



## Effect of food safety and nutrition awareness training at the household level and prevalence of adulteration

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### Abstract

**Aim:** This purpose of this research was to spread awareness on how to prepare safe, hygienic and nutritious food at the household level and to check the prevalence of adulteration.

**Methods:** The awareness program was conducted in Bhayander and Bhiwandi area among women of lower economic area. The participants were educated using PowerPoint presentation in Hindi based on nine sections namely, purchasing of food, storing food, preparing and cooking food, serving food, eating healthy food, packaging food, managing leftover food, maintaining hygiene and sanitation and managing waste along with live demonstration of adulteration tests. Pre-test and post-test were conducted for the awareness program in order to gauge the knowledge of participants. Comparative analysis of the observations was done using t-test to check the effectiveness of the training. Apart from this Samples of Sugar, Tea, Pepper, Chili Powder, Cumin Seeds, Mustard Seeds, Powdered Spices, Ragi were collected from Bhayander area to check the prevalence of adulteration in that area.

**Result and Conclusion:** It was observed that there was a significant increase in knowledge after the training session in Bhayander area. More than half of participants were not aware of fortified food products and storage methods for meat, poultry and fish and leftover food. Participants were also not aware that margarine and vanaspati ghee should not be preferred. Knowledge of First-in, First-out was and handling of leftover food was also rare. Adulteration was found in Pepper and Ragi.

**Keywords:** Adulteration, food safety, nutrition, prevalence of adulteration

### Introduction

Food safety refers to reducing the occurrence of the risks, whether chronic or acute, which can adversely affect the consumer's health. Food safety includes the processing, handling, storage, and preparation of food in a manner that avoids disease and contamination in the food production chain and helps to ensure that food quality and security are managed to promote good health. Foodborne diseases can result from the consumption of microbial pathogens, toxic chemicals or radioactive materials contaminated with food. Food safety is considered by producers, retailers, handlers, and regulators to be largely a supply-side issue reliant. Consumer issues also affect food safety, which is related to how consumers buy, cook, store, and eat food. The policy of the WHO does not fully address the habits of customers which also face risks.

A study in a rural area of India suggested that the knowledge towards food handling is not adequate and those who have adequate knowledge don't practice it regularly. In India, food safety is a growing problem with rampant instances of adulteration and contamination of essential foods that can be a potential source of disease infection or toxic poisoning. Food spoilage occurs mostly during handling from the primary producers to the consumers (e.g. food production, processing, packaging, distribution, storage, cooking or serving). Also, such food is deprived of nutrients essential for proper body growth and development. In many rural homes, small quantities of ingredients are sold out; adulteration is, therefore, a major safety concern.

Roughly 11% of all food sold in India is estimated to be adulterated, such that it is not widely considered a problem and most people are oblivious to even intentional adulteration. Non-permitted colours are the most common food additives. The poor-quality cardamoms (from which essential oils have been extracted) are mixed with good quality green cardamoms, and red pepper powder is adulterated with coloured sawdust in the weekly markets. Black pepper seeds are adulterated with papaya seeds and grass seeds coated with charcoal dust or mineral oil.

There is sufficient evidence to link high consumption of energy-dense food to rising rates of obesity and associated non-communicable diseases, the terms High fat, salt and sugar and nutrient-poor foods are commonly used to characterize foods perceived as unhealthy and to distinguish these from more nutritious options. All of these poses serious threat to nutrition safety, worsening the dual burden of malnutrition. There are increasing demands for restricting certain foods usually considered energy-dense and nutrient poor.

Since 2006, the Food Safety Standards Authority of India has led efforts to promote food safety, tighten food laws, and harmonize these laws with international standards and quality management systems.. Various Books have been made available by FSSAI -Pink book for safe food and sanitation at home, Yellow book for kids, Orange book for Office space and DART for rapid adulteration tests at home.. This project is based on FSSAI books- Pink book for safe food and sanitation at home and DART for rapid

adulteration tests at home. The Pink book consists of nine sections namely, Purchasing of food, Storing food, Preparing and cooking food, Serving food, Eating healthy food, Managing leftover food, Packing food, Maintaining hygiene and sanitation, and Managing waste talking about dos and don'ts at each level. The purpose of DART manual is to list out common methodologies which can be done at home available for food adulterants generally found in India.

Thus, keeping in mind the before stated factors, this research was designed to spread awareness on food safety and nutrition among the people of lower economic area. Knowing the fact that most of the decisions in Indian households are in the hands of the women of family, the target population were women of lower economic area.

This research stands out as it covers minute aspects of food safety and nutrition, right from procurement to waste management and adulteration. This research also takes care of the prevalence of adulteration in an area and thus can give an overall idea of the food safety and nutrition status of the city. And to top it up, the awareness program and post-test makes sure that action has been taken upon the finding of the research.

## **Materials and Methods**

### **1. Pre-preparation for Survey, Training on food safety and nutrition and adulteration test in the lab.**

A consent form was prepared along with a survey questionnaire, both in Hindi, which was used for pretest and post-test to gauge the understanding of participants on food safety and nutrition before and after the training program. The questions were based on the 9 sections of Pink book where participants were asked if they Do, don't do or don't know about various food safety and hygiene and nutrition practices.

A presentation for training purposes was made in Hindi based on Pink book of FSSAI which consists of 9 sections- Purchasing of food, Storing food, Preparing and cooking food, Serving food, Eating healthy food, Packaging food, managing leftover food, Maintaining hygiene and sanitation, Managing waste.

For the demonstration of adulteration test, following adulterated samples were collected – Milk, Sugar, Tea, Chili powder, Cumin seeds, Mustard seeds, Vegetables, Ragi, Pepper

Following miscellaneous requirements were collected for adulteration demonstration- Water, Transparent glass and spoons, Magnet, Cotton ball, Tincture iodine

For the study, area selected was Bhayander.

### **2. Visit to Bhayander area for Food safety and nutrition training based on Pink Book of FSSAI for household and Adulteration test demonstration**

Housewives of a society were approached to conduct the training and demonstration. Training was conducted after the survey using PowerPoint presentations made earlier on Food Safety and nutrition based on Pink Book for the household by FSSAI. A live demonstration on a few adulteration tests was also done after the presentation. Pre-

test and Post-test was conducted before and after training session using the survey questionnaire.

The forms were later collected and all the data of pre and post-test was documented for further analysis.

### **3. Method of collection of samples and their labelling**

Samples of Sugar, Tea, Pepper, Chili Powder, Cumin Seeds, Mustard Seeds, Powdered Spices, and Ragi were collected from Bhayander area for lab adulteration test. The samples were collected in minimum quantities as we were conducting preliminary test that required a minimum amount of sample. Collection of samples was basically done by visiting shops in Bhayander area. The cost of one sample was approximately 5 to 10 Rs. All the samples were not available in any one particular shop, as many of the shopkeepers were sceptical and reluctant to supply such small quantities or did not stock those materials lose.

### **4. Conducting Analysis of The Samples Collected from Bhayander To Check for Adulteration in Them**

Adulteration tests (which were referred from, were performed to detect following adulterants in the collected samples in the laboratory to check the prevalence of adulteration in an area- Water in milk, Starch in milk, Chalk Powder in Sugar, Iron Filings in Tea, Papaya seeds in Pepper Seeds, Water-Soluble Colours in Chili Powder, Grass seeds coated with Charcoal dust in Cumin Seeds, Argemone seeds in Mustard Seeds, Rhodamine B in Ragi.

### **5. Comparative analysis of the results obtained from the pre-training and post-training surveys from the Bhiwandi and Bhayander areas.**

The pre-training and post-training results were analyzed using a paired t-test to statistically understand the effectiveness of training in Bhayander area.

## **Results and Discussion**

Training was done of various housewives in Bhayander area on the lines of FSSAI guidelines for households (Pink Book by FSSAI) and pre-test and post-test were conducted to check the effectiveness of training. Adulteration tests of samples collected from different shops in the same areas was performed to check prevalence of adulteration in those areas.

### **1. Educating on Food Safety and Nutrition and Demonstration of Adulteration tests**

Training session was conducted in Bhayander and Bhiwandi area, where food safety and nutrition were explained using PowerPoint presentation and live demonstration of adulteration tests were done.

### **2. Pictures of the awareness program in Bhayander area**

Below are the pictures of the awareness program conducted among housewives in a society of Bhayander area (Figure 1.a, b, c, d) where the participants were educated using PowerPoint presentation and also live demonstration of adulteration tests was done.



**Fig 1a:** Demonstration of adulteration by starch in milk



**Fig 1b:** Demonstration of adulteration by water in milk



**Fig 1c:** Demonstration of adulteration in Chili powder



**Fig 1d:** Participants performing adulteration tests

### 3. Pre-test and Post-test outcomes of Bhayander Area

A total of 7 women from Bhayander area were part of the research. The participants were selected based on following factors:

1. The participants needed to be women from lower economic area.
2. They were easily accessible
3. The participants were willing to give information about

their food safety practices.

4. They were willing to co-operate completely
5. And the main criterion was their willingness to learn from the awareness program

Below are the responses of participants of Bhayander area (Table 1) of the Pre-test, i.e. the survey taken before the awareness program

**Table 1:** Count for Bhayander area Pre-test and Post-test.

	<b>Form number</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>
Pre-test response	Yes	47	43	50	35	50	49	50
Post-test response	Yes	53	53	54	53	53	54	54
Pre-test response	No	0	9	5	16	5	3	3
Post-test response	No	0	0	0	0	0	0	0
Pre-test response	Don't know	8	3	0	4	0	3	2
Post-test response	Don't know	2	2	1	2	2	1	1

\* 1 to 7 numbers denominate the unique participant form numbers. The number responses below that indicate the number of questions that got "Yes", "No" and "Don't know" responses for Pre-test and Post-test.

Below in Table 2 are the negative responses of participants in Bhayander area. It was shown in a research that many participants believed it was okay to use same cutting board for the preparation of raw and cooked food without cleansing the cutting

board with soap between uses. But the same trend was not found in survey of this research only 14% of participants were not aware about sanitizing cutting boards after each use after each use and use separate boards and knives for vegetarian and non-vegetarian food items

**Table 2:** Food safety and nutrition methods that people don't follow or weren't aware of in Bhayander area

<b>Questions</b>	<b>Total percent of participants not following</b>
Buy fortified wheat flour, rice, oil, milk, and salt	43%
Chose to buy vegetable oils, ghee, butter over vanaspati ghee and margarine	71%
Store food and non-food stuff separately	29%
Clean all storage areas and refrigerator regularly	14%
Store dry grains or flour in sealed containers with a scoop	14%
Wash and dry containers regularly	29%
Store poultry, meat, and fish in the freezer in a leak-proof container	100%

Store green leafy vegetables in perforated bags or paper towels	29%
Sanitize cutting boards after each use after each use and use separate boards and knives for vegetarian and non-vegetarian food items	14%
Cook food properly, so that it is evenly cooked from inside as well as outside	14%
Serve hot food hot and cold food cold	14%
Eat whole-grain cereals and pulses	29%
Eat protein-rich food such as pulses, groundnuts, soybeans, eggs, milk and if non-vegetarian, meat in every meal	86%
Follow the FIFO- First-in, First-out Rule	43%
Reuse leftover food to make healthy snacks	57%
Place leftover on the top shelf of the refrigerator	100%
Promptly discard doubtful leftover food without tasting it	43%
Avoid newspaper and plastic to pack food	29%
Refuse food given in polythene bags	14%
Cool food items before packing them to avoid build-up of steam	14%
Make sure to clean all dark, damp corners weekly	14%
Collect garbage in covered bins and dispose of garbage every day	14%
Clean dish or washcloths regularly with a disinfectant	14%
Use a bag to line your garbage bin before putting waste	29%
Give away excess food that is not likely to be consumed and likely to get spoiled	14%

\*The Food safety and Nutrition related in first column are those whose responses were negative that is “No” or “Don’t know”. The percent response indicates the percent of number of participants who gave negative response.

In another study some consumers who stored raw meat in the refrigerator would do this on the top or middle shelf and this could potentially lead to meat juice contaminating other foods. Similar thing was observed in this study as 100% of people didn’t have proper knowledge of storing non-vegetarian food.

In a survey, half of the group had awareness regarding nutritive value getting diminished because of overcooking. But in this research, all the participants had awareness regarding ill effects of over cooking on nutrients.

In another study, it was observed that consumers did not have adequate knowledge about refrigeration practices, and they did not consider themselves responsible for maintaining the cold chain and food safety. Here in this research too people didn’t have enough knowledge on

maintaining temperature of food. People didn’t know that left over food should be stored on the top shelf of temperature.

Though there are various books which have been made available by FSSAI -Pink book for safe food and sanitation at home, Yellow book for kids, Orange book for Office space and DART for rapid adulteration tests at home, it was observed that people are still not aware about these books or about the presence of FSSAI on social media.

#### 4. Effectiveness of awareness program as per t-test

A paired-samples t-test was conducted to compare the number positive responses in Pre-test and Post-test of Bhayander Area. Following in Table 3 is the result obtained as per t-test.

**Table 3:** Training Results as per T-test

Category	P value	≤/≥ significance level	Interpretation
Bhayander area: Pre and Post-test comparison	0.011893	< 0.05	There was a significant difference in knowledge

\*The t-test result was calculated considering the number of positive responses that is “Yes” responses of Pre-test and Post-test to find out if there was a significant improvement after the awareness program. As the p value was less that significance level it was interpreted that there was a significant difference.

There was a significant difference in the knowledge before (M=46.28571, SD=31.2381) and after the training (M=53.42857, SD=0.285714) conditions;  $t(6) = 2.446912$ ,  $p = 0.011893$ . These results suggest that the awareness program was effective in Bhayander area.

#### 5. Adulteration tests outcome

The samples of Sugar, Tea, Pepper, Chili Powder, Cumin Seeds, Mustard Seeds, Powdered Spices, and Ragi were collected from Bhayander area to check the prevalence of adulteration in the area. Outcome of adulteration tests of samples collected from Bhayander area is given below, in Table 4 below.

**Table 4:** Prevalence of adulteration in Bhayander area

Sample	Adulterant found	Number of samples in which adulterant was found	Total samples
Milk	Water	0	4
	Starch	0	
Sugar	Chalk powder	0	7
Tea	Iron filings	0	3
Chili Powder	Artificial colour	0	7
	Brick powder	0	
Pepper	Papaya seeds	6	6

Cumin seeds	Grass seeds	0	5
Mustard seeds	Argemone seeds	0	5
Ragi	Rhodamine B	2	2

\*The samples collected from various shops in Bhayander area were tested for certain adulterants as mentioned above and out of all samples only Pepper and ragi samples were found to be adulterated.

Summarizing the above adulteration observation, only Pepper and Ragi were found to be adulterated. Another noteworthy observation is that all the Ragi and Pepper samples were found to be adulterated in the Bhayander area. As per the research paper, "Food adulteration and contamination in India: occurrence, implication and safety measures", non-permitted colours are the most common food additives. In this study too, adulteration of Ragi with Rhodamine B (non-permitted colour) was observed in both the samples.

According to research "Common adulterants/contaminants in food and simple screening tests for their detection", adulteration of pepper is very common, same observation was made here as all the six samples were adulterated.

### Summary

1. Training was effective in Bhayander area.
2. There were 43 % of participants who were not aware or were not using fortified food products.
3. There were more than 50% of participants who were not using or were not aware of the fact that vegetable oil, ghee and butter should be preferred over vanaspati ghee and margarine.
4. 100% of participants did not know that poultry, meat and fish products should be stored in freezer in airtight container.
5. More than 50% of participants did not eat protein-rich food such as pulses, groundnuts, soybeans, eggs, milk and if non-vegetarian, meat in every meal.
6. FIFO or First-In, First-Out practice was not common among 43% of participants.
7. Reusing leftover food to make healthy snacks was also not common among the participants.
8. 100% of participants didn't know that they should keep leftover food on top shelf.
9. Out of 39 samples collected, all of the Pepper samples and both Ragi samples were adulterated.

Overall, the results indicate that, there is lack of awareness among women about food safety and nutrition. With proper training, there could be significant difference in the knowledge about food safety and nutrition. Though people are aware of nutrition to a certain extent, food safety is not that common. Adulteration is common in Pepper and Ragi.

### Conclusions

Broadly translated, the findings indicate that the training was significantly effective in both Bhiwandi and Bhayander areas. Also, on comparing the initial knowledge of participants Bhiwandi area and Bhayander area it can be concluded that there was no significant difference in the knowledge and the participants were at same knowledge level. On analysing the initial knowledge of participants, it was observed that participants were not aware of fortified food products and that use of margarine and vanaspati

should be avoided. Also, participants did not have knowledge on the storage methods, that is, they did not know how to store meat, poultry, and fish. They were also not aware of the storage methods of leftover food and concept of First-in, First-out. Other than this, participants were also unaware about proper handling methods for leftover food.

On conducting adulteration tests of samples from Bhayander area it was observed that adulteration of Pepper with low quality pepper or papaya seeds was common. Ragi was not available in most of the shops but out of two samples both were found adulterated with Rhodamine B.

Though the above results are significant, generalizations cannot be made as the number of subjects were small in case of both training and adulteration tests.

### Acknowledgement

The authors thank Nirmala Niketan college of Home Science, Mumbai and St. Xavier's College, Mumbai for help in conducting the research.

### Conflict of Interest

The authors declare no conflict in preparation of the manuscript.

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