

**MICROBIAL ASSESSMENT OF PRE-PACKAGED FOOD****PRACHI CHAUDHARY<sup>1</sup>, SHELZA BANYAL<sup>1</sup>, VIKAS BENIWAL<sup>1</sup> AND VARSHA SINGH<sup>\*2</sup>**<sup>1</sup> Department of Biotechnology, Maharishi Markandeshwar University, Mullana –Ambala-133203<sup>2</sup> Department of Microbiology, Maharishi Markandeshwar University, Mullana –Ambala-133203**ABSTRACT**

The present study was conducted to check the microbiological safety of pre-packaged foods during January 2011 to April 2011. A total of 30 randomly collected samples from retail outlets were subjected for presence of microorganisms and total viable count. Out of 30 samples 28 (93.2%) showed the growth, Total Viable count ranged from  $4 \times 10^2$  to  $2.5 \times 10^7$  CFU/g. Among positive samples 57.14% were Gram-positive organisms, 35.70% Gram-negative organisms while 7.14% fungus i.e. *Candida*. Amongst Gram negative organisms maximum isolates were of *E. coli* 70% , 10% *Pseudomonas sp.* & 20% *Klebsiella sp.* ,while *Staphylococcus aureus* 18.75% was the predominant Gram positive pathogen followed by *Streptococci sp.* 6.25%. The presence of potential pathogens in food samples reveals the need of accomplishment of quality control measures in marketing to improve public health risk.

**KEYWORDS:** Pre-packaged foods, Microbiological safety, Pathogenic, spoilage bacteria.**VARSHA SINGH**Department of Microbiology, Maharishi Markandeshwar University,  
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## INTRODUCTION

The most essential component of human survival is food. It is a chemically complex matrix and is a rich source of proteins, carbohydrates, fat, fiber, vitamins or minerals. Food contains almost all the essential nutrients that support microbial growth. (Newton E. D., 2007) Microbial growth is controlled by intrinsic and extrinsic factors. Intrinsic factors are of the food itself, and extrinsic factors are of the environment where the food is being stored. The intrinsic factors include pH, moisture content, water activity, oxidation-reduction potential, physical structure of the food, available nutrients. Extrinsic factors include temperature, relative humidity, gases present, and the types and numbers of microorganisms present in the food. Food composition is a major intrinsic factor. The pH of food plays an important role in the growth of microorganisms. For example neutral and alkaline pH supports bacterial spoilage. Among extrinsic factors, temperature and relative humidity plays important role in spoilage of food. If relative humidity is high microbial growth will be initiated more rapidly. The environment in which the food is stored is also important. This is particularly true with packaged foods because several packaged materials increased growth of surface-associated microorganisms due to oxygen diffusion. (Willey and Shrewood, 2008; Adams and Moss, 2008). Fluctuation in any of the discussed factors can result in food borne illness. Common microorganisms that cause food borne illness are *Salmonella sp.*, *Campylobacter jejuni*, *Clostridium perfringens*, *E.coli*, *Bacillus sp.*, *Listeria monocytogens*, *Salmonella sp.*, *Pseudomonas aeruginosa*, *Vibrio cholera*, *Streptococci sp.*, *Yersinia enterocolitica*, *Staphylococcus aureus*, *Toxoplasma sp.*, *Aspergillus sp.*, *Mucor rouxii*, *Neurospora*, *Yeast*, etc. (Scallan et al, 2011;Easa, 2010). Food borne disease is perhaps the most widespread health problem in the contemporary world. Microbes associated with contaminated foods result in outbreak of diseases like food poisoning, dysentery, diarrhea, cholera, typhoid,

botulism, campylobacteriosis, gastrointestinal infection, listeriosis etc. Hectic and modern life style attracts the people towards packaged foods. Packaged foods are ready to eat and time consuming. In the late 1970s and early 1980s, with the arrival of plastic as a packaging material, the use of paper faded away. Paper is the oldest form of what today is referred to as "flexible packaging." As a type of rigid packaging, glass and sealed cylindrical cans have many uses today. With the change of time for packaging, molded deodorant squeeze bottles and heat shrinkable films were introduced. One rather recent development in packaging is the labeling of the product with the company name and contents information. (Berger, 2002)

A number of materials are used in food packaging, such as aluminium foil used in chocolate, dairy product. Paper and cardboards made from wood pulp are used to wrap food products like butter, ghee, juices etc. Flexible plastic films are also widely used as a packaging material for milk, snacks, dried food etc., While drinks, squash, milk, water etc are packed using plastic and glass bottles. Packaged foods possess many advantages. It provides all necessary information regarding nutritional status. They provide fewer calories and may prevent overeating since your portions are pre-determined. Though pre packaged foods have become the part and parcel of life, yet they are not the healthiest choice. Packaged foods contain additives and preservatives such as salt which when taken in excess can be linked to poor heart health, bloating and kidney disease (McLaughlin , 2011) Food contamination can occur at multiple steps along the food chain, including production, processing, supply, retail marketing and handling. An outbreak in June 2006 prompted the implicated company to reveal their findings. In the findings, a leaking pipe was discovered that leaked waste water into the milk chocolate crumb mixture. (Elamin A., 2006.) A survey on pre-packaged sandwiches in Ireland reported *Listeria monocytogens* and

*Staphylococcus aureus* in their samples. (FSAI, 2010). Bjorkroth et al. (1997) reported *Lactobacillus fructivorans* in their study. The present study was an attempt to explore the microbiological safety of pre-packaged foods. Microbial quality of pre-packaged food samples were analyzed.

## MATERIALS AND METHODS

The present study has been conducted on 30 randomly collected pre-packaged food products from retail outlets. (Table-1).

### (1) Collection of samples

A total of 30 samples were randomly collected from retail outlets. All samples were collected in sterile container, transported to the laboratory under appropriate condition and refrigerated until further analysis. Only pre-packaged foods were included in this study.

### (2) Preparation of food samples

From each sample 1g was aseptically weighed in a sterile container or on sterile grease-proof paper and macerated and

homogenized it with 5 ml peptone water. This mixture was incubated at 37°C for 16-18 hrs.

### (3) Isolation of microorganisms

Samples were cultured on Blood agar, MacConkey's agar, Selenite F broth and Sabouraud dextrose agar & incubated aerobically at 37°C for 24 hrs. (Mackie and McCartney, 2007). Next day the pathogen was identified colony morphology & confirmed by a battery of biochemical tests. Microbiological standards for satisfactory, unsatisfactory and acceptable levels based on public health laboratory service (PHLSa3w) guidelines for ready to eat foods.

## RESULTS

The present study was performed to give information of the distribution and presence of pathogenic microorganism in pre-packaged foods. Some of the pre-packaged food samples examination contained pathogenic bacteria. In the present study a total of 30 samples were analyzed for microbiological parameter (Table- 2), Out of which 93.2% were found positive (Table 1)

**Table 1**  
*Isolation rate of microorganisms*

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*This table depicts the rate of isolation of microorganisms.*

Total number of items studied	No. of positive samples
30	28 (93.2%)

**Table 2**  
*Microbiological quality of Pre-Packaged food*

**Table 2**  
*This table summarizes the samples which we tested in present study and total viable count.*

Sample No.	Name of samples	Storage Condition	Due Expiry Period	Total viable count (cfu/gm)	<i>Staphylococcus</i> count (cfu/gm)	<i>E.coli</i> count (cfu/gm)	<i>Bacillus</i> count (cfu/gm)
Sample1	Sauce	R T*	4months and 24 D*	$3 \times 10^5$	---	---	$2.8 \times 10^4$

Sample2	Sauce	R T	9months	$2 * 10^5$	---	---	$3.5 * 10^4$
Sample3	Fruit jam	R T	3months	$8.5 * 10^6$	---	---	$8.2 * 10^2$
Sample4	Pineapple juice	R T	3months	$2.5 * 10^7$	---	---	$2.3 * 10^3$
Sample5	Guava juice	R T	3months	$6.7 * 10^3$	---	---	$3.4 * 10^3$
Sample6	Vegetable Sandwich	5°C	12 hrs	$3 * 10^5$	---	$1.1 * 10^2$	---
Sample7	Chocolate	Cool and dry place	8months	$1 * 10^7$	---	---	$2 * 10^3$
Sample8	Milk powder	Cool and dry place	6months	$2.5 * 10^6$	11	---	$7.9 * 10^2$
Sample9	Ice cream	-18°C	After 4 months*	$8.9 * 10^5$	---	18	---
Sample10	Ice cream	-18°C	11 months	$4.2 * 10^3$	---	12	---
Sample11	Butter	>8°C	10 months	$3.6 * 10^4$	$2 * 10^3$	56	---
Sample12	Curd	>8°C	11 months and 9 D	$6 * 10^3$	---	---	---
Sample13	Paneer	4°C	1 day	$4 * 10^2$	---	82	---
Sample14	Pasteurized milk	>8°C	After 2 months*	$5 * 10^2$	---	15	---
Sample15	Tonned milk	Cool and dry place	4months	$6.6 * 10^3$	---	---	$3 * 10^3$
Sample16	Honey	R T	16 months	$8.2 * 10^2$	---	---	$1.1 * 10^2$
Sample17	Candy	Cool and dry place	5months	$1.2 * 10^6$	---	---	$1.1 * 10^4$
Sample18	Chococake	Cool and dry place	2months and 2 D	$9.2 * 10^5$	---	---	$1.8 * 10^4$
Sample19	Kurkure	Cool and dry place	2months	$3.2 * 10^3$	---	---	---
Sample20	Chips	Cool and dry place	3months	$1.8 * 10^3$	---	---	---
Sample21	Uncle chips	Cool and dry place	3months	$1.6 * 10^3$	---	---	---
Sample22	Onion Gravy	Cool and dry place	4months	$6.6 * 10^6$	58	---	---
Sample23	Ready to eat vegetable	Cool and dry place	10 months	$7.9 * 10^2$	---	---	$5.6 * 10^5$
Sample24	Ready to eat vegetable	Cool and dry place	9months	$1.9 * 10^4$	---	---	$2 * 10^3$
Sample25	Coffee	Cool and dry place	10 months	$2.7 * 10^3$	---	---	---
Sample26	Coffee	Cool and dry place	16 months	$3.2 * 10^3$	---	---	---
Sample27	Pickle	Cool and dry place	10 months	$5.6 * 10^3$	---	---	$1.7 * 10^3$
Sample28	Soft Drink	Cool and dry place	1 month and 20 D	$4.2 * 10^4$	---	---	---
Sample29	Gulab Jamun	Cool and dry place	5months	$1.7 * 10^3$	---	09	---
Sample30	Chocolate	Cool and dry place	8months	---	---	---	---

RT – Room Temperature , D – Day , After Expiry Date  
\* Cfu/1000 ml

Samples of Pre packaged food comprises *E. coli*, *Pseudomonas*, *Klebsiella*, *Staphylococcus aureus*, *Bacillus sp.*, *Candida*. (Fig.-2).

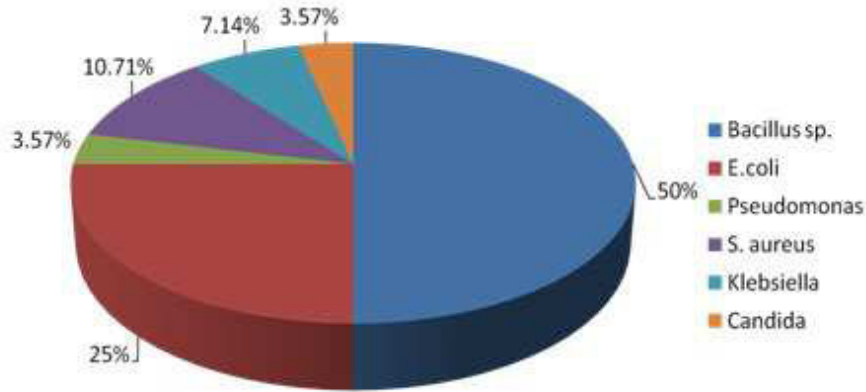


Fig.-2 Percent distribution of isolates in food samples.

**Figure 2**

*This figure contains the percent distribution of isolates.*

In present study we reported that most of the samples contain Gram-positive bacteria (Fig.-1).

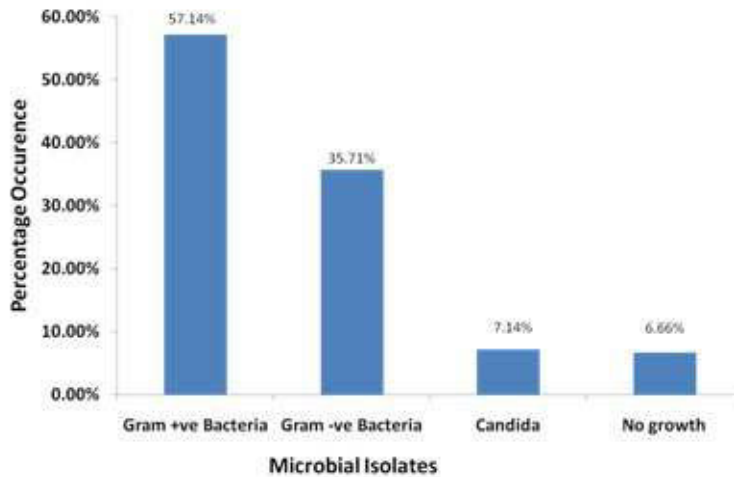


Fig.-1 Percentage occurrence of microbial isolates from pre-packaged foods

**Figure 1**

*The figure summarizes the percentage of isolated microorganisms.*

In the present study 7.14% samples contain *Bacillus* sp. at unsatisfactory level. 14.28% samples were unsatisfactory to *E. coli*., 33% samples were unsatisfactory to *Staphylococcus aureus*. (Fig.3)

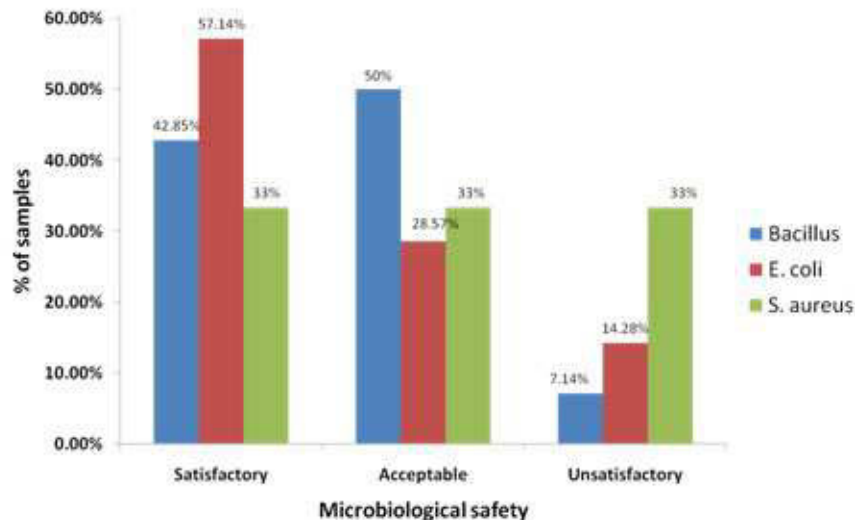


Fig.- 3 Percentage of microbial safety of samples

### Figure 3

**This figure shows the percentage of samples for satisfactory, unsatisfactory and acceptable levels of isolates.**

## DISCUSSION

More and more people are consuming the pre-packaged food may be because of the busy and tiring life style . Inappropriate storage and handling of packaged food can leads to Food borne disease which is most extensive health problem in current world. The present study was conducted to examine microbiological quality of prepackaged food. Out of 30 samples isolation rate of microorganisms was 93.2% (Table-1) which was supported by (FSAI, 2010), Cordier (1994), Laszlo Varga (2007), Joshi et al. (2004), Khomiri et al. (2009) in their study on pre-packaged sandwiches, chocolate, milk powder and pasteurized milk, ice cream, butters samples respectively by isolating the microorganisms. This may be due to extrinsic factors of the environment where the food is being stored at varying temp from  $-18^{\circ}\text{C}$  to  $25^{\circ}\text{C}$  that is higher than the recommended temperature The improper handling was at the level of retailer. The present study depicts isolation of pathogenic bacteria viz Gram positive bacteria ( 57.14%), *Staphylococcus aureus* , Gram

negative bacteria (35.71%) includes *E. coli*, *Klebsiella* sp., *Pseudomonas* sp. and fungus *Candida* sp.(Fig.-1, 2) Similar findings has been reported by Laszlo Varga (2007), Joshi et al. (2004), Varga (2007) and Khomiri et al. (2009), Stankiewicz et al. (2007) , Johanna et al. (1997),in their study they isolated coliforms in milk powder and pasteurized milk, icecream, butter , *Staphylococcus* in cheese and icecream samples and *Lactobacillus fructivorans* in tomato ketchup samples. The additional findings in the present study was *Pseudomonas* sp. and *Candida* sp. from sandwich and curd respectively. Deterioration of the quality of food in present study may be due to contact between microorganism and our foods through food handlers. *Staphylococcus aureus*, *E. coli* and *Bacillus* sp. are unsatisfactory at the range of  $10^4$  CFU/gm,  $10^2$  CFU/gm and  $10^5$  CFU/gm respectively. In present study 33% samples of pre-packaged food has unsatisfactory level for *Staphylococcus aureus* followed by 7.14% for *Bacillus* sp., whereas 14.28% samples had

unsatisfactory level for *E.coli*. (Fig.-3, Table-2) Similar findings were reported by FSAI (2010), the survey revealed that veg. sandwiches had unacceptable range for *Staphylococcus aureus*.

## CONCLUSION

In present study Gram-positive pathogenic organism, *Staphylococcus aureus* was predominant in milk and milk products, which had highest unsatisfactory level. Vegetable Sandwich, milk and milk products and gulab jamun reveals Gram-negative pathogenic organism *E.coli* which also had unsatisfactory level. *Pseudomonas* showed its presence in

veg. sandwich. Contamination in pre-packaged foods might be due to the reason that they were not stored at proper temperature by retailers which can be easily avoided. Moreover there is an urgent need of standard guidelines for food packaging process which should be followed vigilantly.

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### Conflict of Interest

There are no conflicts of interest.

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