

Research Article



Safety Evaluation of Snacks and Beverages Sold at Various Locations of Faisalabad, Pakistan

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Abstract | Street foods play their significant role in the society by satisfying hunger at affordable rate for poor slums. This low infrastructure business is rising day by day due to growing urbanization. The study aimed at exploring the safety status of various snacks and beverages sold in the streets of Faisalabad, Pakistan. The three zones of city were selected for the purpose of sample collection. Mean prevalence of *E. coli* 61.7% was indicated by Spread plate method. Prevalence of Total plate count checked and pathogenic count was calculated in CFU/g and CFU/ml, mean CFU for *E. coli* and TPC was (3.39×10^4 to 3.15×10^5). Total 47.9% samples of spices were found adulterated for eight different adulterants tested. Sugar samples were free of any adulteration while in beverages two other adulterants were found in 22% of samples. Analysis of variance (ANOVA) under two way factorial indicated significant statistical difference ($P < 0.05$) in mean value of microbial count in different location while between different samples it was non-significant ($P > 0.05$). Thus, the conducted study shows that the need for proper implementation of food safety legislation at this low scale patronage.

Received | October 30, 2018; **Accepted** | March 21, 2020; **Published** | June 23, 2020

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Citation | Fatima, I., I. Pasha, A. Saddozai, S. Nadeem, A. Mumtaz and S. Jabbar. 2020. Safety evaluation of snacks and beverages sold at various locations of Faisalabad, Pakistan. *Pakistan Journal of Agricultural Research*, 33(2): 389-394.

DOI | <http://dx.doi.org/10.17582/journal.pjar/2020/33.2.389.394>

Keywords | Snacks, Beverages, Street vendors, Contamination, *E. coli*, Microbes, Adulteration

Introduction

Food is a basic necessity of life. Acquisition of safe food has now become burning issue these days. The occurrence of food problems increasing rapidly due to over population, changing life styles and emergence of new pathogens. Nowadays, the foremost concern related to health is food poisoning for public as well as government (Egan et al., 2007). Globally per year 2.2 million deaths occur due to food borne diseases (WHO, 2004). In developing countries like Pakistan traditional food are considered as affordable, low cost and easily available. Basically, the food is prepared by using traditional methods and sold on

streets (Subratty et al., 2004). Food that are prepared on road sides have poor infrastructure and source of food borne illnesses (Ghosh et al., 2007).

Beverages means intake of any fluid for the best performance of body functions. The category of beverages depends on country's socioeconomic trends (Nergiz-unal et al., 2016). Commercially preservatives added in juices to store for long time while homemade juices prepared and directly consumed. The incidence of micro flora in juices occur either during processing or natural flora in raw fruits. The incidence of bacteriological contamination is more in unpasteurized juices. Heat destroy the spore forming

bacteria and other pathogens (Oluwole et al., 2016).

Snacks means something that eaten in between mealtime. Mostly snacks are sold on road sides and at school, colleges. In snacks different foods are included i.e., fruit chaat, samosa, channa chaat and goll ghapy etc. The trend of consuming snack food increased day by day. These snacks are one of the most common sources of food borne diseases and also cause lack of nutritional value. The increasing trend of snacks consumption in various countries cause nutritional problems (Kelishadi et al., 2017).

E. coli is naturally occurring bacteria. *E. coli* have different strains, some strains are beneficial for human body while others are harmful. One of the harmful strain is Enterohemorrhagic *E. coli* that associated with many food borne diseases. *E. coli* O157:H7 produce toxin that cause damage in the intestine lining, bloody diarrhoea, anaemia, stomach cramps and haemolytic uremic syndrome. In USA 76 million illnesses, 325000 hospitalization and 5000 deaths occur as in the result of consumption of contaminated *E. coli*. The 4 major food borne pathogens are *E. coli* O157:H7, *Salmonella*, *Campylobacter* and *Listeria Monocytogenes*.

Adulteration is the case of food fraud and deceiving of consumer to get more profit. Adulteration means intentionally addition of inferior quality of substance in food to increase the actual amount of food (Spink, 2011). Adulteration have negative effects on health (Bensal et al., 2015). Adulteration have both instant and long term effects on health. In immediate effect diarrhoea occur and in long term effect failure of organ, cancer occur (Chowdhury, 2014).

The need arising with time to increase awareness in people. The need is to aware the vendors as well as consumer about adulteration and contamination. The use of specific brand products may reduce the incidence of adulteration (Kulkarni and Goswami, 2015). Contaminated and adulterated food products harmful to the consumer. Food is only acceptable if it free from contaminants and adulterants (Gahukar, 2014). The proper knowledge of hygiene and sanitation can control the outbreaks of food borne illnesses (Szabo et al., 2008). The objectives of the present study were to evaluate the microbiological safety, specially to confirm the presence of *E. coli* in the food products on basis of selective media and biochemical tests and

adulteration of snacks and beverages in Faisalabad Pakistan and to identify the possible risk factors that may subsidize potential health threats resulting from the consumption of most commonly consumed street vended foods.

Materials and Methods

Collection of samples

Samples were bought from street vendors included goll ghappy, channa chaat, fruit chaat, sugar cane drink, tamarind plum drink, lassi, apple juice, mango juice, mix fruit juice, sugar and spices from 3 different locations of Faisalabad in summer season. The samples were collected and decanted in sterilized polyethylene zip lock bags, glass bottles, sealed tightly, stored in ice box and transported immediately to the Food Microbiology and Biotechnology Laboratory of the Department of National Institute of Food Science and Technology, University of Agriculture Faisalabad.

Microbiological analysis

Samples of selected food items were serially diluted for pathogen determination by using spread plate technique, MacConkey agar for *Escherichia coli* and Nutrient agar plates for Total plate count. These plates are kept for 24 hours at incubation temperature (37°C) and colony forming unit (CFU/g) or (CFU/mL) were estimated. These bacterial colonies further confirmed by standard biochemical tests. Identification was done with reference to (Prescott et al., 2002; Cheesbrough, 2002).

Adulteration analysis

Adulterants in sugar, beverages and spices were examined. All samples were collected from clock tower, Faisalabad, Pakistan. For sugar 10 gram sample taken in a glass of water and allowed it to settle down to confirm chalk powder, drop iodine solution on 5 gram sugar sample, starch presence confirmed on the appearance of blue colour, and dissolve 5 gram sugar in 10mL water and add few drops of HCL. Formation of bubbles confirmed the presence of washing soda. In 5mL beverage sample add little amount of water in it. After that add few drops of HCL and put 10mL solvent ether in it. Now check the taste, saccharin produces lingering sweeter effect on tongue and bitter taste left on the tongue confirmed saccharin presence. Take beverage sample in beaker and color extracted from luke-worm water. Add few drops of HCL in it. Presence of magenta red color indicate the

presence of metanill yellow as method described in [FSSAI \(2012\)](#). Spices include Red chili, Turmeric, Black pepper and Asafetida/Hing were checked for adulterants. In red chili rodamine B presence indicated by adding acetone while brick powder presence confirmed by adding HCL and check on match stick flame. In Black pepper Papaya seed were detected by floating the black pepper in alcohol. While on black pepper coating of mineral oil coating gives kerosene. Presence of starch in asafetida powder were detected by adding of iodine, blue color appearance indicated the presence of starch. However, mixture of foreign soap stones particles and other earthy mailer were detected by adding little portion of sample and 3mL of distilled water in test tube and allow to settle. Soap stones or another earthy mailer was settle down at the bottom. In turmeric powder metanill detected by adding few drops of concentrated HCL, appearance of pink color on dilution shows the presence of adulterants as method described in [Abhirami and Radha \(2015\)](#).

Statistical analysis

All analysis was carried out in triplicates and the data was reported as means. Significance difference among treatments was evaluated through analysis of variance (ANOVA) under completely randomized design (CRD) under two way factorial was applied according to the methods described by [Montgomery \(2008\)](#). Statistics Program, version 8.1 was used to analyze.

Results and Discussion

Street vended snacks and beverages are common in consumers because of their low price and delicious flavour ([Ohiokpehai, 2003](#)). In spite of their economic price potential benefits offered by fresh foods, now a days concerns over their safety and quality have been raised, as freshly prepared ready to eat snacks and drinks are not processed by following standard steps to minimize or eliminate the bacterial content ([Mahale et al., 2008](#)).

In the present study, incidence of Total plate count and *Escherchia coli* contamination in different snacks and beverages included goll ghappy, Channa chaat, fruit chaat, sugar cane drink, Tamarind plum drink, lassi, apple juice, mango juice and Mix fruit juice were examined from three zones of Faisalabad city i.e. Clock tower, Jinnah colony and Iqbal stadium.

In case of goll ghappy highest count of *E. coli* 2.50×10^5 CFU/g were found in clock tower. In channa chaat count of *E. coli* at three zones were found 2.20×10^5 , 1.30×10^5 , and 7.00×10^4 CFU/g respectively while highest total plate count 2.31×10^5 were recorded. In fruit chaat sample *E. coli* count in Jinnah colony were found zero while in zone 1 and 3 the count was 3.00×10^5 and 2.04×10^5 CFU/g. The total plate count in fruit chaat was 4.00×10^5 CFU/g. The results found in snacks were similar to the research of [Tambekar et al. \(2008\)](#) conducted at Amarvati city of India on RTE street vended foods. Moreover, bacterial load in food samples due to personal hygiene and unhygienic measures was observed 78% due to *E. coli*. ([Hussain et al., 2015](#)).

The Viable count of *E. coli* in beverages samples at three zones are presented in [Table 1](#). In Lassi sample highest 1.00×10^5 CFU/ml count found in Iqbal stadium, while in Jinnah Colony the count was found zero. In sugar cane drink, highest enumeration of *E. coli* 1.34×10^5 CFU/ml. In tamarind plum drink highest count of *E. coli* was detected by 1.10×10^5 CFU/ml while count found in Iqbal stadium 9.0×10^4 CFU/ml and clock tower 2.17×10^4 CFU/ml. However, the enumeration of *E. coli* in pack juices was found because juices are prepared and pasteurized so pathogens destroy at pasteurization temperature.

The main reason of the *Escherichia coli* presence in food is due to the lack of cleanliness in handling, inadequate processing, cross contamination of raw materials and improper storage condition ([Das et al., 2010](#)).

The results of total plate count in beverages samples at three zones is well depicted in ([Table 1](#)). The highest count in sugar cane drink, tamarind plum drink and lassi was recorded 2.73×10^5 CFU/ml, 1.73×10^5 CFU/ml and 2.03×10^5 respectively. In pack juices included apple Juice, mango juice and mix fruit juice highest count 5.8×10^4 CFU/ml, 4.9×10^4 CFU/ml and 3.1×10^4 CFU/ml recorded at clock tower and Iqbal stadium.

All the drinks that sold on road sides are highly contaminated and the main reason of contamination in freshly prepared drinks is lack of pasteurization ([Iqbal et al., 2015](#)). In another study of [Iqtedar and Yasin \(2014\)](#) the count of tamarind plum ranged from $9.0 \times 10^3 \pm 0.35 \times 10^3$ (CFU/ml).

Table 1: Total plate count and *E. coli* counts (CFU/mL)/ (CFU/g) of snacks and beverages samples sold in Faisalabad, Pakistan.

Sample analyzed	Zone	TPC (CFU/g)	<i>E. coli</i> (CFU/g)
Goll Ghappy	Zone 1	2.70×10 ⁵	2.50×10 ⁵
	Zone 2	2.80×10 ⁵	1.41×10 ⁵
	Zone 3	2.45×10 ⁵	1.75×10 ⁵
Channa Chaat	Zone 1	2.30×10 ⁵	2.20×10 ⁵
	Zone 2	2.31×10 ⁵	1.30×10 ⁵
	Zone 3	1.85×10 ⁵	7.00×10 ⁴
Fruit Chaat	Zone 1	4.00×10 ⁵	3.00×10 ⁵
	Zone 2	3.80×10 ⁵	ND
	Zone 3	3.30×10 ⁵	2.04×10 ⁵
Lassi	Zone 1	1.90×10 ⁵	9.2×10 ⁴
	Zone 2	2.03×10 ⁵	ND
	Zone 3	1.80×10 ⁵	1.0×10 ⁵
Sugar cane drink	Zone 1	2.32×10 ⁵	1.34×10 ⁵
	Zone 2	2.50×10 ⁵	1.28×10 ⁵
	Zone 3	2.73×10 ⁵	8.0×10 ⁴
Tamarind plum drink	Zone 1	2.32×10 ⁵	2.17×10 ⁴
	Zone 2	2.50×10 ⁵	1.10×10 ⁵
	Zone 3	1.73×10 ⁵	9.00×10 ⁴
Apple Juice	Zone 1	5.80×10 ⁴	ND
	Zone 2	3.40×10 ³	ND
	Zone 3	2.20×10 ⁴	ND
Mango juice	Zone 1	4.90×10 ⁴	ND
	Zone 2	3.80×10 ³	ND
	Zone 3	2.00×10 ⁴	ND
Mix fruit juice	Zone 1	2.30×10 ⁴	ND
	Zone 2	3.00×10 ³	ND
	Zone 3	3.10×10 ⁴	ND

Zone 1: Clock tower; Zone 2: Jinnah colony; Zone 3: Iqbal stadium; ND: not detected; Safe limit of *E. coli*: <10 cfu/g.

In sugar samples adulterants named chalk powder, starch and washing soda were tested in collected samples from three zones of Faisalabad described in Table 2. All the samples were found free from adulterants. [Abhirami and Radha \(2015\)](#) reported that there was no presence of washing soda and chalk powder in both sugar and sugar powder. [Faheem et al. \(2014\)](#) stated that presence of starch in sugar samples. [Srivastava \(2016\)](#) analyzed that chalk powder in sugar samples causing stomach infections. The presence of these adulterants such as starch, chalk powder, washing soda and metanil yellow color in brown sugar in up to fifty percent of the samples.

Table 2: Adulterants in spices, sugar and beverages.

Sample analyzed	Adulterants	Results	Percentage
Red chili powder	Brick powder	10/18	55.5%
	Rodamine B	10/18	55.5%
Turmeric	Colored saw dust	12/18	66.6%
	Metanil yellow	10/18	55.5%
Black pepper	Papaya seed	9/18	50%
	Mineral oil coating	9/18	50%
Asafetida	Starch	3/18	16.6%
	Foreign soap stones	6/18	33.3%
Sugar	Starch	0/9	0%
	Chalk Powder	0/9	0%
	Washing soda	0/9	0%
Beverages	Metanil yellow	6/27	22.2%
	Saccharin	6/27	22.2%

Adulterants metanil yellow color and saccharin were analyzed in collected samples of juices depicted in (Table 2). The results showed that 77.7% samples of beverages were free from metanil yellow color and saccharin. The results are quite similar to [Nath et al. \(2015\)](#) stated that 20.94% samples were adulterated with metanil yellow. [Hammud et al. \(2014\)](#) studied that the utilization of saccharin by beverage industries.

There are eight different adulterants that are tested in spices collected from three zones of Faisalabad, overall results showed in (Table 2). Samples adulterated with colored saw dust 66.6% and 55.5% with brick powder, rodamine B and Metanil yellow. About 50% samples adulterated with papaya seed and mineral oil coating while 16% with starch and 33% with foreign soap stone. Overall 47.9% samples were detected for adulterants.

Conclusions and Recommendation

This study done in Faisalabad, Pakistan. It covered and dignifies the food related issues such as microbial contamination, safety knowledge and their practices among food vendors. This study concluded that vendors have not making safe food. Now the main objective is just making money. Positive aspect of the study was that, vendors showed their willingness in getting food safety trainings. So, there is an immediate need to impose food safety knowledge to food vendors. The local and provincial government should legalize the standards of food safety in the light of

recommendations of WHO and monitor the sanitary and hygienic conditions on a regular basis. Policies should be made to initiate the training programs on ground level to mass level. The principal of Hazard Analysis and Critical control Point (HACCP) system should be applied on low level. Media ought to play their role in raising awareness of hand washing. At last but not the least national Food Sanitation Code should ensure the sanitary permit and health /medical certificate to food handlers.

Author's Contribution

Iram Fatima: Conceived the idea, Overall Management of the article and research work.

Imran Pasha: Provided chemicals and instruments, overall supervision.

Ambreen Saddozai: Data entry in SPSS and analysis.

Shahid Nadeem: Technical input at every step.

Amer Mumtaz: References.

Saqib Jabbar: Did SPSS analysis.

Conflict of interest

The authors have declared no conflict of interest.

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