

## Microbiological Quality Analysis of the Pastry sold in the Jalandhar City and Public Perception about the Pastry

Harsh Kumar<sup>\*1</sup>, Rajdeep Palaha<sup>2</sup>, Deepshikha Sharma<sup>3</sup>, Vivek Sharma<sup>3</sup>,  
Deepti Singh<sup>3</sup>, Amandeep Kaur<sup>4</sup>

<sup>1</sup>*Faculty of Bio- Sciences, Department of Biotechnology, Lovely Professional University, Phagwara- 144402, Punjab, India*

<sup>2</sup>*Department of Health, Civil Hospital, Sangrur- 148001, Punjab, India*

<sup>3</sup>*Department of Biotechnology, Lovely Professional University, Phagwara- 144402, Punjab, India*

<sup>4</sup>*Department of Management, Lovely Professional University, Phgwara- 144402, Punjab, India*

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### Abstract

*Bakery product Pastry is a commonly consumed food throughout the year. It harbors many potent pathogens, its microbial quality especially bacteriological as well as yeast and mold quality has always been crucially important to public health. This study aims to access the bacteriological as well as yeast and mold quality of the pastry sold in the different markets in the Jalandhar city. Randomly 40 pastry samples were collected from the different retail shops and studied to determine the colony forming units per gram of the pastry samples. For aerobic colony counts samples were classified as satisfactory, acceptable and unsatisfactory categories according to PHLS (Public Health Laboratory Services, UK) guidelines. For yeast and mold counts, WQAS (Woolworths Quality Assurance Standard) guidelines were followed. In aerobic colony counts, all the samples of the 10 zones selected for the study, showed heavy contamination of bacteria ranging 1.37\*10<sup>6</sup> cfu/g to 11.27\*10<sup>6</sup> cfu/g. Whereas yeast and mold counts ranging 1.33\*10<sup>5</sup>cfu/g to 92.5\*10<sup>5</sup>cfu/g. Public perception was also taken care about the food. A structured questionnaire was administered to 104 public members in Jalandhar city. Most respondents (78.8%) consumed pastry. Some (28.8%) felt ill from eating pastry, but only (12.5%) reported to a medical doctor/health authority. The paper recommends that there is need to minimize the contamination and HACCP systems could be applied to the control of the spoilage microorganisms at all stages of manufacture, storage, transport and retail steps as well as there is need for health education in order to ensure food safety for the consumers.*

**Key words: Pastry, contamination, consumer, Jalandhar city, colony forming units.**

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### Introduction

The ancient Egyptians fashioned the first crude pastry out of grain meal flavoured with honey, fruits and spices. The Greeks and Romans improved on the early recipes, but it was in the Middle East pastries were developed into something of a culinary art form. Pastries were first brought to Europe during the Muslim invasion of the 7th century and quickly captured the imagination of European chefs. In India pastry has become very popular throughout the country. This item is consumed by people of all age groups.

Obviously it is one of the favorite foods in Jalandhar city also. A good pastry is light and airy, easily broken in the mouth, but firm enough to support the weight of the filling. The important raw material is wheat flour, sugar, eggs, yeast and milk cream. Water and milk are most commonly used liquids in pastry. Bakery industry in India is the largest among the processed food sectors, the unorganized sector alone consists of 75, 000 bakers mostly located in residential areas of cities and towns (Anonymous 2010). Like cream cake, pastry is an excellent growth medium for many kinds of microorganisms, as it provides rich nutrient for microorganisms, is high moisture and has neutral pH (Siriken et al. 2009). The water activity (aw) of pastry is high (aw 0.60- 0.90) (Jay 2000). The ingredients of pastry

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\*Corresponding author. mailing address: Faculty of Bio- Sciences, Department of Biotechnology, Lovely Professional University, Punjab, Tel: 01824-506555, Fax: 01824-506111, E.mail: [harsh.12054@lpu.co.in](mailto:harsh.12054@lpu.co.in)

such as butter cream, fruits, chocolate has also perishable food. In addition to bacteria, yeasts and molds are the main cause of spoilage. Freshly baked pastries are sterile and do not contain viable microorganisms but soon become contaminated upon exposure to air and surfaces. Contamination also occurs, after baking process, during the storage, transport and unhygienic handling (Saddozai and Khalil 2009). Staphylococcal food poisoning is caused by the ingestion of food that contains one or more performed toxins produced by *Staphylococcus aureus* (Stewart et al. 2003). Foodborne outbreaks associated with cream filled baked goods are attributed primarily to contamination by food handlers followed by inadequate refrigeration during manufacture and/or storage (Bryan 1976). The main objective of this study was to determine the microbiological contamination in the most commonly consumed bakery product i. e. pastry sold in the different markets in Jalandhar city.

### Material and Methods

**Collection of Samples.** For collection of pastry samples, whole of the Jalandhar city was divided into 10 zones. 40 samples were collected in the month of August 2011 from the retail shops randomly without concern to their flavour form each of the 10 zones. While collecting the samples a special care also was taken to the serving practice of the retailers, like use of apron, covering of hair, usage of gloves and handling of money while serving. The samples were collected in sterile sampling box that were kept at low temperature and were immediately shifted to laboratory of Microbiology, department of Biotechnology in Lovely Professional University.

**Aerobic colony counts.** Aerobic colony counts (ACC) were performed using the spread plate method (Gilbert et al. 2000; Cappuccino and Sherman 2002). Nutrient Agar plates (CDH Pvt. Ltd, India) was inoculated with 100 $\mu$ l of 10<sup>-4</sup>

### Results and Discussion

It was observed that hygienic conditions in terms of usage of apron, handling of pastry and covering of hair was not appropriately followed by any of the retailers considered in the present investigation. The fact that they are generally unaware of food regulations in India and have no training in food related matters, need to be considered here. The aerobic colony counts in the 40 samples obtained from 10 zones of Jalandhar city are presented in Table 1. A comparison of the aerobic colony counts for the samples with the standard guidelines of PHLS is presented in Table 2.

times diluted pastry samples in (0.85% NaCl) physiological saline and were incubated at 37°C (Prescott and Harley 2002). After 24 hrs of incubation, the total number of colonies that were appear were counted with the help of digital colony counter (LABFIT™, Ambala, India). PHLS (Public Health Laboratory Services, UK) guidelines were used to classify the samples in satisfactory, acceptable and unsatisfactory categories.

**Yeast and Mold Count.** Yeast and Mold Count (YMC) were also performed using the spread plate method. Oxytetra Glucose yeast Agar W/ Biotin with Oxytetra supplement (Titan Biotech Ltd., India) was used as selective medium for the growth of the yeast and mold. Plates were inoculated with 100 $\mu$ l of 10<sup>-4</sup> times diluted pastry samples and were incubated at 28°C. After 24 hrs of incubation, the total number of colonies that were appear were counted with the help of digital colony counter (LABFIT™, Ambala, India). The values of the yeast and mold count were compared with standards as per WQAS (Woolworths Quality Assurance Standard) guidelines (WQAS 2009).

**Consuming Public Questionnaire.** The Likert scale based structured questionnaire obtained information on the demographics of respondent (gender and occupational status). The questions asked on the consumption and purchase of pastry as well as the awareness of food borne illness by respondents. The questionnaire was pretested on the 10 members of the public for comprehension and clarity before being administered to the 104 respondents.

**Statistical analysis.** Results were analyzed by calculating the Mean value and Standard deviation using the Microsoft Excel, 2010. Reliability of the questionnaire was checked by Test- Retest reliability method (Anonymous 2002). Whereas Data of the questionnaire was analyzed using the Statistical Package for Social Sciences (SPSS) program version 16.

The samples of all the zones show heavy contamination of bacteria ranging 1. 37\*10<sup>6</sup> cfu/g to 11.27\*10<sup>6</sup> cfu/g. The mean results indicate that the highest contamination found in Rama Mandi pastry samples (11.27\*10<sup>6</sup> cfu/g) followed by Chick- Chick chowk (7.27\*10<sup>6</sup> cfu/g), Nakodar chowk (6.75\*10<sup>6</sup> cfu/g), Bus stand premises (6.7\*10<sup>6</sup> cfu/g), Kapurthala chowk (5.05\*10<sup>6</sup> cfu/g), Model Town (3.85\*10<sup>6</sup> cfu/g), Milap chowk (2.27\*10<sup>6</sup> cfu/g), Station road (2.25\*10<sup>6</sup> cfu/g), Luv Kush chowk (1.8\*10<sup>6</sup> cfu/g), and Jyoti chowk (1.37\*10<sup>6</sup> cfu/g).

**Table 1. Aerobic Colony Count (CFU/g) for different pastry samples**

Name of Area	Aerobic Colony Count (cfu/g)	Mean	Standard Deviation
	Individual		
<b>Bus Stand Premises</b>	12.6*10 <sup>6</sup> 4.3*10 <sup>6</sup> 5.1*10 <sup>6</sup> 4.8*10 <sup>6</sup>	6.7*10 <sup>6</sup>	3.9*10 <sup>6</sup>
<b>Station Road</b>	3.5*10 <sup>6</sup> 1.9*10 <sup>6</sup> 0.8*10 <sup>6</sup> 2.7*10 <sup>6</sup>	2.25*10 <sup>6</sup>	1.15*10 <sup>6</sup>
<b>Rama Mandi</b>	23.8*10 <sup>6</sup> 12.4*10 <sup>6</sup> 3.8*10 <sup>6</sup> 5.1*10 <sup>6</sup>	11.27*10 <sup>6</sup>	9.16*10 <sup>6</sup>
<b>Jyoti Chowk</b>	0.1*10 <sup>6</sup> 0.7*10 <sup>6</sup> 2.3*10 <sup>6</sup> 2.4*10 <sup>6</sup>	1.37*10 <sup>6</sup>	1.15*10 <sup>6</sup>
<b>Model Town</b>	3.4*10 <sup>6</sup> 1.3*10 <sup>6</sup> 3.5*10 <sup>6</sup> 7.2*10 <sup>6</sup>	3.85*10 <sup>6</sup>	2.45*10 <sup>6</sup>
<b>Luv Kush Chowk</b>	3.5*10 <sup>6</sup> 1.6*10 <sup>6</sup> 0.7*10 <sup>6</sup> 1.4*10 <sup>6</sup>	1.8*10 <sup>6</sup>	1.19*10 <sup>6</sup>
<b>Milap Chowk</b>	1.2*10 <sup>6</sup> 2.3*10 <sup>6</sup> 2.9*10 <sup>6</sup> 2.7*10 <sup>6</sup>	2.27*10 <sup>6</sup>	0.75*10 <sup>6</sup>
<b>Chick-Chick Chowk</b>	5.2*10 <sup>6</sup> 18.3*10 <sup>6</sup> 2.4*10 <sup>6</sup> 3.2*10 <sup>6</sup>	7.27*10 <sup>6</sup>	7.44*10 <sup>6</sup>
<b>Nakodar Chowk</b>	4.2*10 <sup>6</sup> 6.3*10 <sup>6</sup> 1.4*10 <sup>6</sup> 15.1*10 <sup>6</sup>	6.75*10 <sup>6</sup>	5.91*10 <sup>6</sup>
<b>Kapurthala Chowk</b>	2.0*10 <sup>6</sup> 7.0*10 <sup>6</sup> 9.3*10 <sup>6</sup> 1.9*10 <sup>6</sup>	5.05*10 <sup>6</sup>	3.70*10 <sup>6</sup>

Hygienic quality of these pastry samples on the basis of yeast and mold count with their mean value is given in Table 3. The mean results indicate that the highest contamination found in Chick- Chick chowk (92.5\*10<sup>5</sup> cfu/g) followed by Nakodar chowk (34.33\*10<sup>5</sup> cfu/g),

**Table 2. Microbiological Quality (CFU/g) of Pastry samples on the basis of Aerobic Colony Count (ACC)**

Name of Area	Microbiological quality (CFU/g) on the basis of ACC as per PHLS guidelines		
	Satisfactory < 10 <sup>5</sup>	Acceptable 10 <sup>5</sup> -< 10 <sup>6</sup>	Unsatisfactory ≥10 <sup>6</sup>
<b>Bus Stand Premises</b>	-	-	100%
<b>Station Road</b>	-	-	100%
<b>Rama Mandi</b>	-	-	100%
<b>Jyoti Chowk</b>	-	-	100%
<b>Model Town</b>	-	-	100%
<b>Luv Kush Chowk</b>	-	-	100%
<b>Milap Chowk</b>	-	-	100%
<b>Chick-Chick Chowk</b>	-	-	100%
<b>Nakodar Chowk</b>	-	-	100%
<b>Kapurthala Chowk</b>	-	-	100%

Kapurthala chowk (28.5\*10<sup>5</sup> cfu/g), Rama Mandi (8.75\*10<sup>5</sup> cfu/g), Bus stand premises (8.25\*10<sup>5</sup> cfu/g), Milap chowk (6.33\*10<sup>5</sup> cfu/g), Model Town (4.66\*10<sup>5</sup> cfu/g), Jyoti chowk (3.66\*10<sup>5</sup> cfu/g), Station road (1.5\*10<sup>5</sup> cfu/g) and Luv Kush chowk (1.33\*10<sup>5</sup> cfu/g).

**Table 3. Microbiological Quality (CFU/g) of pastry samples on the basis of Yeast Mold Count**

Name of Area	Yeast Mold Count Cfu/g	Mean	Standard Deviation	Microbiological quality (CFU/g) on the basis of YMC as per WQAS guidelines	
				Maximum Limits <1, 000 cfu/g	% of Unsatisfactory Samples
<b>Bus Stand Premises</b>	4.0*10 <sup>5</sup> 2.0*10 <sup>5</sup> 25.0*10 <sup>5</sup> 2.0*10 <sup>5</sup>	8.25*10 <sup>5</sup>	11.20*10 <sup>5</sup>		100%
<b>Station Road</b>	<b>Out of 4, 2 shows growth</b> ND ND 1.0*10 <sup>5</sup> 2.0*10 <sup>5</sup>	1.5*10 <sup>5</sup>	0.70*10 <sup>5</sup>		50%
<b>Rama Mandi</b>	10.0*10 <sup>5</sup> 12.0*10 <sup>5</sup> 6.0*10 <sup>5</sup> 7.0*10 <sup>5</sup>	8.75*10 <sup>5</sup>	2.75*10 <sup>5</sup>		100%
<b>Jyoti Chowk</b>	<b>Out of 4, 3 shows growth</b> 3.0*10 <sup>5</sup> 7.0*10 <sup>5</sup> ND 1.0*10 <sup>5</sup>	3.66*10 <sup>5</sup>	3.05*10 <sup>5</sup>		75%
<b>Model Town</b>	<b>Out of 4, 3 shows growth</b> 2.0*10 <sup>5</sup> 10.0*10 <sup>5</sup> ND 2.0*10 <sup>5</sup>	4.66*10 <sup>5</sup>	4.61*10 <sup>5</sup>		75%
<b>Luv Kush Chowk</b>	<b>Out of 4, 3 shows growth</b> 1.0*10 <sup>5</sup> 1.0*10 <sup>5</sup> ND 2.0*10 <sup>5</sup>	1.33*10 <sup>5</sup>	0.57*10 <sup>5</sup>		75%
<b>Milap Chowk</b>	<b>Out of 4, 3 shows growth</b> 15.0*10 <sup>5</sup> 2.0*10 <sup>5</sup> 2.0*10 <sup>5</sup> ND	6.33*10 <sup>5</sup>	7.50*10 <sup>5</sup>		75%
<b>Chick- Chick Chowk</b>	107.0*10 <sup>5</sup> 220.0*10 <sup>5</sup> 17.0*10 <sup>5</sup> 26.0	92.5*10 <sup>5</sup>	94.14*10 <sup>5</sup>		100%
<b>Nakodar Chowk</b>	<b>Out of 4, 3 shows growth</b> 71.0*10 <sup>5</sup> 28.0*10 <sup>5</sup> 4.0*10 <sup>5</sup> ND	34.33*10 <sup>5</sup>	33.94*10 <sup>5</sup>		75%
<b>Kapurthala Chowk</b>	<b>Out of 4, 2 shows growth</b> 2.0*10 <sup>5</sup> 55.0*10 <sup>5</sup> ND ND	28.5*10 <sup>5</sup>	37.47*10 <sup>5</sup>		50%

The results suggest high negligence during the storage of the products. As observed during sample collection, the handling of pastry with bare hands, non-usage of aprons, absence of hair covering and handling of money during serving might also contribute to poor hygienic conditions. At the same time, busy road with heavy vehicular traffic and presence of garbage dumps along the roadsides might increase the air borne particles which ultimately increase the contamination. Consumption and purchase practice of the consumers showed in Table 4.

**Table 4. Consumption and Purchase of “Pastries” in Jalandhar City, Punjab**

Questions	Frequency, n= 104	% of responses
<b>Do you like pastries?</b>		
Strongly agree + Agree	80	76.9
Neither	8	7.7
Strongly disagree + Disagree	16	15.4
<b>Do you eat it?</b>		
Strongly agree + Agree	82	78.8
Neither	9	8.7
Strongly disagree + Disagree	13	12.5
<b>Do you purchase from a special vendor?</b>		
Strongly agree + Agree	55	52.9
Neither	28	26.9
Strongly disagree + Disagree	21	20.2
<b>Do you purchase it daily?</b>		
Strongly agree + Agree	11	10.6
Neither	23	22.1
Strongly disagree + Disagree	70	67.3
<b>Do you eat in the morning?</b>		
Strongly agree + Agree	12	11.5
Neither	19	18.3
Strongly disagree + Disagree	73	70.2

Most respondent were male (50.96%), female (49.09%), among them employed (48.07%), Student (47.11%) and unemployed (3.84%). Maximum respondent consumed pastry (78.8%). The consuming public purchased pastry

from special vendors (52.9%). Only consumers (10.6%) purchased the pastry daily. Only (11.5%) consumers eat the pastry in the morning. In terms of consumer awareness and occurrence of food borne illness showed in Table 5.

**Table 5. Awareness and occurrence of foodborne illness by the consuming public of “Pastries” in Jalandhar city, Punjab**

Questions	Frequency, n= 104	% of responses
<b>Are you aware that the pastries are made up of with the help of yeast?</b>		
Strongly agree + Agree	79	76
Neither	9	8.7
Strongly disagree + Disagree	16	15.4
<b>Are you asking your vendors about the freshness of the pastries?</b>		
Strongly agree + Agree	75	68.3
Neither	15	19.2
Strongly disagree + Disagree	14	12.5
<b>Are you aware that foodborne diseases/ illness may be transmitted through the consumption of food e.g. pastries?</b>		
Strongly agree + Agree	71	68.3
Neither	20	19.2
Strongly disagree + Disagree	13	12.5
<b>Have you ever felt any ill effects from eating pastries?</b>		
Strongly agree + Agree	30	28.8
Neither	30	28.8
Strongly disagree + Disagree	44	42.3
<b>Did you make a formal report of your foodborne illness to your local health department?</b>		
Strongly agree + Agree	13	12.5
Neither	24	23.1
Strongly disagree + Disagree	67	64.5

Most consumers (68.3%) were aware that foodborne diseases/ illness may be transmitted through the consumption of pastry. Regarding the freshness of the pastry (12.5%) consumers never asked to the retailer. Of the (28.8%) of consumers who felt ill from the consumption of pastry, only (12.5%) visited a doctor. In 2011 at the end of September month, total 403 cases of food poisoning has been reported in which 6 death case was recorded in India (Anonymous 2011), also supports the view that there is an

urgent requirement to implement food safety guidelines to ensure the safety and quality of pastry.

Overall, the results of the study indicate that all the pastry samples studied in Jalandhar city are heavily contaminated. This may be attributed to non-enforcement of inspection act and lack of maintenance of standard hygiene practices in relation to pastry, thereby suggesting possible risk of infection involved in the consumption of such food. There is a need to implement guidelines to ensure the safety and quality of food.

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