



ISSN: 0975-833X

Available online at <http://www.ijournalcra.com>

International Journal of Current Research
Vol. 12, Issue, 09, pp.13646-13650, September, 2020

DOI: <https://doi.org/10.24941/ijcr.39646.09.2020>

INTERNATIONAL JOURNAL
OF CURRENT RESEARCH

RESEARCH ARTICLE

MICROBIOLOGICAL QUALITY OF STREET VENDED FOOD SOLD IN DISTRICT MARDAN, PAKISTAN

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ARTICLE INFO

Article History:

Received 15th June, 2020

Received in revised form

27th July, 2020

Accepted 04th August, 2020

Published online 30th September, 2020

Key Words:

Street Vended Food, Microbial
Contamination, Mardan, Pakistan.

ABSTRACT

The present study was undertaken to inspect the microbiological quality of street vended food sold in district Mardan, Pakistan. Three hundred and fifteen (315) food samples including white kidney beans, chickpea, white split lentil, rice, mixed vegetable salad, tamarind sauce and chicken soup, were aseptically collected from different locations of district Mardan. Analysis of the samples revealed that 81% of food samples were contaminated with bacterial pathogens. Among them coliforms were highest i.e., 88.6%, while *Staphylococcus* and *Salmonella/Shigella* were 7.9%. All the collected samples of rice, tamarind sauce, mixed vegetable salad and chicken soup were contaminated (100%), while 86% of white kidney beans, 80% of chickpea and none (0.0%) of white lentil. The tested samples are highly contaminated with coliforms, and it is suggested that regular monitoring of the quality of street foods must be practiced to avoid any food-borne infection in future.

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Citation: Asma Waheed Qureshi, Asma Naeem and Hadia Tila. 2020. "Microbiological quality of street vended food sold in district Mardan, Pakistan.", *International Journal of Current Research*, 12, (09), 13646-13650.

INTRODUCTION

Street-vended foods and beverages are prepared and sold by vendors in streets and similar public places. According to the Food and Agriculture Organization, street foods are consumed by 2.5 million people daily (FAO 1989). Street foods are more common in developing countries and it has assumed new dimensions due to an increase in urbanization. As the street foods are delicious and are offered at rational rates so it appeals large number of people including children, adults and old peoples. The microbiological quality of foods are very important as far as health is concerned. Vended foods presented on expose places can very easily be polluted by dust, flies, vehicle smoke and physical contact of buyer's hand. There are a number of agents of microbial intrusion of vended foods. Pathogens attack the outer parts of the food during flaking off cutting, manipulating, and other procedures like wrapping and marketing (Barro et al., 2007; Ghosh et al., 2007). Vendors-sold foods generally utilize simple facilities like carts, wheeled vehicles, mats and make-shift stalls, thus giving more opportunity to pathogens to flourish in food. Contamination from resources and equipment, further processing conditions, inappropriate managing and pervasiveness of unhygienic environment add

considerably to the entrance of bacterial pathogens (Mahale et al., 2008). The health risk of such foodstuffs on account of their reduced microbiological quality include the whole procedure, from choosing raw material, processing, cooking, staking away, presenting to serving. As street food industry has grown to a considerable size with the passage of time so an increase in concern about the safety and purity of food arise. Street vendors are supposed to prepare and sell food that are full of nutrients and are safe healthwise (Mohapetra, 2003; Gadi et al., 2013). Mostly people do not believe in exercising lethal effects from foods. Some people believe that food related risks are of little importance (Frewer et al., 1996; Redmond and Griffith, 2004). Street vended foods are more exposed to germs and are the major cause of food associated outbreaks. In most regions the street vended food is found to be unsafe from microbiological point of view since the bacterial loads of such foods are moderately high as compared to packed food (Bhat and Waghay, 2000). In developing countries, where street food industry is well developed, little is known about the epidemics of food borne diseases associated with the street-vended foods. Studies on such foods in American, Asian and African countries have shown that a variety of pathogens are found and outbreaks of diseases linked to the use of street vended foods are reported (Mahale et al., 2008). In Pakistan during recent years there is an increasing trend in the sale and consumption of foods on the roadside. Lots of work has been done on different aspects of street foods and vendors in countries like China, India and

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Nigeria, however such studies are limited in Pakistan. Some information is however, available in the street foods of Lahore (Qazi and Qureshi, 2002), Multan (Razzaq *et al.*, 2014) and Karachi (Mehboob and Abbas, 2019) but not from Mardan. As the popularity of street foods is growing day by day in our area, it is necessary to evaluate the quality of street foods. Current study is designed to evaluate the microbial contamination of street-vended foods sold in district Mardan and identify some pathogens.

MATERIALS AND METHODS

Study area: Food samples were collected from randomly selected areas of district Mardan including Takhtbhai, Katlang and Mardan.

Samples collection: Food samples were collected from randomly selected areas of district Mardan between April and October. All samples were collected in sterile containers, kept at 4°C and analysed within an hour after collection. The type of food consisted of rice, vegetable salad (mixed vegetables), white kidney beans, Tamarind sauce, white split lentil, chickpea and chicken soup (Table 1).

Sample processing for microbiological contamination: 10 grams of food sample was weighed under aseptic condition, homogenized with 90 ml of distilled water by using motor and pistol. Following media were used i.e., Eosin-Methylene Blue (EMB-Sigma), Mannitol Salt agar (MSA-Sigma) and *Salmonella Shigella* agar (Sigma) to detect the presence of coliforms, *Staphylococcus* and *Salmonella/Shigella*, respectively. All three media were prepared according to manufacturer instructions. Each sample was inoculated on all three media separately, by spread plate method and plates were incubated at 37°C for 18-24 hrs in an inverted position. After incubation, the petri plates were observed for bacteriological enumeration and colony forming units (cfu/ml). Colour and other features of bacterial colonies on the media used were noted and the growth identified according to Merk (1996).

Statistical analysis: Prevalence of microbes or contamination indicated in percentage (%). Chi-square test was used for comparison between prevalences.

RESULTS

This study has revealed that street vended foods were heavily loaded with pathogenic bacteria which causes infection in human.

Overall microbial contamination of street vended food in District Mardan: Overall microbial contamination of street vended food commonly consumed in district Mardan was very high. Out of 315 samples of street vended food, 255 were positive for different pathogenic bacteria having 81% prevalence rate.

Area wise contamination of street vended food in district Mardan: Although there was no significant difference ($P > 0.05$) between area, distribution of microbes was highest in Katlang followed by Takhtbhai and lowest in Mardan city (Table 2).

Microbial contamination of different food samples in District Mardan: Seven different types of ready to eat food were examined for microbial contamination (Table 3).

Out of these samples, vegetable salad, tamarind sauce, rice and chicken soup had highest microbial contamination followed by white kidney beans, chickpea while white split lentil was not contaminated at all (Table 3).

Overall prevalence of different microbes in street vended food in selected areas of District Mardan:

Overall prevalence of coliforms were 88.46% while that of *Staphylococcus* and *Salmonella/Shigella* were 7.7%. Prevalence of coliforms in Mardan, Takhtbhai and Katlang was 88.23%, 84.21% and 93.75%, respectively. *Staphylococcus* and *Salmonella/Shigella* were 23.53% in Mardan and 0% in food collected from Takhtbhai and Katlang (Table 4).

Overall Mean microbial profile of street vended food in district Mardan:

Overall result of street vended food examined in district Mardan revealed that average total plate count of coliforms were very high in white kidney beans, chickpea and chicken soup i.e., 55.6×10^3 , 48.66×10^3 and 83.1×10^3 cfu/ml, respectively. While tamarind sauce, rice and mixed vegetable salad had 2.1×10^3 , 1.101×10^3 and 6.09×10^3 cfu/ml, respectively. *Salmonella/Shigella* counts were observed only in white kidney beans (0.024×10^3 cfu/ml) and mixed vegetable salad (0.097×10^3 cfu/ml). No growth of *Staphylococcus* was found in the food items except chickpea (Table 5).

DISCUSSION

In present study microbial contamination of street vended food mostly consumed and sold in District Mardan, Pakistan was analysed. The results revealed prevalence of microbial contamination in 80% of street vended food. Many studies have been conducted in different parts of the world for analysing the microbial contamination of street vended food and reported similar findings. Nelá *et al.* (2013) detected microbes in 60.1% of street vended food consumed in Ozamiz city, Phillipines. Mugampoza *et al.* (2013) from Nakawa division, Uganda, Mirriam *et al.* (2012) from Alice, South Africa and Das *et al.* (2010) from Bangalore, India reported that all the samples included in their study were contaminated with microbes. The heavy microbial count may be due to various factors like use of impure water for dilution (Lateef *et al.*, 2006). Improper washing of utensils, poor maintenance of premises or domestic hygiene, peeling of vegetables beforehand, dust particles in the air and lack of good personal hygienic practices are responsible for microbial count (Bhaksar *et al.*, 2004; Tambekar *et al.*, 2009; Sunday *et al.*, 2011). Food vendors usually find more consumers by the side of the busy road with heavy vehicular traffic, where the waste disposal system and overcrowding seem to add further to the contamination (Titarmare *et al.*, 2009).

Results of present study showed variation in the prevalence of microbial contamination in street vended food in different areas. The highest prevalence was noted in Takhtbhai followed by Katlang, while the lowest in Mardan city. Statistical analysis showed non-significant difference among all the study area. This non-significant difference in prevalence of microbial contamination in street vended food was influenced by same local climatic conditions public related hygienic practices and sanitary facilities (Eraky *et al.*, 2014).

Table 1. Area of sampling, number and types of samples

Sr. No.	Type of Food	Sampling Area		
		Mardan	Takht Bhai	Katlang
1.	Kidney bean (white)	15	15	15
2.	Chickpea	15	15	15
3.	Mixed vegetables salad	15	15	15
4.	Tamarind Sauce	15	15	15
5.	Rice	15	15	15
6.	White split lentil	15	15	15
7.	Chicken soup	15	15	15
Total		105	105	105

Table 2: Prevalence microbial contamination of street vended food and juices in different areas of District Mardan

Study Areas	Number of samples collected	Number contaminated	Prevalence (%)	Chi-square (χ^2)
Mardan	105	68	64.76	$\chi^2= 5.458$, df= 2, P < 0.065
Takht Bhai	105	89	84.76	
Katlang	105	98	93.33	
Total	315	255	80.95	

Table 3: Overall Microbial contamination of different food in District Mardan

Sr no.	Street vended food	Samples observed	Positive samples	Microbial contamination (%)	Chi-square (χ^2)
1.	White kidney beans	45	39	86.7%	$\chi^2=54.44.26$, df= 6, P < 0.0001
2.	Chickpea	45	36	80%	
3.	Vegetable salad	45	45	100%	
4.	White split lentil	45	0	0%	
5.	Rice	45	45	100%	
6.	Tamarind sauce	45	45	100%	
7.	Chicken soup	45	45	100%	
Total		315	255	81%	

Table 5: Mean microbial profile of street vended food in district Mardan

Food item	Coliforms	Salmonella	Staphylococcus
White kidney beans	55.6x10 ³	0.024x10 ³	Absent
Chickpea	48.66x10 ³	Absent	0.044x10 ³
White split lentil	Absent	Absent	Absent
Tamarind sauce	2.1x10 ³	Absent	Absent
Rice	1.10x10 ³	Absent	Absent
Mixed vegetable salad	6.09x10 ³	0.097x10 ³	Absent
Chicken soup	83.1x10 ³	Absent	Absent

Table 4. Overall prevalence of different microbes in street vended food in study areas of District Mardan

Type of Microbes	No of Positive samples (%)			Overall prevalence (%) N=315
	Mardan n=105	Takht Bhai n=105	Katlang n=105	
Coliforms	93 (88.6)	88 (83.8)	98 (93.33)	279 (88.6)
Staphylococcus	25 (23.8)	0(0.0)	0(0.0)	25 (7.9)
Salmonella	25 (23.8)	0(0.0)	0(0.0)	25 (7.9)

n= Number of sample observed in each area; N= Total number of sample observed in District Mardan

Table 5: Mean microbial profile of street vended food in district Mardan

Food item	Coliforms	Salmonella	Staphylococcus
White kidney beans	55.6x10 ³	0.024x10 ³	Absent
Chickpea	48.66x10 ³	Absent	0.044x10 ³
White split lentil	Absent	Absent	Absent
Tamarind sauce	2.1x10 ³	Absent	Absent
Rice	1.10x10 ³	Absent	Absent
Mixed vegetable salad	6.09x10 ³	0.097x10 ³	Absent
Chicken soup	83.1x10 ³	Absent	Absent

Total counts of coliforms were found highest and varied between $1.1-55.6 \times 10^3$ cfu/ml for food items which is beyond acceptable microbial limit. Suneeta *et al.* (2011) reported coliform counts in street food in Tirumala that varied between $0.28-3.99 \times 10^3$ cfu/g and Kwiri *et al.* (2014) from Zimbabwe evaluated the microbiological stock of cooked vended food in which coliform count ranged from $0.8-8.5 \times 10^3$ cfu/g, which is low than our findings. Mehboob and Abbas (2019) reported total mean aerobic count 7.18 ± 1.26 cfu/ml that was also not under the acceptable microbial limits. Existence of coliforms in vended foods might be due to mixing of sewage water with drinking water used for cooking and washing of vegetables and utensils (Khalil *et al.*, 1996; Razzaq *et al.*, 2014).

Staphylococcus counts in street vended food in district Mardan in present study was found only in chickpea. Nester *et al.* (2001) reported the presence of *S. aureus* in vended foods in which the bacterial count ranged from $0.24-1.38 \times 10^3$ cfu/g. This bacteria might had introduced into the food during handling, dispensation or vending as this bacteria form part of the normal microflora that is present in different part of human body. *S. aureus* contamination might have resulted from human's respiratory passages, skin and superficial wounds which are common sources of *S. aureus* (Nester *et al.*, 2001). *Salmonella/Shigella* counts were only found in white kidney beans and mixed vegetable salad among the street vended food included in present study. Mixed vegetable salad contained raw seasonal vegetables. As they are not cooked so had high risk of contamination with viable pathogens. Wadhai and Khobragade (2012) also reported the presence of *Salmonella/Shigella* in street foods in Chundrapur city, India. The presence of *Salmonella/Shigella* indicated poor sanitary conditions and high content of contaminated water used. Lack of attention towards basic safety issues by vendors contribute high microbial loads in food sold by them. These include use of contaminated water for washing, use of crude stands and carts, preservation of food for long time without refrigeration, unhygienic surroundings with swarming flies and airborne dust (Lewis *et al.*, 2006; Mehboob and Abbas, 2019).

Conclusion

Based on current findings, it is concluded that coliform contamination is very high in District Mardan, indicating mixing of sewage water with drinking water. Critical control points should be identified and actions should be taken to lessen the contamination. Proper facilities and training should be given to the food vendors. Local authorities can then go through planning, investment, mass media and campaign regulations.

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