Study Of Hygienic Practices Of Dairy Street Food Vendors In Allahabad City India And Determination Of Critical Control Points For Safe Dairy Street Food

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Abstract

The study was conducted to evaluate the hygienic practices of dairy street food vendors in Allahabad City and to assess the bacteriological safety of water and dairy food items sold by street vendors with regard to Coliform, Salmonella and E.coli between March and May, 2014. A total of 30 street food vendors were chosen for interview to collect data on personal hygiene and food handling practices. A total of 40 dairy food items classified as cooked and raw foods, along with 15 water samples were analyzed. The highest Salmonella contamination was found in Milk shake followed by Gulab jamun with overall (40%) in all dairy food samples. The contamination is mainly due to unhygienic conditions, poor maintenance of premises, poor personal hygiene and slime layer on poorly cleaned utensils. The highest E.coli contamination was observed in Gulab jamun followed by Milk shake samples with overall (65%) in all dairy food samples. Seventy two per cent of the water samples were presumed to be Coliform positive. To ensure safe dairy street food production critical control points were identified and control measures were suggested. Health hazards may be significantly minimized by following GMPs and by operating under sanitary environmental conditions.

Keywords: *Control measures, GMPs, CCPs, Salmonella , Coliform, E.coli.*

1. Introduction

Street food is ready-to-eat food or drink sold in a street or other public place, such as a market or fair, by a hawker or vendor, often from a portable stall. While some street foods are regional, many are not, having spread beyond their region of origin. Most street foods are cheaper on average than restaurant meals. The FAO defines street foods as ready-to-eat foods and beverages prepared or sold by vendors and hawkers especially in streets and similar public places. According to a study from the *Food and Agriculture Organization (2007),* 2.5 billion people eat street food every day. Milk is a

highly nutritious food that serves as an excellent growth medium for a wide range of microorganisms *(P.L. Ruegg, 2003).* The microbiological quality of milk and dairy products is influenced by the initial flora of raw milk, the processing conditions, and post-heat treatment contamination. Undesirable microbes that can cause spoilage of dairy products include Gram-negative psychrotrophs, Coliforms, lactic acid bacteria, yeasts, and molds. In addition, various bacteria of public health concern such as *Salmonella* spp., *Listeria monocytogenes*, *Campylobacter jejuni*, *Yersinia enterocolitica*, pathogenic strains of *Escherichia coli* and enterotoxigenic strains of *Staphylococcus aureus* may also be found in milk and dairy products. For this reason, increased emphasis should be placed on the microbiological examination of milk and dairy foods.

Microbiological analyses are critical for the assessment of quality and safety, conformation with standards and specifications, and regulatory compliance. High nutritional value and high water activity (0.96) is conducive for the growth of bacteria *(Sawhney et al., 1994).* Microbial content of heat dried dairy product depends on the temperature and time of preheating evaporation process, contamination and growth during storage. *Salmonella spp.* is a post modern pathogen which belongs to important food contaminating bacteria, causing a high number of human infections worldwide. Salmonella have been isolated from several raw vegetables from many countries and these foods have been implicated in outbreaks of Salmonellosis in U.S. *(Beauchat, 1997).* In Senegal more than 200 cases of food poisoning were reported and street foods made from dairy products were incriminated *(Dawson and Canet, 1991).* In Cuba, 14 people died and 70 others were hospitalised for food poisoning after eating fried foods sold by private vendor (CNN, 1999) and many others are examples of food borne illness associated with consumption of street vended foods.

According to *WHO (1989),* food handling personnel play an important role in ensuring food safety throughout the chain of food production and storage. To instill professional face to dairy street food operators,

the street food safety management needs a Hazard Analysis Critical Control Point (HACCP) and the pre-requisite system as good manufacturing practices (GMPs) and good hygienic practices (GHPs). Microbial hazards and their solution, critical points, practical control processing measures and monitoring procedures as well as principles of food microbiology and food safety need to be incorporated for the safe street food preparation. The present work was undertaken to observe food safety and hygienic practices among street food vendors and to assess the microbiological quality of water and food items with respect to Coliform, Salmonella and E.coli along with determination of CCPs and application of control measures for safe street food production.

2. Materials and Methods

2.1 Interview and Observation of Vendors

Thirty dairy street food vendors operating in the major streets, schools, colleges and markets of Allahabad City (U.P),India were randomly selected for the interview to elicit information on their personal hygiene and environmental sanitation. Chosen vendors included road side dhaba's, small shops and food cart vendors. The survey tool contained 30 questions concerning the current status of food hygiene and sanitation practised by vendors of street foods. Not all information was obtained from the questionnaire. Some aspects pertaining to vendors required observation. Therefore an observational study was used in the assessment of food safety practices (food preparation, cooking and serving) by street food vendors during their trade. The status of nails, smoking, handling of food and money without washing hands in between were observed.

2.2 Sample Collection

Eight locations in Allahabad City, India were chosen for collection of samples. A total of 40 samples of food on sale (30gm or 30ml) were collected for analysis which included cooked Gulab jamun, raw Paneer, Dahi/Lassi, milk shake and ice cream. Fifteen water samples were also collected in sterile glass bottles and transported to the laboratory within 1 hour to test for the presence of Coliform. Samples were collected in the summer season of the year 2014 from March to May.

2.3 Sample Analysis

For Presumptive Coliform Test serial dilution of water samples was done in ringer solution and 1ml of each dilution of water sample was transferred aseptically into tubes containing 9ml of MacConkey's broth and Durham tube near the flame. All the tubes were incubated at 35^0C for 24 to 48 hours. The lactose fermentation tubes were examined for the production of

acid (yellow colour) and gas after 24 to 48 hours of incubation. For detection of Salmonella 25.0g/25.0ml of suspected food was weighed and suspended in 225ml of sterile Selenite F broth for selective enrichment of Salmonella. Samples were incubated at 37^0C for 24 hours. After 24 hours of incubation, looful of the broth was sub cultured to the SSA plates by streaking with flame sterilized platinum loop and plates were incubated at 37^0 C for 24 hours. Plates were observed for the presence of black centered colonies/black colonies *(Kannan, 2002)*. For detection of E.coli25.0g/25.0ml of suspected food was weighed and suspended in 225ml of sterile distilled water, 9ml of diluted dairy food sample was taken and inoculated in EMB agar media plates and were incubated at 37^0 C for 24 hours. Lactose-fermenting organisms such as *E.coli* produce a black precipitate on EMB. Their colonies will be either black or possess dark centers with transparent, colorless peripheries.

2.4 Statistical analysis

Statistical analysis was done on the data by analysis of variance (ANOVA) on Surface Response Methodology. RSM were used for multivariative variance analysis test at ($p<0.05$). Whenever ANOVA indicated a significant, a pair-wise comparison of means by least significance difference (LSD) was carried out.

2.5 Identification of critical control points and application of control measures

CCPs were identified along the main steps of dairy street food chain for production of safe street food.

3. Results and Discussion

In this study the food safety and hygienic practices of dairy street food vendors has been studied in Allahabad city, India. In addition to this bacteriological safety of water and dairy food items sold by street vendors with regard to Coliform, Salmonella and E.coli were evaluated. Food handling practices, health and Personal hygiene were observed which showed that Out of 30 vendors chosen for survey, (83.33%) were in healthy condition and (16.66%) of them were suffering from cold and fever. 76.6% of vendors continue food preparation during illness and only 23.3% take rest or day off. It was also revealed that no vendor was using disinfecting solution for washing hands. 46.7% of them use only water for hand washing and 26.7% use soap. A few of them 6.6% used ash for washing. 33.3% washed hands after using the toilets and handling garbage. Other reasons of hand washing include during and after food preparation 13.33% after meal 10%, blowing nose 6.6% and handling raw food 3.3%. *Bhaskar et al.(2004)* reported that defective personal hygiene can facilitate

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the transmission of pathogenic bacteria found on environment and on peoples hand via food to humans.

The vendors washed utensils with cold soapy water, with detergent and cold water or with water alone. Most of vendors washed their utensils with detergent and cold water (40%) followed by cold soapy water (40%) and cold water alone16.6%. Only (3.3%) of them wiped utensils by cloth only. 66.6% of vendors washed their stalls everyday followed by (23.3%) who washed stalls on alternate day and (10%) washed stalls weekly. Un renewal of dish washing water explain their poor bacterial quality *(Mensah et al.,2002)*. It observed that one of the most critical problems; especially in developing countries was the lack of adequate supply of water for cooking and washing.

Adequate temperature in cooking and storage of food is important to minimise the growth of bacteria and the food that cannot be maintained within safety temperature zone may act as incubator for pathogenic bacteria whether the food is raw, partially cooked or fully cooked *(Roller,1999)*. Results showed that vendors (23.3%) cooked food in advance of sale and 16.6% of them cooked food on morning of sale. Only 23.3% of the vendors reheat the food, 53.3% vendors served food in steel plate and glass followed by dona 26.6% and on leaves 6.66% or newspaper 13.4%. 40% handling with bare hands may result in cross contamination, hence introduction of microbes on safe food *(FAO, 1997)*.

Personal hygiene of the vendors was observed and was found that clothes of the 43.6% vendors were moderately clean and cloths of 13.3% vendors were dirty. 63.3% had short nails which were not polished and 36.7% worn jewellery. About 40% of the venders were chewing tobacco during food handling and 70% of vendors did not wiped their hands after every serving. Chewing of tobacco during food handling and preparation could lead to cross contamination of foods. 46.6% of vendors threw waste outside the vending site on the ground while 26.6% threw it besides the vending site. Poor personal hygiene of vendor resulted in higher contamination this may be due to dirty clothing, unhygienic handling and serving practices, contaminated hands and lack of knowledge of hygienic practices *(Tambekar et al., 2006)*. Only 26.6% reported that they dispose waste water into the drain. Kitchen waste was dumped beside/behind the vending site by 80% vendors and remaining 20% burn the garbage. No one disposed the garbage in municipal bins. Drainage and waste disposal system play an important role in food safety. According to *FAO (1999)* adequate drainage and waste disposal system and facilities should be provided in dairy street food industry and properly designed so that the risk of contamination of food and portable water is low.

In regard with the study of bacteriological safety of water and dairy street food it was found that about 72.33 % of total water samples collected were indicated by positive Coliform test. Only 27.77% of the samples collected were found negative for PCT. The results of the present study were comparable with *Ehiri et al. (2009)*. He reported that high count of Coliform in water usually indicate heavy pollution, their absence does not guarantee that the water is free from contamination, since Coliform die rapidly in water. The reson for the presence of Coliform on water samples may be that the water was used repeatedly for washing utensils before it was replaced. Similar findings were given by *Muinde and Kuria (2005)*. Out of total 20 samples, 12 samples (60%) were tested negative for Salmonella and 8 samples (40%) were tested positive for the Salmonella. The similar results were also drawn by *Godbole et al. (2013)* and *Suchitra et al. (2013)*. And out of total 20 samples, 13 samples (65%) were tested positive for E.coli and 7 samples (35%) were tested negative for the e.coli. The similar results were also drawn by *Soomro et al. (2002)* and *Baraheem et al. (2007)*.

In the study it was also found that the number of microorganism in the water and dairy street food varies according to various conditions like localities, time of sample collection and hygienic conditions. The detail of the study is described in *Table 1*.

Table 1 : Distribution of Coliform Salmonella and E.coliin dairy street food & water samples collected from different localities in various conditions.

Parameter	Type	Coliform (%)	Salmonella (%)	E.coli(%)
Crowding status at stall	Crowded	71.5	68.8	66.6
	Less crowded	28.5	31.2	33.4
Time of collection	Morning	38.3	19.5	22.3
	Evening	61.7	80.5	77.7
Site of food preparation	Inside shop	36.6	16.4	23.7
	On street side	63.4	83.6	76.3
Number of servants	One	18	27.3	25.2
	Two	34	35.2	38.3
	Three	48	47.5	46.5
Personal	Poor	60.4	71.8	65.3

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Hygiene of vendor	Fair	39.6	29.2	34.7
Cloths of vendors	Dirty	65.7	66.6	70.2
	Clean	34.3	33.4	29.8
Time of food preparation	Long before eating	-	65.4	68.7
	Just prior to eating	-	34.6	31.3
Hygienic condition of vending site	Poor	70.7	67.7	71.4
	Fair	29.3	32.3	28.6

The data collected from the dairy street food vendors in Allahabad City was subjected for the identification of Hazards and Critical Control Points at every step of food production chain. Seven main steps were identified in street vended food production chain. *Table 2* reports current Hazards and Critical Control Points observed at the main steps along the dairy street food production chain. In current study control measures were applied as precautionary measures to reduce risk along the street food production chain.

Table 2 : Hazards and critical control points identified at different steps of dairy street food production chain.

Step	Hazards (Biological)	Critical control point
Primary production: raw food stuff	Initial contamination	# Raw food stuffs from illegal # sources and bad quality Contamination of raw food stuffs by different elements
Storage	Growth of bacteria from initial contamination	# Storage in inadequate containers or stores without protection from rodents and flies # Contamination by excrements and other food wastes # Storage under inappropriate conditions
Fragmentation and conditioning	Growth of bacteria	# Alteration of products and addition of illegal ingredients # Further contamination via hands
Processing: precooking/preparation	# Cross contamination and survival of bacteria # Initial contamination occur in uncooked food	# Bad separation of raw products with cooked food # Contamination via hands or in other ways # Inadequate washing of raw food before preparation
Vending: cooking/cooling/reheating	# Survival of pathogens & spores # Production of toxins	# Inefficient cooking or reheating temperature # Cross contamination
Exposure/vending	# Contamination and growth of bacteria and spores # Production of toxins	# Inefficient holding temperature Bad protection from flies and dust # Contamination from various sources
Serving/consumption	# Contamination and growth of bacteria and spores # Production of toxins	# Bad handling # Bad hygienic practices

4. Conclusion

The study indicated that dairy street food contamination in Allahabad City is mainly due to poor water quality and hygiene during food preparation and processing, preparation of food long before consumption, and crowded, dusty vending location. These findings demonstrate that the dairy street food vended in Allahabad City constitute an important potential hazard to human health. The HACCP strategy has the potential to make a significant contribution in food safety which will improve dairy food quality.

Acknowledgments

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