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Microbiological Analysis of Street-vended *Paratha* Samples Sold in the Markets of Noida, Uttar Pradesh, India

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The present study was carried out to assess the microbiological quality of street-vended *paratha*samples obtained from five different locations in the markets of Noida, Uttar Pradesh. The results demonstrated the non-hygienic quality of *paratha* samples which might be attributed to the time of day when the number of clients passing nearby varies. It might also be attributed to natural factors such as wind velocity, season, humidity, etc. since these *paratha*s are generally sold in an open atmosphere.

Key words: Street foods, *paratha, microbiological analysis*, street-vended food.

Street-vended foods sold in the markets of developing countries are often prepared under unhygienic conditions and are contaminated with microorganisms which are of a global concern(Swranresearch, 2010). Street foods may be defined as the "*ready to eat foods and beverages prepared and sold by vendors and hawkers especially in street and similar other public places*" (FAO F. A., 1987). Street food industry plays an important role in meeting the food requirements of commuters and urban dwellers because this industry feeds large number of people daily with a wide range of foods which are relatively cheap and easily accessible(Tambekar, Jaiswal, Dhanorkar, Gulhane, & Dudhane, 2008). Consumers are getting attracted to these products because they are readily available at reasonable costs(Mosupye & Holy, 2002).But the microbiological quality of these foods is of serious concern since these are usually prepared under unhygienic conditions. Many studies have shown that the street- vended foods do not meet the microbiological standards and are often contaminated with various pathogens viz. *Escherichiacoli*,*Salmonella*, *Vibrio*, *Listeria* etc. (Chiou, Wang, & Lin, 1996)(Ryu & Beuchat, 1998). The workers handling the food are highly responsible for transmitting the pathogens to food from the contaminated surfaces, other food items or from the hands contaminated with microorganisms of gastrointestinal origin (Cruickshank, 1990) (Muzzafar, Amin, & Bhat, 2013). In India, there have been several reports of food-borne illnesses associated with the consumption of street-vended ready-to-serve foods (FAO, 1993)(Chumber, Nwinyi, & Chinedu, 2007)(Ghosh, Wahi, & Ganguli, 2007). Vendors are often not aware of good hygienic practices (GHPs) and good manufacturing practices (GMPs). Despite knowing the ill effects of street vended foods, consumers still disregard the health hazards (Bryan, 1998)(Garode & Waghode, 2012). Also, on this basis, it is not possible to stop the consumption of these street-vended RTE foods, however regular monitoring and quality control checks need to be ensured to avoid any outbreak of food-borne disease(Muzzafar, Amin, & Bhat, 2013).

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The present study was conducted to assess the microbiological quality of *parathas*sold in the markets of Noida, Uttar Pradesh India.

MATERIALS AND METHODS

Materials

For carrying out a study, five different locations were selected in the market of Noida, Uttar Pradesh, India. From each location, five different*paratha* samples were collected and were then immediately brought to the laboratory under aseptic conditions at a temperature of 4°C. The samples were then immediately analyzed for microbial quality.

Microbiological analysis

For microbial analysis, 1 g of each of the sample was serially diluted to 10^0, 10^{-1} and 10^{-2} dilutions in saline (0.85% NaCl w/v). The total aerobic colony counts were determined by spreading 0.1 ml from each dilution (10^0, 10^{-1} and 10^{-2}) on nutrient agar (MERCK) plates followed by incubation at 37°C for 48 hrs **(**Gilbert et al. 2000) after which colonies were counted by colony counter (QUEBEC). The total aerobic colony count was reported as colony forming units per gram of food sample (cfu/g). The plates with colony forming units per ml (cfu/ml) ranging from 30-300 were considered for counting as the colonies less than 30 would have run into statistical inaccuracy and the colonies greater than 300 would have been tedious to count.

Statistical analysis

All of the experiments were carried out in triplicates and the results were expressed as Mean ± SD. A One-Way ANOVA diagnosis of the data collected was done using Minitab Statistical Software to study the data with a statistical insight(Bhat, Melo, Chaugule, & D'Souza, 2008) (Nayik, Amin, & Bhat, 2013).

RESULTS AND DISCUSSIONS

The zones of inhibition of *paratha*samples from different locations are shown in Table 1. The minimum sample size of 15 data points per group which gives a clear picture of the study was met. The ANOVA diagnosis was run under both 5% Confidence Level and 1% Confidence Level to study the detection of a difference in either of the two cases.

Snapshots of the Diagnostic Reports of the study carried out using Minitab are given below.

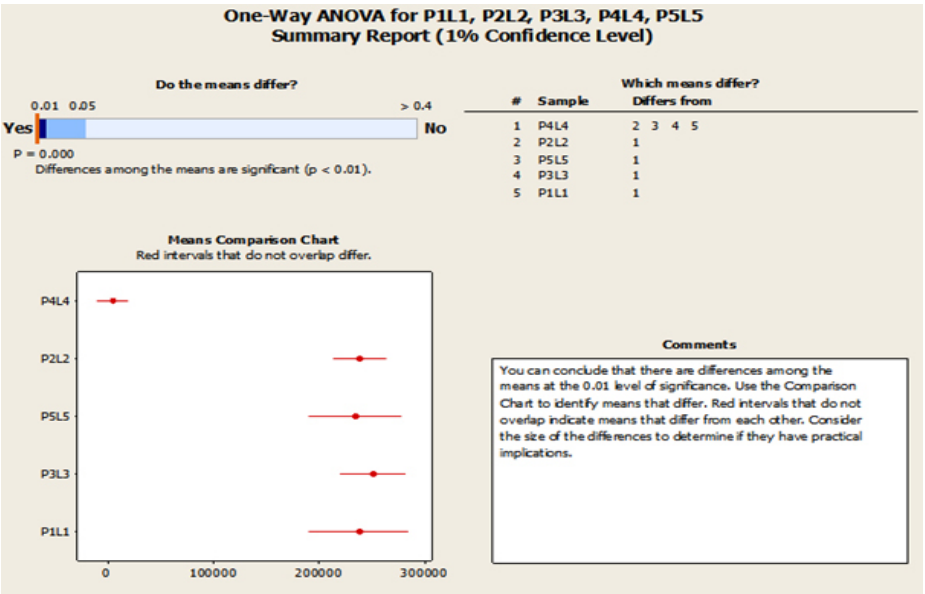

Fig. 1. One-Way ANOVA Summary Report at 1% Confidence Level

Table 1. Zones of inhibition of various *paratha* samples

Sample	Location 1	Mean ± SD	Location 2	Mean ± SD	Location 3	Mean ± SD	Location 4	Mean ± SD	Location 5	Mean ± SD
P1L1 (2.37±0.33)	2.47×10^5	(2.75±0.25) ×	2.95×10^4	(2.59±0.34) ×		1.95×10^5	(2.32±0.44)	2.65×10^5	(2.70±0.29)	2.10×10^5
	2.93×10^5	10^5	2.27×10^5	10^5	2.82×10^5	$\times 10^5$	2.44×10^5	$\times 10^5$	2.74×10^5	$\times 10^5$
	2.87×10^5		2.55×10^5		2.21×10^5		3.02×10^5		2.28×10^5	
P2L2	2.66×10^5	(2.69±0.119)	1.96×10^5	(2.35±0.45)	1.66×10^5	(2.08±0.50)	2.54×10^5	(2.47±0.32)	1.96×10^5	(2.28±0.34)
		$\times 10^5$		$\times 10^5$		$\times 10^5$		$\times 10^5$		
	2.83×10^5		2.24×10^5		1.96×10^5		2.76×10^5		2.24×10^5	
	2.60×10^5		2.85×10^5		2.64×10^5		2.12×10^5		2.65×10^5	
P3L3	2.42×10^5	(2.79±0.33) ×	2.36×10^5	(2.59±0.56)	2.64×10^5	(2.54±0.40)	1.46×10^5	(1.98±0.45)	2.64×10^5	(2.61±0.38)
	2.88×10^5	10^5	2.18×10^5	$\times 10^5$	2.89×10^5	$\times 10^5$	2.32×10^5	$\times 10^5$	2.22×10^5	$\times 10^5$
	3.08×10^5		3.24×10^5		2.10×10^5		2.16×10^5		2.98×10^5	
P4L4	2.30×10^3	(2.85±0.68) ×	1.83×10^3	(1.73±0.57) ×	2.56×10^3	(2.62±0.21)	2.36×10^3	(2.34±0.35)	2.24×10^3	(2.24±0.13)
		10^5		10^5		$\times 10^5$		$\times 10^5$		$\times 10^5$
	2.64×10^3		1.12×10^4		2.86×10^3		2.68×10^3		2.38×10^3	
	3.62×10^3		2.26×10^3		2.44×10^3		1.98×10^3		2.11×10^4	
P5L5	2.15×10^5	(2.4±0.24173)	2.02×10^5	(2.31±0.57) ×	4.56×10^4	(3.23±1.17)	2.16×10^5	(2.50±0.35)	2.26×10^5	(2.60±0.44)
	2.63×10^5	$\times 10^5$	2.98×10^5	10^5	2.34×10^5	$\times 10^5$	2.87×10^5	$\times 10^5$	3.10×10^5	$\times 10^5$
	2.44×10^5		1.94×10^5		2.79×10^5		2.49×10^5		2.45×10^5	

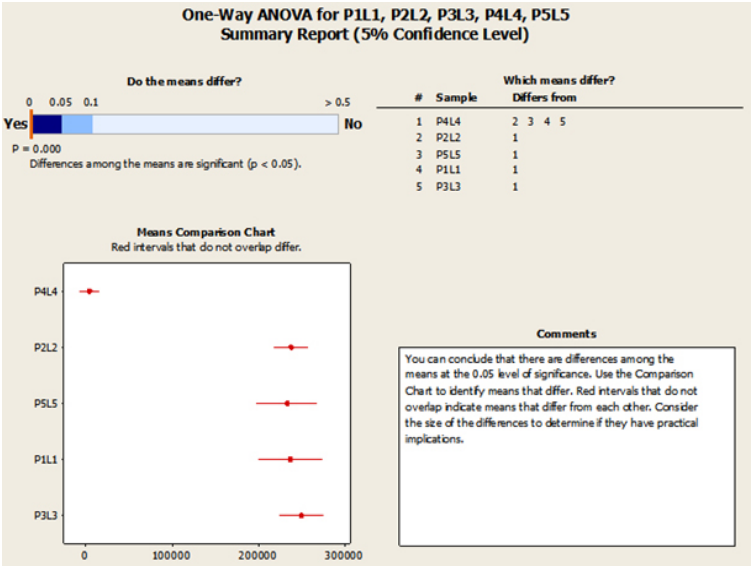

Fig. 2. One-Way ANOVA Summary Report at 5% Confidence Level

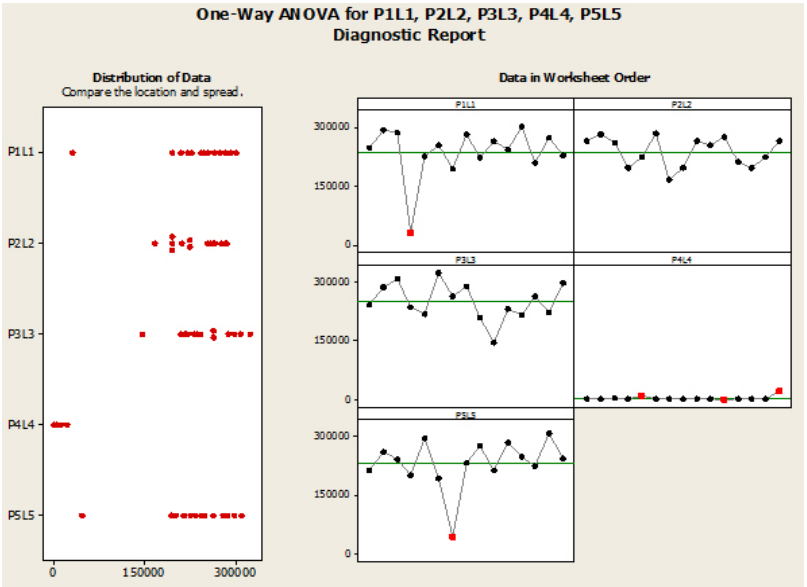

Fig. 3.

The diagnostic report showed that there was a significant difference among the means of the different locations under study. The data from sample code P4L4 differed with all the other sample codes while the means of the rest sample codes didn't differ significantly from each other at 5% Confidence Level. This same diagnosis was observed at 1% Confidence Level.

Snapshots of the Diagnostic Reports of the study carried out using Minitab are given below.

When the run of data is compared within the same sample code and with the other sample codes, several observations were noted. Several outliers had been found during the study which can be referred to as the occurrence of special case events. These are marked in red in the below pictorial representation.

The occurrence of special case events can be attributed to several causes such as time of the day (morning, afternoon, or evening) when the number of clients vary at these street food vending locations which affects the way the handlers there

take care of hygiene related aspects. The occurrence of these special case events can also be attributed to natural factors like season, humidity, wind velocity etc. as these street food vending locations are open to the atmosphere and hence easily respond to the changes in the ambience around.

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