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### Microbial analysis of selected fast foods popular among college students of rural and urban areas

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**Abstract**

The present study was undertaken to assess the microbial quality of fast foods popular among college students. Faizabad district was purposively selected for the study. Two colleges namely Chandrabali Singh Urmila Mahavidyalaya, Shivanagar, Kumarganj, Faizabad from rural area and Saket P.G. College, from urban area Faizabad were selected for the study. A sample of 260 college students 130 each, were selected from two colleges. Information regarding age, sex, caste, family composition, education and economic status of the family and specific information regarding fast food choice, type of fast food liked, reason for consuming fast food, opinion of respondents about fast food etc. were gathered through self structured questionnaire. In this study the majority of respondents were belong to general category (33.84%). In case of their preference of fast foods majority of respondents in rural area like chaat (30.76%), samosa (29.23%), chole-bhature (18.46%), burger (30.0%) etc. On the other hand, in urban area the majority of respondents liked kachorie (23.84%) and samosa (22.30%) followed by chole-bhature (13.84) and burger (28.46%). The microbial analysis of fast foods explored showed that maximum colonies were found in chaat ( $6.01 \times 10^5/\text{gm}$ ) and burger ( $3.45 \times 10^5/\text{gm}$ ), whereas, in pastry ( $1.2 \times 10^5/\text{gm}$ ) and samosa ( $2.25 \times 10^5/\text{gm}$ ) lowest colony were observed. The reason behind this could be that in chat boiled chole is added which is boiled in the morning and is used as such tillate night which favours the growth of microbes, while in burger raw cut vegetable like tomato, cabbage, onion are added. These vegetables are cut in the bulk in the morning and used throughout the day and have greater chance for microbial growth. Whereas samosa are deep fried and pastry are kept in air conditioned show cases.

**Keywords:** Fast food, Self-structured questionnaire, fast food preferences, Microbial composition

**Introduction**

Fast foods are foods or beverages that are low in nutrient density and they provide calories primarily through fats or added sugars and have minimal amount of vitamins and minerals. In short they are energy dense foods poor in micronutrients. Regular and consistent consumption of such food over a long period of time may therefore, be deleterious to health. Foods like burger and cola are nutritionally only refined carbohydrate containing empty calorie and hardly any vitamins, minerals and proteins. But their sodium content is very high. Some may contain chemical, artificial colour, flavours and preservatives which are not good for health. (Vani, 2016) [8] There are many options for microorganisms to contaminate fast foods ie. If the food is prepared, processed, handled, and stored under unhygienic conditions. The microbiological quality of different fast foods of Jessore city was determined whether the samples are contaminated with coliforms or not. Among the fast food *Enterobacteriaceae*, *Klebsiella spp.* was the most prevalent bacteria found (Ahmed *et al.* 2014) [4]. Fast food is especially popular among adolescents, who visit fast food outlet twice per week. Several factors have contributed to this phenomenal increase in the intake of fast foods including – a greater number of working women, dual career families, more diverse schedule of family members, an aging population and an increasing number of one and two persons households. Fast food meet the needs of many people because they are quick,

reasonable priced and readily available. (Vaida, 2013) [9]. India is no exception to this changing fast-food trend. India's fast-food industry is growing by 40 percent per year. Statistics place India in 10th place in fast food per capita spending figures with 2.1 percent of expenditure of annual total spending. (Ashakiran and Deepthi, 2012). Hence, this study was taken to analyse microbial loads in fast food which was preferred by college students of urban and rural areas.

### Materials and Methods

**Locale of the study:** Faizabad district of Eastern U.P. was purposively selected because of easy accessibility and availability of sample size

**Sampling Design:** For the sample selection stratified sampling was used. One rural college Chandrabali Singh Urmila Mahavidyalaya, Shivnagar, Kumarganj, Faizabad and one urban college Saket P.G. College, Faizabad were selected. A sample of 260 college students 130 each, were selected from two colleges. Out of 130, 65 were girls and 65 boys from rural college and 65 girls and 65 boys were from urban college.

**Tools and techniques used:** Self structured questionnaire was prepared to elicit information of the respondents with respect to their general profile and specific information regarding their fast food choices. Thus, the questionnaire included the following aspects:

**a) General Information:** Information regarding age, sex, caste, family composition, education and economic status of the family were collected through self-structured questionnaire.

**b) Information regarding fast food choice:** Specific

information regarding fast food choice, consumption pattern, and type of fast food liked etc. were collected through self structured questionnaire.

**Microbial count of fast foods:** Labelled the sets of the Petri dishes for each of the food samples to be tested and their dilutions ( $10^{-2}$ ,  $10^{-3}$ ,  $10^{-4}$ ). Melted the brain-heart infusion agar deep tubes in a water bath, cooled, and maintained at  $45^{\circ}\text{C}$ . Placed 20 g of each food sample, weighed on sterile glassine paper, into its labeled blender jar. Added 180 ml of sterile water to each of the blender jars and blended each mixture for 5 minutes.  $1:10$  ( $10^{-1}$ ) dilution of each food sample was prepared. Transferred 1 ml of the  $10^{-1}$  ground beef suspension into its labeled 99-ml sterile water blank, thereby effecting a  $10^{-3}$  dilution, and 0.1 ml to the appropriately labeled  $10^{-2}$  Petri dish. Shaked the  $10^{-3}$  sample dilution, and using a different pipette, transfer 1 ml to the plate labeled  $10^{-3}$  and 0.1 ml to the plate labeled  $10^{-4}$ . Added a 15-ml aliquot of the molten and cooled agar to each of the plates. Swirled the plates gently to obtain a uniform distribution, and allow the plates to solidify. Repeated Step 4 for the remaining two  $10^{-1}$  test food sample dilutions. Aseptically prepared a four-way streak plate and inoculate each  $10^{-1}$  food sample dilution on it's appropriately. Incubated all plates in an inverted position for 24 to 48 hours at  $37^{\circ}\text{C}$ . Counted the colonies using colony counter.

### Results and discussion

#### The demographic profile of college students:

The results of the present study are presented in the following tables. The data presented in table no. 1 shows that the majority of rural college students were from OBC (other backward classes) (30.76%) followed by generally category (28.46), scheduled caste (25.38%) and least were schedule tribes (15.38%).

**Table 1:** Caste profile of rural and urban college students

Caste	Rural			Urban			Grand total N=260 (%)
	Boys N (%)	Girls N (%)	Total N=130 (%)	Boys N (%)	Girls N (%)	Total N=130 (%)	
General	17(26.15)	20(30.76)	37(28.46)	28(43.07)	23(35.38)	51(39.23)	88(33.84)
OBC	19(29.23)	21(32.30)	40(30.76)	20(30.76)	21(32.30)	41(31.53)	81(31.15)
SC	16(24.61)	17(26.15)	33(25.38)	14(21.53)	14(21.53)	28(21.53)	61(23.46)
ST	13(20.00)	7(10.76)	20(15.38)	3(4.61)	7(10.76)	10(7.69)	30(11.53)
Total	65(100)	65(100)	130(100)	65(100)	65(100)	130(100)	260(100)

In case of urban college students the majority was from general category (39.23%) followed by other backward classes (31.53%), schedule caste (21.53%) and schedule tribe (7.69%), respectively. Overall the maximum (33.84%)

subjects were from general category followed by OBC (31.15%), schedule caste (23.46%) and schedule tribe (11.53%).

**Table 2:** Monthly Pocket money (Rs.) of rural and urban college students

Pocket Money (Rs)	Rural			Urban			Grand total N=260 (%)
	Boys N (%)	Girls N (%)	Total N=130 (%)	Boys N (%)	Girls N (%)	Total N=130 (%)	
None	9(13.84)	15(23.07)	24(18.46)	1(1.53)	16(24.61)	17(13.07)	41(15.76)
100-300	25(38.46)	23(35.38)	48(36.92)	46(70.76)	15(23.07)	61(46.92)	109(41.92)
301-600	18(27.69)	15(23.07)	33(25.38)	4(6.15)	20(30.76)	24(18.46)	57(21.92)
above 600	13(20.00)	12(18.46)	25(19.23)	14(21.53)	14(21.53)	28(21.53)	53(20.38)
Total	65(100)	65(100)	130(100)	65(100)	65(100)	130(100)	260(100)

The data presented in Table No.2 shows that in rural college 36.92, 25.38, and 19.23 per cent students received Rs. 100-300 Rs, 301-600 and more than Rs. 600 as pocket money respectively. While, in urban college 46.92, 18.46 and 21.53

per cent received Rs. 100-300 Rs, 301-600 and above 600 rupees pocket money respectively. 18.46 per cent rural and 13.07 per cent urban students did not receive any pocket money.

**Most preferred fast foods among college students:** The fast food choices of rural and urban students were asked and information is presented in table 3. It was found that in rural area *chaat* (30.76%) was found to be most popular traditional fast food followed by *Samosa* (29.23%), *Chole- bhature* (18.46%), *Dosa* (7.69%), *Kachories* (4.61%), *Pav- bhaji*

(4.61%), and *Idli* (2.30%) and *Pakor*s (2.30%), respectively. Among urban college students the most popular traditional fast food was *Kachories* (23.84%) followed by *Samosa* (22.30%), *Chaat* (16.92%) *Chole-bhature* (13.84%), *Dosa* (10.0%), *pav- bhaji* (8.46%), *Pakor*s (3.07%) and *Idli* (1.53%), respectively.

**Table 3:** Preferred traditional fast foods among rural and urban college students

Traditional Fast foods	Rural			Urban			Grand total N=260 (%)
	Boys N (%)	Girls N (%)	Total N=130 (%)	Boys N (%)	Girls N (%)	Total N=130 (%)	
Chaat	16(24.61)	24(36.92)	40(30.76)	11(16.92)	11(16.92)	22(16.92)	62(23.84)
Samosa	23(35.38)	15(23.07)	38(29.23)	10(15.38)	19(29.23)	29(22.30)	67(25.76)
Chole-bhature	14(21.53)	10(15.38)	24(18.46)	10(15.38)	8(12.30)	18(13.84)	42(16.15)
Kachories	2(3.07)	4(6.15)	6(4.61)	14(21.53)	16(24.61)	31(23.84)	37(14.23)
Dosa	6(9.23)	4(6.15)	10(7.69)	8(12.30)	5(7.69)	13(10)	23(8.84)
Pakors	0	3(4.61)	3(2.30)	3(4.61)	1(1.53)	4(3.07)	7(2.69)
Idli	3(4.61)	0	3(2.30)	1(1.53)	1(1.53)	2(1.53)	5(1.92)
Pavbhaji	1(1.53)	5(7.69)	6(4.61)	8(12.30)	4(6.15)	11(8.46)	17(6.53)
Total	65(100)	65(100)	130(100)	65(100)	65(100)	130(100)	260(100)

Kumar *et al.* (2006) [7] also reported in their study that *samosa*, a deep fried Indian snack, was most preferred (99.2%) fast food item. Whereas, Arulogun and Owolabi (2011) showed that respondents mostly preferred flour-based

fast food products together with carbonated drinks. *Chaat* also came out to be the most common fast food item preferred by 99.2 per cent, respondents.

**Table 4:** Preferred western fast foods among rural and urban college students

Western Fast foods	Rural			Urban			Grand total N=260 (%)
	Boys N (%)	Girls N (%)	Total N=130 (%)	Boys N (%)	Girls N (%)	Total N=130 (%)	
Burger	20(30.76)	19(29.23)	39(30.00)	16(24.61)	21(32.30)	37(28.46)	76(29.23)
Noodles	1(1.53)	3(4.61)	4(3.07)	9(13.84)	10(15.38)	19(14.61)	23(8.84)
Pizza	10(15.38)	3(4.61)	13(10.00)	13(20.00)	5(7.69)	18(13.84)	31(11.92)
Hot dog	11(16.92)	19(29.23)	30(23.07)	14(21.53)	9(13.84)	23(17.69)	53(20.38)
Pastry	20(30.76)	17(26.15)	37(28.46)	12(18.46)	12(18.46)	24(18.46)	61(23.46)
Chicken burgers	3(4.61)	4(6.15)	7(5.38)	1(1.53)	8(12.30)	9(6.92)	16(6.15)
Total	65(100)	65(100)	130(100)	65(100)	65(100)	130(100)	260(100)

The choice of students regarding most popular western/chinese fast foods was also explored and results presented in Table no. 4 showed that among western type of fast foods burger was the first choice (30.0%) followed by *pastry* (28.46%), *Hotdog* (23.07%), *Pizza* (10.0%) *chicken burgers* (5.38%) and *noodles* (3.07%) in rural college students. Among urban college students most popular western

fast foods was *burgers* (28.46%), it was followed by *pastry* (18.46%), *Hotdog* (17.69%), *Noodles* (14.61%), *pizza* (13.84%) and *chicken burger* (6.92%), respectively. Ismail (2016) also found that the most preferred fast food item was *burger* (44.7%). On the other hand, Kumar *et al.* (2006) [7] found that *pizza* (22.8%) came out to be least preferred fast food items.

**Table 5:** Consumption pattern of eating fast food among rural and urban college students

Consumption pattern	Rural			Urban			Grand total N=260 (%)
	Boys N (%)	Girls N (%)	Total N=130 (%)	Boys N (%)	Girls N (%)	Total N=130 (%)	
Twice a day	2(3.07)	2(3.07)	4(3.07)	12(18.46)	5(7.69)	17(13.07)	21(8.07)
Once daily	19(29.23)	24(36.92)	43(33.07)	23(35.38)	34(52.30)	57(43.84)	100(38.46)
Once a week	20(30.76)	24(36.92)	44(33.84)	18(27.69)	18(27.69)	36(27.69)	80(30.76)
Occasionally	24(36.92)	15(23.07)	39(30.00)	12(18.46)	8(12.30)	20(15.38)	59(22.69)
Total	65(100)	65(100)	130(100)	65(100)	65(100)	130(100)	260(100)

Both rural and urban college students were asked how frequently they consume fast foods. The result presented in Table 5, showed that 43.84 per cent urban and 33.07 per cent rural college students consume fast foods daily, while the frequency of consuming twice a day was 13.07 and 3.07 per cent in urban and rural college students.

**3. Microbial analysis of selected fast foods:** The most popular each three traditional and western fast food samples were collected and analyzed for total microbial count. Among

the samples collected from rural area the average total bacterial count was maximum in *chaat* i.e.  $6.01 \times 10^5$  /gm followed by *pastry*  $4.5 \times 10^5$  /gm, *chole-bhature*  $3.85 \times 10^5$  /gm, *burger*  $3.6 \times 10^5$  /gm, and minimum in *samosa*  $2.2 \times 10^5$  /gm. Gowri *et al.* (2011) [3] studied food items like *athirasam*, *bajji*, *bonda*, *murukku*, *vadai* and sugar cane juice and found that the maximum bacterial count was present in *athirasam* ( $3 \times 10^4$  /gm) followed by *bonda* ( $3 \times 10^4$  /gm), *Bajji* ( $2 \times 10^4$  /gm) *Murukku* ( $2 \times 10^4$  /gm), *Vadai* ( $1 \times 10^4$  /gm) and *Sugar cane juice* ( $1 \times 10^4$  /ml).

In the fast food samples collected from urban shops the average microbial count was maximum in *burger*  $3.45 \times 10^5$ /gm followed by *hotdog*  $3.25 \times 10^5$ /gm and *kachories*  $3.25 \times 10^5$ /gm *chole-bhature*  $3.3 \times 10^5$ /gm and minimum in *samosa*  $2.25 \times 10^5$ /gm and *pastry*  $1.2 \times 10^5$ /gm. Ahmed *et al.* (2014) [4] revealed that fast food retains such ingredients which can supply various essential nutrients to many microorganisms for their optimum growth. There are many options for microorganisms to contaminate fast foods, if the food is prepared, processed, handled, and stored under unhygienic conditions. They evaluated the microbiological quality of different items of fast food of Jessore city and determined the samples were contaminated with coliforms. Among the fast food *Enterobacteriaceae*, *Klebsiella spp.* was the most prevalent bacteria found.

**Table 6:** Bacterial count of fast food samples collect from rural area

Fast foods	Dilution Taken		Average
	$10^{-3}$	$10^{-4}$	
Chaat	$2.02 \times 10^5$	$10 \times 10^5$	$6.01 \times 10^5$
Chole-bhature	$5.1 \times 10^5$	$2.6 \times 10^5$	$3.85 \times 10^5$
Samosa	$3.2 \times 10^5$	$1.2 \times 10^5$	$2.2 \times 10^5$
Burger	$4.1 \times 10^5$	$3.1 \times 10^5$	$3.6 \times 10^5$
Hotdog	$3.6 \times 10^5$	$2.9 \times 10^5$	$3.25 \times 10^5$
Pastry	$1 \times 10^5$	$8 \times 10^5$	$4.5 \times 10^5$

The variation in microbial load of fast food may be attributes to poor handling, preparation and storage conditions. In rural shops proper condition for storage of cooked foods are not available. The maximum microbial load in chaat may be due addition of boiled peas and sweet, sour and chilly chutney. Cut onion and coriander leaves etc. are also added as topping which might be the reason for heavy total bacterial count. Pastries contain cream thus need refrigerated storage condition which are not available in rural area thus might be responsible for heavy microbial load, chole-bhature are deep fried and pressure cooked and samosa are also deep fat fried. Thus may be responsible for less microbial level.

**Table 7:** Bacterial count of fast food samples collected from urban areas

Fast foods	Dilution Taken		Average
	$10^{-3}$	$10^{-4}$	
Samosa	$2.9 \times 10^5$	$1.6 \times 10^5$	$2.25 \times 10^5$
Chole-bhature	$2.9 \times 10^5$	$3.7 \times 10^5$	$3.3 \times 10^5$
Kachorie	$3.6 \times 10^5$	$2.9 \times 10^5$	$3.25 \times 10^5$
Burger	$4 \times 10^5$	$2.9 \times 10^5$	$3.45 \times 10^5$
Hotdog	$3.6 \times 10^5$	$2.9 \times 10^5$	$3.25 \times 10^5$
Pastry	$1.1 \times 10^5$	$1.3 \times 10^5$	$1.2 \times 10^5$

Table No.7 depicts that in urban area *burger* contained maximum bacterial load. That might be due to addition of cut vegetables both in *burger and hotdogs*. *Kachories*, *chole-bhature* and *samosa* being deep fried products contained comparatively less count. *Pasteries* were most safe having minimum bacteria. This may be due to the fact that in urban shops refrigerated storage facilities are commonly available for storage of *pastries*. Thus, had less microbial load.

### Summary and conclusion

The findings demonstrate that fast food is one of the world fastest growing sectors in food industry. Due to urbanization, increase in number of working women, economic growth, increase in per capita income, movement for higher education as well as due to globalization fast food culture gained

prominence in India and the world. Majority of rural college students were from other backward classes while majority of urban students were from general category. The majority of rural and urban college students were from families having monthly income between Rs. 15,000 to 25,000 rural college students were net getting pocket money between Rs. 100 to 300 per month. *Chaat*, *samosa*, and *chole-bhature* were these most popular fast foods in rural student. Among western type of fast foods *burger*, *hotdog* and *pastry* were at the top. Urban college students ranked *samosa*, *chole-bhature* and *kachorie* was most liked traditional and *burger*, *hotdog* and *pastry* as most liked western fast foods. The microbial analysis of fast food revealed that maximum microbial growth was found in *chaat*, whereas minimum found in *samosa*. However among urban fast food sample maximum colony were found in *burgur* and minimum in *pastry*, this might be due to reason *chola* which added in *chaat* and fresh vegetable like tomato, cabbage, onion has greater chance for microbial growth as *samosa* which deep fried and *pastry* which kept in cooled condition.

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