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ORIGINAL ARTICLE

MICROBIOLOGICAL EVALUATION OF ROADSIDE FAST FOOD IN NORTH INDIA AND RELEVANCE TO FOOD SAFETY

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ABSTRACT

Bacterial contamination of fast food has become a global health concern. Road side commonly available Fast foods consumed by majority of population are considered vulnerable from hygiene point of view. In the present study, an attempt has been made to develop the understanding of the microbiological quality of some fast food samples. A total number of fifty six commonly available fast food samples from different locations of North India were studied for microbiological parameters comprising total bacterial count, coliform count and for detection of *Escherichia coli* and *Salmonella*. The samples were found to be contaminated with total bacterial count in the logarithmic range of 2-2.99 to 7-7.99 (log_{10}cfu), coliform count in the logarithmic range of 2-2.99 to 5-5.99 (log_{10}cfu), *Escherichia coli* count in the logarithmic range of 3-3.99 to 5-5.99 (log_{10}cfu). Coliform group as a major food contaminant was detected in 53.57% samples whereas the major pathogenic bacteria *Salmonella* was not detected in any of cooked food sample. Other pathogen like *Escherichia coli* was detected in 12.5% of the samples. This investigation further paves the way to have some more detailed studies on good hygienic practices to improvise the quality of food and also help to develop new fast rapid molecular biological techniques for the detection of pathogens in the fast food samples.

Keywords: : Fast Food, Bacterial contamination, *Escherichia coli, Salmonella*

1.INDRODUCTION

Food borne illness of microbial origin is a major international health problem associated to Food Safety and an important cause of death in Developing countries. The problems of food safety in the developed countries differ considerably from the Developing countries (Nicolas et al., 2007). "Food poisoning" is a general name given to illnesses contracted by consuming contaminated food or water. The micro-organisms responsible for illness are bacteria, viruses and fungi, commonly called "germs: or "bugs". But illness can also be caused by chemical contaminants (such as heavy metals), toxins produced by the growth of some micro-organisms (e.g. *Staphylococci* bacteria) and by a variety of organic substances that may be present naturally in foods (such as certain mushrooms and some seafood). Food poisoning bacteria grows more easily on some foods than others. These high-risk foods include Meat, Poultry such as chicken and turkey, Dairy products, Eggs, Seafood, Cooked rice, cooked pasta, prepared salads such as coleslaw, pasta salads and rice salads. Generally food poisoning results from contamination of food and the subsequent growth of food poisoning microorganisms. Food poisoning outbreaks are often recognized by the sudden onset of illness within a short period of time among many individuals who have eaten or drunk one or more foods in common. According to the report of the World Health Organization, hundreds of millions of people worldwide suffer from diseases caused by contaminated food. The Contamination of the food supply with pathogens and its persistence, growth, multiplication or toxin production has emerged as an important public health concern. Over two hundred different diseases are known to be transmitted by the food (Bryan, 1982). Food-related bacteria constitute a heterogeneous group with their original habitats extending to all ecological niches where food for human consumption is produced and handled. The contaminated surfaces play a crucial role in relation to potential transmission of pathogens to food in food processing, catering and domestic environment. Several studies indicates that various bacteria, including *Escherichia coli, Staphylococcus aureus and Salmonella spp.*, survive on

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hands, sponges/cloths, utensils and currency for hours and days after initial contact with the microorganisms (Scott and Bloomfield, 1990). In some other studies, the extent of bacterial survival and cross contamination between hands and food or various kitchens surfaces have been quantified (Zhao et al., 1998). Early studies also indicated that cross contamination, from raw products via hands, cleaning cloths or sponges and utensils to foods not subjected to further cooking, contributed to the occurrence of outbreaks of food-borne salmonellosis in the United States (Bryan, 1988). In the past decade, several Hazard Analysis Critical Control Points (HACCP) studies have been carried out, both in individual homes and in streets (Bryan 1982). However, most of these studies gave information in absolute terms of microbiological contamination, and there is little information about the relative risk, compared to food from other locations.

Several investigations regarding the microbiological quality of foods have been studied. Microbial surveys of mid day meals have found significant contamination with a variety of bacterial contaminants, including fecal coliforms, *Escherichia coli, Campylobacter, Salmonella*. Microbiological analysis of mid day meal is of paramount importance because of the fact that exponential growth of microorganisms occurs in case of microbial contaminated food which critically affects the quality of cooked food. It is also necessary because the presence of pathogenic microbes in food products will have adverse (hazardous) effects on health. The incidents of food borne illness have been increasing world over. The regulatory agencies have been setting standards of food quality in such a way that the food borne illness can be avoided. In other words quality of food means safety of food. The aim of microbiological analysis of mid day meal is to estimate the extent of presence of different types microbes as well as determining the nature of microbes whether pathogenic or non-pathogenic. The techniques adopted for the purpose vary from product to product as well as based on level of contamination. Ideally the inputs such as water, grains, pulses and vegetables etc. should be evaluated for microbiological parameters in addition to the final cooked products the understanding the quality of inputs is necessary for deciding the appropriate system and procedures to ensure safe quality of Fast food. The present study focuses on the six major mid day meal items e.g. Samosa, Sandwich, Spring roll, Aloo Tikki, Bhelpuri and Pawvaji. The present study involves, (a) Collection of above six fast food samples from road side hawker at different location of North India (b) Evaluation of the food products for different microbiological parameters and (c) Interpretation of the data generated for the benefit of regulatory agencies and to increase general awareness among people.

2.MATERIALS AND METHODS

Collection of food samples:

Wide mouth PET jars sterilized by gamma-radiation were used for sampling of fast food samples. The lid of the jar was removed by maintaining all aseptic conditions. The samples were kept in an ice pack to prevent any changes in the microbial flora of the samples. The samples were transported to the lab for testing in vertical position maintaining the temperature 1-4°C with ice pack enveloped conditions were reached to the laboratory starting the analysis within 6 hrs of collection (IS: 5404-1984 reaffirmed: 2005).

Enumeration of Bacterial and Coliform Population:

For total bacterial and coliform count, 10 g of homogenized sample was diluted with 90 ml of 0.1 % peptone. After proper mixing, sample was serially diluted up to 10^7 dilutions. 1 ml of each dilution was transferred into four sterile petri dishes (90 mm of size). About 15 –20 ml melted media (Plate count agar for Total Bacterial Count & Violet Red Bile Agar for Coliform count) poured and mix properly by rotating the plates clock and anticlockwise. Plates were incubated at 30^0C for three days and 37^0C for one day for enumeration of bacterial and coliform population respectively. Colonies on the plates were counted with the help of Quebec Colony Counter and then calculated in terms of cfu/gm of sample (IS: 5402:2012, IS: 5401 (Part 1):2002, Reaff: 2007).

Isolation and identification of Pathogens:

Detection of *E. coli*: For detection of *E. coli*, 0.1 ml of aliquot from each dilution was spread on Tergitol-7 agar (Hi-Media). Confirmatory identification was done by sub culturing on Eosin Methylene Blue Agar and on Mac Conkey Agar. Further confirmation was done by biochemical test using HiIMViC test kit (Hi media) IS: 5887(Pt-1) 1976, Reaff.2005.

Detection of *Salmonella* sp.:

For the detection of salmonella 25 g homogenized sample was diluted with 225 ml of Buffer Peptone Water and then incubated at 37 ^{0}C for 24 hrs. 0.1 ml of above enriched sample was inoculated in 10 ml of Rappaport Vassiliadis medium and then incubated at 42 ^{0}C for 24 hrs. Sub cultured on the plates Brilliant Green Agar and Bismuth Sulphide Agar. Plates were observed for characteristic colonies such as pink colonies on Brilliant Green Agar and black metallic sheen colonies with H_2S on Bismuth Sulphide agar plates. Further confirmation was done by biochemical test using HiIMViC test kit (Hi media) IS: 5887(Pt-3) 1999, Reaff.2005.

3.RESULTS AND DISCUSSION

A large number of population consumed fast foods from road side hawker on regular basis. Food-borne illnesses associated with the consumption of commonly available fast foods have been reported in several places in India. Amongst total 56 fast food samples collected from different location and analyzed for its microbiological quality. All the samples were found to have bacterial contamination in the range of 10^3-10^7 cfu/g (Table 1 & Table 2). Nineteen samples were found in the logarithmic range of 7-7.99 ($\log_{10}$cfu) and other nineteen were in the range 6-6.99 ($\log_{10}$cfu). Similarly, nine samples were found in the range of 5-5.99 ($\log_{10}$cfu) and seven samples were in the logarithmic range of 4-4.99 ($\log_{10}$cfu). The least number of samples i.e. two were in the range of 2-2.99 ($\log_{10}$cfu). Coliform count was found to be present in thirty samples out of total 56 samples analyzed. Ten samples showed the logarithmic range between 5-5.99 ($\log_{10}$cfu). Nine samples and seven samples showed logarithmic count between 4-4.99 ($\log_{10}$cfu) and 3-3.99 ($\log_{10}$cfu) respectively.

Table: 1. Microbiological profiling of mid day meal collected from different location

S. No	Sample Name	Total bacterial count (cfu/gm)	Coliform Count (cfu/gm)	*E. coli* (cfu/gm)	*Salmonella* (/25gm)
S-1	Samosa	1.2×10^4	4.9×10^4	Absent	Absent
S-2	Spring roll	1.3×10^6	1.1×10^5	Absent	Absent
S-3	Samosa	9.9×10^6	9.4×10^4	Absent	Absent
S-4	Aloo tikki	2.2×10^6	Less than 10	Absent	Absent
S-5	Bhelpuri	1.2×10^4	Less than 10	Absent	Absent
S-6	Samosa	1.8×10^7	2.8×10^5	Absent	Absent
S-7	Sandwich	7.7×10^5	Less than 10	Absent	Absent
S-8	Pawvaji	1.6×10^6	6.8×10^4	Absent	Absent
S-9	Aloo tikki	7.5×10^5	3.7×10^4	Absent	Absent
S-10	Spring roll	2.4×10^7	8.4×10^5	Absent	Absent
S-11	Samosa	1.3×10^7	Less than 10	Absent	Absent
S-12	Pawvaji	1.4×10^7	Less than 10	Absent	Absent
S-13	Aloo tikki	5.5×10^6	8.1×10^5	Absent	Absent
S-14	Spring roll	1.3×10^7	4.3×10^3	Absent	Absent
S-15	Samosa	2.5×10^7	1.8×10^5	Absent	Absent
S-16	Bhelpuri	2.4×10^6	4.2×10^4	Absent	Absent
S-17	Samosa	1.1×10^7	3.2×10^4	Absent	Absent
S-18	Spring roll	5.1×10^6	7.5×10^5	1.8×10^5	Absent
S-19	Aloo tikki	4.6×10^6	3.5×10^3	Absent	Absent
S-20	Aloo tikki	7.5×10^4	1.6×10^4	Absent	Absent
S-21	Pawvaji	2.6×10^7	Less than 10	Absent	Absent
S-22	Samosa	8.4×10^5	3.3×10^3	Absent	Absent
S-23	Sandwich	4.5×10^6	Less than 10	Absent	Absent
S-24	Pawvaji	1.8×10^6	5.1×10^3	Absent	Absent
S-25	Samosa	1.6×10^7	1.4×10^6	5.8×10^4	Absent
S-26	Sandwich	8.3×10^5	Less than 10	Absent	Absent
S-27	Bhelpuri	1.5×10^6	1.3×10^5	Absent	Absent
S-28	Bhelpuri	4.3×10^6	Less than 10	Absent	Absent

The least number of samples i.e. four samples were in the range of 2-2.99 ($\log_{10}$cfu). Seven samples were positive for the presence of pathogenic *E. coli*. Out of these seven samples three were showed logarithmic range between 4-4.99 ($\log_{10}$cfu), and among rest four, two were in the logarithmic range between 3-3.99 ($\log_{10}$cfu) and another two were in the range between 5-5.99 ($\log_{10}$cfu). The graphical representation of logarithmic range ($\log_{10}$cfu) of Total bacterial count, coliform count and *E. coli* count showed in Fig 1. The emergence of Verotoxin-producing *Escherichia coli* (VTEC) as zoonotic food borne pathogens in recent years has become a public health concern because of its life threatening human diseases. Serotype O26 followed by O153 and O157 were the predominant VTEC (Hazarika R.A. et al, 2004). In our study no sample was found to be present for its growth of *Salmonella* in all the mid day meal sample analyzed.

Table: 2. Microbiological profiling of mid day meal collected from different location

S. No	Sample Name	Total bacterial count (cfu/gm)	Coliform Count (cfu/gm)	*E. coli* (cfu/gm)	*Salmonella* (/25gm)
S-29	Samosa	1.3×10^{6}	2.3×10^{5}	Absent	Absent
S-30	Pawvaji	7.2×10^{6}	Less than 10	Absent	Absent
S-31	Spring roll	1.9×10^{6}	Less than 10	Absent	Absent
S-32	Sandwich	1.8×10^{7}	2.8×10^{6}	2.8×10^{5}	Absent
S-33	Bhelpuri	1.3×10^{7}	Less than 10	Absent	Absent
S-34	Samosa	1.1×10^{6}	Less than 10	Absent	Absent
S-35	Pawvaji	8.4×10^{7}	Less than 10	Absent	Absent
S-36	Spring roll	7.1×10^{6}	Less than 10	Absent	Absent
S-37	Sandwich	4.5×10^{5}	1.5×10^{4}	Absent	Absent
S-38	Samosa	1.2×10^{6}	Less than 10	Absent	Absent
S-39	Sandwich	5.2×10^{4}	Less than 10	Absent	Absent
S-40	Sandwich	1.2×10^{7}	Less than 10	Absent	Absent
S-41	Pawvaji	1.3×10^{7}	1.2×10^{3}	Absent	Absent
S-42	Bhelpuri	1.6×10^{7}	Less than 10	Absent	Absent
S-43	Sandwich	1.3×10^{7}	Less than 10	Absent	Absent
S-44	Samosa	2.7×10^{7}	1.3×10^{6}	Absent	Absent
S-45	Samosa	1.0×10^{7}	Less than 10	Absent	Absent
S-46	Bhelpuri	9.0×10^{4}	Less than 10	Absent	Absent
S-47	Pawvaji	2.2×10^{4}	4.8×10^{3}	Absent	Absent
S-48	Sandwich	2.5×10^{4}	Less than 10	Absent	Absent
S-49	Spring roll	1.4×10^{5}	Less than 10	Absent	Absent
S-50	Bhelpuri	4.7×10^{6}	Less than 10	Absent	Absent
S-51	Pawvaji	8.6×10^{3}	7.0×10^{3}	4.0×10^{3}	Absent
S-52	Spring roll	1.5×10^{6}	1.0×10^{5}	9.5×10^{3}	Absent
S-53	Samosa	1.3×10^{5}	6.0×10^{4}	1.4×10^{4}	Absent
S-54	Pawvaji	1.5×10^{4}	Less than 10	Absent	Absent
S-55	Samosa	5.3×10^{3}	Less than 10	Absent	Absent
S-56	Sandwich	1.5×10^{7}	1.3×10^{6}	1.2×10^{4}	Absent

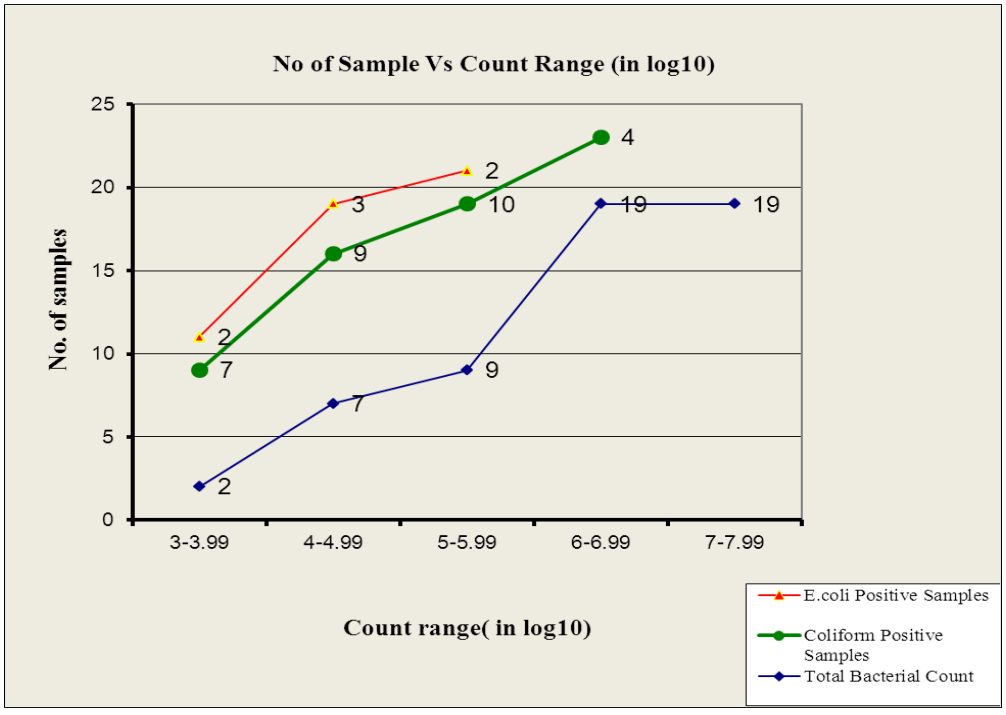

Fig 1: Graphical representation of Count Range (in log10) in Total Bacteria\ Count, Coliform Count and *E .coli* Count

The reason for the presence of high Total aerobic bacterial count in the samples might be due to the ill treatment of cooked food or exposure to the contaminated air. The cooked food might have been kept in open air from where it got contaminated by the microbes present in the air. Factors that might seem responsible for the contamination by Coliform and *E. coli* are improper handling of food, contaminated water and improper cooking. Studies show that *E. coli*, coliforms and a variety of microorganisms could be present in cooked food demonstrating either the poor quality of source water used or a lack of hygiene in production or handling or both. Since, *Escherichia coli* is always present in the human intestine, its presence in the water alerts public health officials to the possible presence of other human or animal intestinal pathogens. *E. coli* and its toxins have been found are transmitted to humans via Undercooked foods and contaminated well water. Presence of coliform as a main causative agent and to some extent presence of pathogenic *E. coli* for food poisoning indicates that these samples are microbiologically contaminated, might be because of use of contaminated water in cooking, improperly cleaned utensils or good hygienic practices were not implemented properly. A number of studies have been carried out throughout the world involving the investigation of the microbiological quality of street vended foods. Results were found very conclusive as high bacterial counts and high incidence of food borne pathogens were reported in such foods (White et al. 2002). Nicholas et al. (1999) also studied the cooked rice from restaurants and take-away premises for its microbiological quality and found significant results supporting our study.

4.CONCLUSION

Present investigation suggests that fast food samples collected from road side hawker may also have high amount of Total Bacterial count. Coliform count as a major food contaminant was also present in 53.57% samples whereas pathogenic microorganisms like *E. coli* was present in almost 13% of the total samples. None of the samples were found to be present with *salmonella*. This study further leads to fast develop more rapid molecular biological techniques for early detection of pathogens to stop the morbidity rate globally due to food poisoning in various countries. Measures need to be taken to ensure that fast foods are produced and stored hygienically at appropriate temperatures protected from flies, dust, wind and all source of cross contamination. Therefore, there is a need to increase the general awareness among the people and in regulatory agencies with respect to Quality improvement.

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