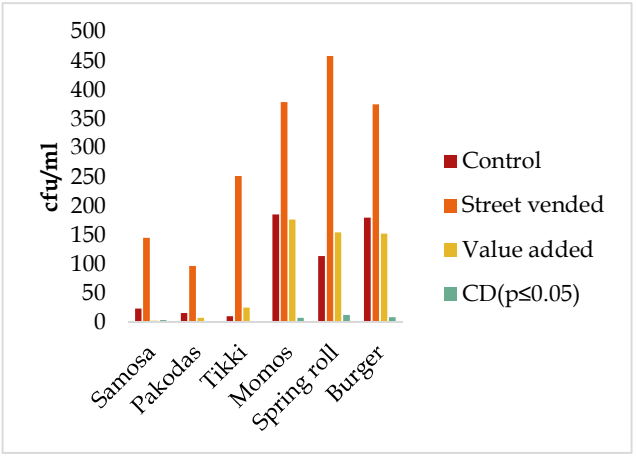

Figure 1. Graphical representation of no. of colonies in various samples (10²)

4. Discussion

The count was maximum in the street vendor sample followed by control and value added sample of *Samosa*. Gawande et al, studied the socio-economic profile of street food vendors and quality evaluation of *Samosa* and *Pani-puri* in Allahabad city, (UP) India and collected 33 samples of selected street foods (5). They reported that the microbiological results indicated the presence of *salmonella* in *Samosa* and *Pani-puri* to the extent of 75 to 30 per cent yeast, mould were 36 percent in *Samosa* and 81 per cent in *Pani-puri.*

The value was observed maximum in the street vendor *Pakoda* and minimum in the value added *Pakoda.* The value was maximum in the street vendor *Tikki* followed by control and value added *Tikki*. According to a study conducted by Chauhan et al, revealed that the *Allu Tikki*, *Momos*, *Chowmein* and *Chutney* were found to have total viable count of 30×10^5 cfu/mL, 35×10^5 cfu/mL, 10×10^5 cfu/mL, and 35×10^5 cfu/mL, respectively (6).

Microbiological analysis on foods like *Samosa* and *Momo* was experimented and it was reported that total viable count of 2.8×10^3 cfu/mL in Samosa and 3.7×10^3 cfu/mL in *Momos*, respectively (7).

In another study, it was reported that out of 160 samples of street foods collected from mobile food seller, stationary food seller with shelter (26.3%) were found to be contaminated with *Bacillus cereus* and 24 (15.9%) with *Staphylococcusaureus*, respectively (8).

The total plate count in *Pani-puri* and noodles was log 4.77 cfu/g and log 7.14 cfu/g, respectively (9). Also, the total viable count of bacteria in all the samples varied between $0.4\text{-}3.0\times10^4$ cfu/g, faecal coliforms between $0.03\text{-}0.14\times10^4$ cfu/g and faecal streptococci between $0.2\text{-}11\times10^4$ cfu/g, respectively in the samples of *Gupchup, Chaat, Dahi-bada*and *Panipuri* sold in Bhubaneswar city (10).

In the current study, the count was maximum in the street vendor sample of *Spring roll* as compared to control and value added *Spring roll*. According to microbiological analysis by Kharel et al, the street foods like *Samosa*, vegetable *Momo*, *AlluTikki* and vegetable *Pakodas* were found to have total viable count of 6.9 ± 0.02 cfu/mL, 6.3 ± 0.02 cfu/mL, 5.7 ± 0.0 cfu/mL and 6.4 ± 0.08 cfu/mL, respectively (11). Ethnic street foods of Gangtok city of Uttarakhand i.e. *Samosa* and vegetable *Momo*, had total viable count of 7.3 ± 0.06 cfu/mL and 7.0 ± 0.06 cfu/mL, respectively. Microbial count was even higher in exotic street foods prepared in the laboratory, which might have been due to the reason that the soy sauce and tomato sauce were procured from the market.

5. Conclusions

From the results of the study, it is clear that total viable count in all samples of the selected street foods i.e. *Samosa, Pakoda, Tikki, Momo, Spring roll* and *Burger* was maximum in the samples procured from street vendor when compared with control and value added samples. The high viable count in the street vendor samples might have been due to the preparation of these foods in unhygienic or unfavourable conditions. This might have been contributed in increasing the microbial load. Use of ready made sauces affected the microbial load of the exotic street foods, thereby, resulting in more microbial load. Fresh ingredients should be used during preparation of fast foods/ street foods. Street vendors must be encouraged to use freshly prepared sauces or dips. Further studies are needed for the microbial analysis of soy sauce, tomato sauce and chutnies /dips used for serving.

Conflict of interest

The authors declare that there is no conflict of interest.

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