IMPACT OF AN INTERVENTION PROGRAMME ON FOOD SAFETY AMONG WOMEN 'FOOD BUSINESS OPERATORS' IN TRIVANDRUM AND KOLLAM

by

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THESIS

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DECLARATION

I, hereby declare that this thesis entitled **"IMPACT OF AN INTERVENTION PROGRAMME ON FOOD SAFETY AMONG WOMEN 'FOOD BUSINESS OPERATORS' IN TRIVANDRUM AND KOLLAM"** is a bonafide record of research done by me during the course of research and the thesis has not previously formed the basis for the award to me of any degree, diploma, associate ship, fellowship or other similar title, of any other University or Society.

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CERTIFICATE

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LIST OF ABBREVIATIONS

BIS	- Bureau of Indian Standards
CCPs	- Critical Control Points
DGHS	- Director General of Health Service
EMB	- Eosine Methylene Blue
FPO	- Fruit product order
FSSAI	- Food Safety and Standard Authority of India
GMP	- Good Manufacturing Practices
GHP	- Good Hygienic Practices
HACCP	- Hazard Analysis and Critical Control Points
ICMR	- Indian Council of Medical Research
JECFA	- Joint FAO/WHO Expert Committee on Food Additives
KFC	- Kentucky Fried Chicken
NA	- Nutrient Agar
NFHS	- National Family Health Survey
PDA with RB	- Potato Dextrose Agar with Rose Bengal
PFA	- Prevention of Food Adulteration Act
SHG	- Self Help Group
TSS	- Total Soluble Solids

Introduction

1. INTRODUCTION

Our nutritional status, health, physical and mental faculties depend on the 'food we eat and how we eat it'. Access to good quality food has been man's main endeavor from the earliest days of human existence. Foods that are served to the consumers should be "clean and safe". Food- borne diseases are a worldwide problem of great magnitude, both in terms of human suffering and economic costs. The task of accurate estimation of the occurrence of food -borne diseases globally is truly formidable as in most countries.

Food is one of the basic necessities of life and food safety is a matter that affects anyone who eats food. Ensuring safe and healthy food is essential for improving quality of human life globally. Food safety is defined as the degree of confidence that food will not cause harm to the consumer when it is prepared, served, and eaten according to its intended use (WHO, 2004). Improving the safety of food supply and reducing food borne diseases require a concerned effort by all stakeholders from farm to table. Food safety has emerged as an important global issue with international trade and public health implications. Improving the safety of food supply and reducing food borne diseases require a concerned effort by all stake holders from farm to table (Singh, 2004).

Food borne illnesses are a widespread public health problem globally. Developing countries bear the brunt of the problem due to the presence of a wide range of food-borne diseases. In India an estimated 4,00,000 children below five years age die each year due to diarrhoea. Several millions more suffer from multiple episodes of diarrhoea and still others fall ill on account of hepatitis A, enteric fever, etc. caused by poor hygiene and unsafe drinking water. Many food products are highly perishable. They are easily contaminated when produced in an unhealthy and unclean environment. In fact, food is a very good indicator of environmental pollution and is quite often used to monitor the state of the environment. Microbiological contamination and spoilage of food needs to be prevented through good handling practice (www.fssai.gov.in).

The food processing industry is one of the largest growing industries in India. India is the world's second largest producer of food next to China. Food safety has emerged as an important global issue and food adulteration is also a major public hazard which affects the quality of life of people. At present, in Kerala, self help groups (SHG) are implementing a large number of village cottage industries, especially food processing industries. As consumers we are all concerned about the safety of the food we eat. And, we all consume a lot of processed foods now a days, which are sometimes processed at home/ cottage level. In the absence of quality control measures, quality packaging material, proper transport of foods, use of contaminated water, high turn-over of food handlers, lack of personal hygiene and non judicious use of colorants and preservatives, these units pose considerable food safety hazards. The popularity of these foods among consumers clearly reflects an urgent need for stringent food safety regulations for these food processing units (www.foodsafety.com).

In the above context, this study has been planned to conduct an intervention programme on food safety among women 'food business operators' running fruit and vegetable processing units in Trivandrum & Kollam district was attempted with the following objectives.

- To study the socio – economic and personal profile of the respondents
- To study the infrastructure facilities of the processing units
- To conduct food risk assessment of selected processed foods through microbial and chemical analysis
- To conduct an intervention programme on food safety for women 'food business operators' based on the food risk assessment conducted
- To assess the impact of the intervention programme through change in knowledge , attitude and practices adopted.
- To assess the extent of use of adulteration kit.

Review of Literature

2. REVIEW OF LITERATURE

Literature available on different aspects related to the present study entitled "Impact of an intervention programme on food safety among women 'food business operators'. in Trivandrum & Kollam" is reviewed under following headings.

2.1 Importance of food safety in the processing sector
2.2 Current scenario of food safety risks
2.3 Food safety risk and it's implications in human health
2.4 Adulteration in foods and it's health effects
2.5 Ensuring food safety in the food processing sector

2.1 IMPORTANCE OF FOOD SAFETY IN THE PROCESSING SECTOR

Food safety has emerged as an important global issue with international trade and public health implications. In response to the increasing number of food borne illnesses, governments all over the world are intensifying their efforts to improve food safety. The World Health Assembly adopted a resolution in which, the World Health Organization (WHO) was asked "to give greater emphasis on food safety with the goal of developing suitable, integrated food safety systems for the reduction in health risk along the entire food chain, from primary producer to the consumers".

The food processing industry is one of the largest growing industry in India. India is the world's second largest producer of food next to China. Owing to market forces such as rising income levels and changing consumer behaviours due to rapid economic growth, It is expected that the indian food industry reach a growth rate of 10 per cent in 2010 and 25 per cent in 2020. Indian processing sectors are mainly classifieds in to two types. Organized sector and Unorganized sector (www.foodsafety.com).

The present economic situation and global market conditions have led companies to look for ways to increase competitiveness by improving production

processes, reducing production costs, and improving product quality (Bal and Nath, 2005).

Many human illnesses are food-related. Nutritional status and economic well-being are affected by food carrying pathogenic organisms and their toxins and by poisonous chemicals. It is estimated that approximately 3 million children below the age of five die of diarrhoea every year. About 70 per cent of these deaths are said to be of food-borne origin (Jaganathan and Thomas, 2003).

Many food products are highly perishable. They are easily contaminated when produced in an unhealthy and unclean environment. In fact, food is a very good indicator of environmental pollution and is quite often used to monitor the state of the environment. Microbiological contamination and spoilage of food needs to be prevented through good handling practices (Chakravarthy, 2005).

Concern for the supply of food that is safe for the consumer has increased over the years. Rising liberalization of agro-industrial markets and the world-wide integration of food supply chains require new approaches and systems for assuring food safety. The days of locally produced food being processed, distributed and consumed in the same locality have significantly decreased in recent decades (Bhat, 2003).

Rapid proliferation of the street food industry has led to a growing concern for the safety of these foods. Serious health problems are arising the world over due to consumption of foods contaminated with pathogens or microbially spoilt foods (Raghuramaiah, 2001).

Eating away from home is a major trend of recent years. Many of the meals eaten away from home require extensive food handling and cold foods that are not cooked before consumption. Subsequently this leads to the potential for transmission of food-borne diseases from food handlers to consumers. Added mechanization and larger volume operations of food processing and preparation have increased the need for workers in all segments of the food industry to have an understanding of sanitary practices and how hygienic conditions can be attained and maintained.

A safe food supply that will not endanger consumer health and good quality food is essential for proper nutrition. It would ensure prevention of food borne diseases, provide consumer unadulterated food of good quality. It also promotes participation in International trade in food products and stimulates economic development (Kumar *et al.*, 2007).

Maintaining food safety and quality is essential in the entire chain of food production ranging from primary food production at the level of farmers, primary food processing at the farm, dairy, abattoir and grain mills, secondary food processing level such as canning, freezing, drying and brewing, food distribution, both at National and International level of import/export, Food retailing and Food catering and domestic Food preparation level (Sheth *et al.*, 2007).

Food processing is the transformation of raw ingredients into food, or of food into other forms. Food processing can provide quick, nutritious meal options for busy families (Kalpana and Srinivasan, 2004). Laudan and Rachel (2010) in their study reported that benefits of food processing include toxin removal, preservation, easing marketing and distribution tasks, and increasing food consistency. In addition, it increases yearly availability of many foods, enables transportation of delicate perishable foods across long distances and makes many kinds of foods safe to eat by de-activating spoilage and pathogenic micro-organisms. Processing can also reduce the incidence of food borne diseases and improve the taste.

Any processing of food can affect its nutritional density, the amount of nutrients lost depending on the food and method of processing. Another safety concern in food processing is the use of food additives. Food processing is typically a mechanical process that utilizes large mixing, grinding, chopping and emulsifying equipment in the production process. These processes inherently introduce a number of contamination risks. Large food processors will utilize many metal detectors within the processing stream, to reduce both damage to processing machinery as well as risk to the consumer (Karmas and Harris, 2005).

2.2 CURRENT SCENEARIO OF FOOD SAFETY RISKS

Abraham *et al.* (2009) reported that as the international commerce expands and people eating outside the home have enormously increased, food borne illnesses have become a major public health focus world wide. Food borne illnesses are a widespread public health problem globally. Developing countries bear the brunt of the problem due to the presence of a wide range of food-borne diseases

Studies revealed that food-borne diseases are a serious health hazard and important cause of morbidity and mortality in developing countries. Most cases go unreported and scientific investigations are rarely feasible (Bhat and Rao, 2004). Recent studies carried out during 2005- 2010 showed that the incidence of food-borne disease outbreaks were due to microorganisms like *Salmonella, Campylobacter jejuni* or Norwalk Virus, toxins like *Y. enterocolitica* (Anyawu and Jukes, 2010).

The WHO (2012) estimate that world wide food borne and water borne diarrhoeal diseases taken together kill about 2.2 million people annually. it is estimated that about 76 million people in the united states become ill from food borne pathogens each year and that about 5,000 of these people die.

According to the India retail report (2009), 80 per cent of the population eats outside at least once a month, while almost 28 per cent eats outside 4-6 times in a month. The reasons for that being demographic changes, emergence of nuclear families in urban areas, growing trends of female professionals etc. In India according to UNICEF (2012), an estimated 400,000 children under 5 years of age die each year due to diarrhoea. About 13.2 per cent prevalence of food borne diseases like diarrhoea, hepatitis A, and enteric fever have been reported in Hyderabad (Bhaskar *et al.,* 2004). The Hindu (2013) has reported that In Bihar, 22 children died due to food poisoning in midday meal and 41 students were hospitalized due to food poisoning in Kumbakonam, Street vended foods from Hyderabad were also found to cause food poisoning in college students.

Kerala news (2013) has reported the present status of food safety risks in Kerala that, seventy students of a school in Idukki district have been hospitalized

due to suspected food poisoning allegedly after they had food at the hostel. An Arabian delicacy (shawarma) caused death due to food poisoning in Kerala. KFC Kerala outlet sealed after live worms found in chicken and also 11hotels across Kerala were closed down (www. foodsafety.com).

2.3 FOOD SAFETY RISK AND IT'S IMPLICATIONS IN HUMAN HEALTH

Risk relating to public health hazards from food. Food risks could be classified as those with acute and chronic health effects of unsafe food.

2.3.1 Acute Health Effects of Unsafe Food

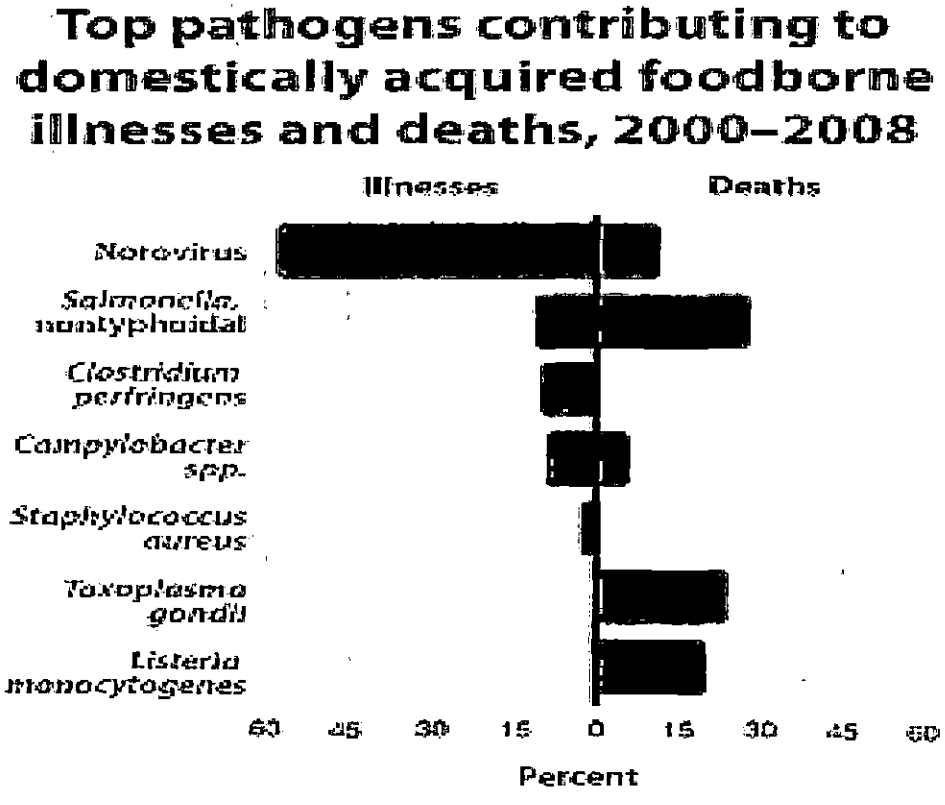
Centers for Disease Control and prevention (2005) reported that in the area of acute health effects, a majority of these problems are associated with pathogenic microorganisms, bacteria, viruses, and mold by products. Among these the most important organism which pose a hazard in processed food include bacteria like *Bacillus cereus, Brucella, Campylobacter jejune, Clostridium botulinum, C.perfringens, E.coli, Listeria monocytogenes, Mycobacterium bovis, salmonella typhi, vibrio parahaemolyticus and yersinia enterocolitica.*

Kaul and Mahajan (2004) in their study in Kerala revealed that the water used to prepare the street food was contaminated with fecal Coliforms and *Bacillus aureus.*

Studies reveal that food-borne diseases are a serious health hazard and important cause of morbidity and mortality in developing countries. Recent studies carried out during 1995-2005 showed that the incidence of food-borne disease outbreaks were due to microorganisms like Salmonella and *Campylobacter jejuni* (Amruthasri and Devi, 2005).

Babu and Shenolikar (2000) reported that microbiological examination of various food items served by the street vendors in various parts of India indicated the presence of microorganisms in most of the food sold as well as the use of non permitted coal tar food colours in sweetmeats and of *Lathyrus sativus*, a harmful legume banned under the Prevention of Food Adulteration Act.

According to Bhat (2003), the presence of naturally occuring environmental contaminants like mycotoxins in processed foods is rare. However there is a possibility of occurance of Aflatoxin in processed groundnut product like chikkies, curry powders containing chilies, aflatoxin M1 in milk products. Patulin in the apple juice, ochratoxin in soluble coffee and wine and deoxynivalenol in ordinary and refined wheat flour. Some of these mycotoxins cause toxicity in humans.



WHO, 2008 survey about pathogens contributing to domestically acquired foodborne illnesses has listed norovirus, salmonella, clostridium, campylobacter, staphylococcus, toxoplasma and *listeria monocytogenes* as the top most pathogens contributing to this. About 50 per cent of illnesses was due to norovirus and about 25 per cent of deaths occurred due to salmonella.

Simopoulos and Bhat (2008) have presented the acute health effects of fungal contamination, to various adulterants in foods which is shown in Table 1.

Table 1. Acute health effects of fungal contamination

Sl. No	Adulterant	Foods Commonly Involved	Diseases or Health Effects
1	Aflatoxins	Aspergillus flavus-contaminated+ foods such as groundnuts, cottonseed, etc.	Liver damage and cancer
2	Ergot alkaloids from Claviceps purpurea Toxic alkaloids, ergotamine, ergotoxin and ergometrine groups	Ergot-infested bajra, rye meal or bread	Ergotism (St.Anthony's fire-burning sensation in extremities, itching of skin, peripheral gangrene)
3	Toxins from Fusarium sporotrichioides	Grains (millet, wheat, oats, rye,etc)	Alimentary toxic aleukia(ATA) (epidemic panmyelotoxicosis)
4	Toxins from Fusarium sporotrichiella	Moist grains	Urov disease (Kaschin-Beck disease)
5	Entamoeba histolytica Viral	Raw vegetables and fruits	Amoebic dysentery

2.3.2 Chronic Health Effects of Unsafe Food

Chronic health effects are usually related to chemicals added to food or contaminating foods. In the production and processing of food different products are used such as fertilizers, pesticides, herbicides, food additives and in packaging. It causes possible damage to the digestive system, muscles, nervous, the immune system and other body organs (Hui *et al.*, 2006).

Schafer *et al.* (2009) found that chronic health effects have been related to heavy metal contaminants in food such as lead, mercury, and cadmium. Lead

contamination of food and the environment has been linked to encephalopathy, neuritis, anemia and learning disabilities in children.

In India in a multi centric study carried out by ICMR (2001) arsenic, cadmium, lead and zinc have been detected above permissible limits in commercial brands of infant formula. In canned fruit products arsenic and cadmium were detected. The other metals that can be found in canned products like fruit juices and jam are arsenic, aluminium, copper, iron, lead, tin and zinc (Mahadeviah *et al.*, 2004).

2.4 ADULTERATION IN FOODS AND IT'S HEALTH EFFECTS

The adulteration problem in India has attained massive dimensions. Adulteration may be intentional or unintentional. The former is a willful act on the part of adulterator who intends to increase the margin of profit. On the other hand, adulteration may be incidental contamination. The process of lowering the nutritive value of food either by removing a vital component or by adding substances of inferior quality, is called food adulteration and the substance that is used to lower the quality is known as adulterant (WHO, 2001).

Weston (2010) in a study reported that intentional adulteration is a willful act on the part of adulterator who intends to increase the margin of profit. Unintentional adulteration may be incidental contamination, which is usually due to ignorance, negligence or lack of proper facilities.

Vasanthakalam (2006) in his study reported that adulteration usually refers to mixing other matter of an inferior and sometimes harmful quality with food or drink intended to be sold. As a result of adulteration, food or drink becomes impure and unfit for human consumption.

In India several independent studies carried out in various parts of the country have focused on adulteration of different food with added colours. The findings of most of the studies showed that a variety of food such as milk products, non milk products, fresh vegetables, fruits and spices were usually adulterated with non permitted colours such as metanil yellow, congo red, malachite green and orange II (Rao, 2004).

An exposure assessment of the synthetic food colours in children indicated that in some of the subjects the intake of tartrazine, sunset yellow and erythrosine exceeded the acceptable daily intake of colours specified by the JECFA. Even these permitted food colours were known to evoke allergic reactions ranging from urticaria to dermatitis, angio oedema and exacerbation of the asthmatic patients in some individuals (Rao *et al.*, 2010).

Dixit *et al.* (1995) in a study showed that in India among the eight permitted colours, only six of the colours were being used to colour food consumed by most individuals.

A study in Hyderabad showed that many vendors were selling snack preparations which either contained synthetic colours that were not permitted to be used in food by the government or were prepared using unhygienic practices, while other studies in the same place showed that E. coli was highest in pineapple juice ($34.35x10^4$) indicating fecal contamination in the water used to make the juice (John, 1998).

According to Dyani and Saklani (2007), the three main causes of food adulteration are dishonesty of traders to make quick and easy money, loopholes in food adulteration act and ignorance of consumer regarding their right and responsibilities towards food adulteration resulting in faulty buying practices.

Evans *et al.* (2005) have reported that the use of certain colours has been banned as they are well known or their toxicity in experimental animals. Non-permitted colours like auramine, rhodamine B, Sudan red, malachite green, orange II lead to retardation of growth and affects the proper functioning of vital organs like liver, kidneys, heart spleen, lungs, bones and the immune systems.

The commonly used metanil yellow could be injurious to the stomach, ileum, rectum, liver, kidney, ovary and testis. All the non- permitted colours can also bring about changes in genes, most having been identified as potential cancer-causing agents. Toxicity of permitted colours is also well demonstrated as allergic response to these colours e.g. Tartrazine (Holt and Henson, 2000).

2.5 ENSURING FOOD SAFETY IN THE FOOD PROCESSING SECTOR

Mishandling of food plays a significant role in the occurrence of foodborne illness. Improper food handling may be implicated in 97 per cent of all foodborne illness associated with catering outlets. In two studies of general outbreaks of infectious intestinal disease, the primary causes were related to poor food-handling practices. Improper practices responsible for microbial foodborne illnesses have been well documented and typically involve cross-contamination of raw and cooked foodstuffs, inadequate cooking and storage at inappropriate temperatures. Food handlers may also be asymptomatic carriers of food poisoning organisms (Clayton *et al.*, 2002)

The studies conducted by Daga *et al.* (2003) showed that most of the food handlers lacked training in food hygiene which was evident by the microbial count from their hand washings. Since food handlers in bigger eating establishments cater to a larger number of people, they are epidemiologically more important than domestic food handlers in spreading of food-borne diseases.

Butool (2004) reported that most of the street food recipes are very simple, involving limited utensils and material for the preparation. Hence, poor hygiene and sanitation practices are one of the major bottlenecks in street food vending. Inadequate water availability, location near garbage, exposure to atmospheric pollutants and poor personal hygiene practices of personal involved, all precipitate to higher incidents of health problems.

To help to minimize the spread of pathogens, it is important to follow proper hygienic practices. Some practices and procedures that will help reduce risk include: Wash your hands frequently. This is one of the most basic and important preventative measures you can take against the flu and some other viral diseases. Use warm soapy water and wash for 15-20 seconds (Morrison *et al.*, 2004).

Consideration of safety needs to be applied to the complete food chain, from food production on the farm, or equivalent, through to the consumer. To achieve this integration of following food safety tools is required. Good Hygienic Practice (GHP), Good Manufacturing Practice (GMP), and Hazard Analysis Critical Control Point (HACCP). These tools can be implemented worldwide, which can ease

communication with food distributors and regulatory authorities especially at port of entry.

Taylor (2000) reported that food safety management system is an integrated approach to food safety for the safe food production requires an all encompassing approach involving the food operatives at the shop flour through to the management.

Luby *et'al.* (2001) reported that large food companies in many parts of the world adhere to a code of manufacturing practice known as 'Good Manufacturing Practice (GMP)'. This code helps to assure that products are manufactured under conditions of proper storage and sanitation. GMP is a system for ensuring that products are consistently produced and controlled according to quality standards. It is designed to minimize the risks involved in any pharmaceutical production that cannot be eliminated through testing the final product (Kirby *et al.*, 2003).

Good manufacturing practices (GMP) refers to guidelines laid down by agencies which control authorization and licensing for manufacture and sale of food. These guidelines are laid down with the intention of providing minimum requirement that a food product manufacturer must meet while manufacturing of a food product , which then assures that the product manufactured in compliance with (GMP) practices are of good quality and does not pose any risk or hazard from cross contamination. Good manufacturing practice guidelines provides guidance for manufacturing, testing, and quality assurance in order to ensure that product is safe for human consumption (Chandrasekaran, 2005).

The hazard analysis and critical control points (HACCP) system is widely recognized as a management tool capable of ensuring food safety. The keyword of the system is "prevention" (Mortimore and Wallace, 2001), by means of the identification of possible contaminations before they occur, and of the definition of control measures to maximize food safety in every step of the process (Leitao, 1999 ; Cullor, 2001) .

Lack of food safety awareness among the workers in street foods resulted in high microbial loads. In a few studies, the Critical Control Points (CCPs) for deterioration of the quality of food was identified as *coliform* contamination from

the hands of the food handlers and this was reduced drastically when the food handlers used soap to wash their hands (Ismail and sumar, 2001).

Kashinath *et al.* (2009), found in a study of HACCP in the Khoa industry indicated that presence of coliforms, Bacillus cereus and Staphylococcus aureus contamination as the major problem. Barriers to the implementation of HACCP in small businesses have been identified which include lack of expertise, absence of legal requirements, financial constraints and attitudes (Taylor, 2001).

Most of the studies showed that food handlers were directly involved in some stages of food processing. These studies emphasized the need to educate food handlers on GMP/GHP and also that application of HACCP in the Indian context is possible and would yield the desired results of improving the safety of food (Sharma *et al.*, 2000).

Food handler training is seen as one strategy whereby food safety can be increased, offering long-term benefits to the food industry. A postal survey of manufacturing, retail and catering food businesses by (Mortlock, 2000) revealed that less than 10 per cent had failed to provide some food hygiene training for staff. This lack of training for food managers may restrict their ability to assess risks in their business and to assign appropriate hygiene training for their staff.

Aiyer (2001) reported that there is an urgent need to train food handlers in safe and hygienic catering operations, food material handling practices with special focus on layout, equipment and utensils, accessories, water supply, pre preparation, preparation, holding, dish washing and personal hygiene practices with the aim of serving safe food to consumers.

Vasanthakalaam and Manimegalai (2005) attempted improvisation of existing physical facilities, sanitation, hygiene and work schedule of a private canteen in Coimbatore. It was found that educating and training the personnel brought about a greater awareness among them, which in turn improved the sanitation of the canteen.

Recent studies carried out in various parts of Hyderabad to assess food safety in institutional catering, industrial canteens, and hospital catering and selected commercial and non-commercial food service institutions indicated that about 20

per cent of the personnel who had undergone training in institutions showed good scores when evaluated for their awareness on food safety. This was evident from their post-cooking storage practices, food handlers' hygiene and garbage disposal (SIIHH, 2007)

The knowledge, attitudes and practices of selected kitchen personnel from a selected group of hospitals showed that although most of them were aware of the food safety practices and hygiene, this was not evident from their practices (Murugeshan, 2004).

Devi (2005) in a study on improvisation of existing physical facilities, sanitation hygiene and work schedule of a private canteen in Coimbatore indicated that educating and training the personnel brought about a greater awareness among the personnel which in turn improved the canteen.

A similar study carried out in industrial canteens showed a majority of the food handlers to be in the habit of washing hands, wearing uniforms and aprons while cooking and there were no incidence of food-borne disease outbreaks, indicating that the food handlers who undergo training maintain good standards of hygiene (Yadav and Verma, 2006).

Amruthasree and Devi (2005) revealed that the sanitation and hygiene practices followed by commercial institutions were satisfactory, whereas in non-commercial institutions the personal hygiene of food handlers was not satisfactory.

Potty (2005) reported that food safety programs have become increasingly necessary due to technological advances in food and agricultural sectors and also due to social changes introducing new food habits. In the past, food was consumed by those who produced it or by their immediate neighbours. Increased world production, urbanization, industrialization and migration have however introduced new food safety problems into our food supply.

A study carried out by Shah *et al.* (1996) to investigate awareness pertaining to use of edible food colours among selected housewives in the north-western part of India showed that a majority purchased expensive and packaged food colours considering them to be safe. Although more than three fourth of the housewives were aware about the hazards due to non - permitted synthetic food colours, none

of them were aware of the limits at which the synthetic colours are added indicating that there is a need for consumer education programmes to impart knowledge on the purchase and use of safe edible food colours.

The knowledge, attitudes and practices of selected kitchen personnel from a selected group of hospitals showed that although most of them were aware of the food safety practices and hygiene, this was not evident from their practices (Uma *et al.*, 2003).

A study which was carried out to assess the attitudes and practices regarding diarrhoea in a rural community revealed that majority of mothers were not aware of the precautionary measures to be taken to prevent diarrhoea. A striking observation of the study was that the prevalence of diarrhoea was high (23 per cent) among pre-school children in spite of access to safe drinking water, availability of toilet facilities in most of the households and existence of a strong health infrastructure (Waghray *et al.*, 2005).

Gowri (2010) conducted a study on the impact of nutrition education and awareness of food safety among women self help groups (SHG) members in Dindigul District (Tamil Nadu). It was found that there was lack of awareness amongst the SHG women involved in food processing trade. Hence, it was suggested that educational materials need to emphasize safe food handling practices among the SHG women.

Gowri and Vasanthadevi (2012) conducted a study on microbial quality of food products sold by self help group women of informal sectors in Tamilnadu. They have suggested implementation of training programmes to these SHG women to improve the methods of preparation, serving food hygienically and proper packing.

Materials and Methods

3. MATERIALS AND METHODS

This chapter deals with the methodology followed in this study entitled "Impact of an intervention programme on food safety among women 'food business operators' in Trivandrum and Kollam".

The methodology is discussed under the following headings.

3.1 Locale of the study and selection of the respondents

3.2 Variables selected for the study

3.3 Research instruments used for the study

3.4 Food risk assessment

3.5 Development of adulteration kit and educational aids

3.6 Conduct of intervention programme

3.7 Impact assessment of the programme

3.8 Data processing and analysis

3.1 LOCALE OF THE STUDY AND SELECTION OF THE RESPONDENTS

The study was conducted in ten food processing units selling fruit and vegetable processed products selected at random from the list of processing units maintained by Trivandrum Corporation and Kollam. The ten food processing units were from Manacaud, Ambalathara, Thiruvallam, Nemom, Palapur, Vellayani, Konchiravila, Peroorkada, Pappanamcode, Kottarakkara, and Edava.

Fifty women food business operators were selected from the ten food processing units formed the study sample. Five 'food business operators' from each of the ten processing units were selected for the conduct of the study. Thus the total number of respondents were fifty.

3.2 VARIABLES SELECTED FOR THE STUDY

Based on the objectives, review of literature, discussions with experts and observations made the researcher, the following dependent and independent variables were selected for the study.

3.2.1 Dependent Variables

In this study knowledge, attitude and practices about food safety formed the dependent variables. Knowledge, attitude and practices have been measured using the knowledge test, attitude scale and safe food practice inventory developed for the purpose.

3.2.1.1 Knowledge on Food Safety and Their Importance

For the present study in order to measure gain in knowledge, a simple teacher made test was constructed following the procedure adopted by Santhoshkumar (1990) with slight modifications. A set of forty two closed ended questions were developed. This was approved by a panel of experts in the field of Home Science. Care was taken to ensure that the questions covered a wide range of subject matter selected for the study.

3.2.1.2 Attitude Towards Food Safety

Attitude of the respondents towards food safety was measured by developing an attitude scale using Edward method (1957). After discussion with experts, thirty statements were selected. Twenty two positive and eight negative statements were included in the attitude scale. Responses for each item were obtained in a five point scale ranging from 'strongly agree' to' strongly disagree'.

3.2.1.3 Adoption of Practices Towards Food Safety

Safe food Practices followed by the respondents like sanitary conditions of the unit, food preparation, handling and storage was measured by developing a interview schedule and observation. After discussion with experts, twenty four statements were selected. Responses for each item were scored by assigning 1 for all the positive answers and 0 score for all the negative answers.

3.2.2 Independent Variables

Based on the review of literature and discussions with experts selected independent variables that were expected to be related with the dependent variables were identified. The independent variables selected for the study are given below.

3.2.2.1 Age

It refers to the number of calendar years completed by the respondents at the time of interview. This variable was measured by directly asking the respondent the number of years she had completed at the time of investigation. Then the responses were categorized as below for statistical analysis.

Category	Age	Score
Young	≤ 35 years	1
Middle	36-55 years	2
Old	>55 years	3

Scoring pattern suggested by Sindhudevi (1994) was adopted with slight modification in the study.

3.2.2.2 Caste

The categorization followed in the Census Report of India (1991) was adopted in this study. All the respondents in the study population were classified into following category and scores were assigned as indicated against each other for the purpose of classification.

Category	Score
Forward caste	3
OBC	2
SC/ST	1

3.2.2.3 Type of Family

In this study family type means nuclear family or joint family. Nuclear family consists of husband, wife and their unmarried children whereas joint family is composed of grand parents and married sons and daughters with their spouses. The respondents were asked to indicate the type of family whether nuclear or joint type.

Supe and Singh (1968) in their study on dynamics of rational behavior of Indian farmers, nuclear family was given the score of 'one' and joint family a score of 'two'. The same procedure was followed in this study also.

Category	Score
Nuclear	1
Joint	2

3.2.2.4 Area of Residence

Area of residence is mainly classifieds in to urban and rural area. The respondents were asked to indicate the type of residence whether urban or rural area. An urban area was given the score as 'one' and rural area score as 'two'.

Category	Score
Urban	1
Rural	2

3.2.2.5 Type of House

Characteristic of the house is classified on the basis of roof and floor pattern. The following scores were used for the classification.

3.2.2.5. a Type of Roof

Category	Score
Tiled	1
Thatched	2
Tin roof	3
Concrete	4

3.2.2.5. b Type of Floor

Category	Score
Tiles	1
Concrete	2
Mosaic	3

3.2.2.6 Educational Status

It is defined as the formal education attained by the respondent (Jayalekshmi, 2001). Educational status of the respondents was measured using a scoring system developed by National Family Health Survey-2 (2001) as listed below.

Educational status	Score
Illiterate	0
Primary education	1
Upper primary	2
High school	3
Pre-degree	4
Degree/Diploma/Professional courses	5
PG and above	6

3.2.2.7 Occupational Status

Occupation is defined as the position of the respondent, which acts as a source of income in which he spends major part of his time and attention. The

occupational status of the different family members was assessed and grouped as follows.

Occupational status	Score
Government sector	1
Private sector	2
Casual labourer	3
Self employment	4

3.2.2.8 Type of Self Employment

The self employment status of the respondent were classified on the following basis. Each category was assigned a score of "1".

Type of self employment	Score
Food processing	1
Cattle raring/ poultry raring	1
Tailoring	1
Cultivation or Farming	1

3.2.2.9 Family Income

Monthly family income from all sources was taken into account for measuring this variable. The scoring procedure was adopted from Kuppuswamy's modified socio-economic status scale (2006).

Family income(Rupees)	Score
>= 979	0
980-2935	1
2936-4893	2
4894-7322	3
7323-9787	4
9788-19574	5
<=19575	6

3.3 RESEARCH INSTRUMENTS USED FOR THE STUDY

3.3.1 Interview Schedule

A structured and modified interview schedule was developed keeping in mind the objectives of the study (Lin and Sneed, 2010). Initially an English version of the questionnaire was developed and was translated in to Malayalam for field operation. The questionnaire was divided into five parts consisting of personal and socio-demographic characteristics, knowledge, attitude, practice and details about processing units. Part I was designed to determine the food handlers' socio-demographic characteristics including age, sex, academic qualification, ethnicity and income. The investigator collected general information by personally interviewing the subjects using an interview schedule and observation. The interview schedule helped to elicit information on the socio-economic background of the selected respondents, as well as personal characteristics, general health profile of the respondents, infrastructure facilities of the processing units.

Interviewing is considered as one of the reliable methods of collecting data (Rangaswamy, 1989). Besides, this technique also permits exchange of ideas and information (Sindhu, 1984). An interview schedule was constructed to collect information about the personal variables like age, sex, family type, family size, family income, and educational status of the respondents. Also information was collected about the socio-economic variables like occupational status, monthly income, type of house and cultivation details from the respondents. The interview schedule constructed is given in Appendix I.

Data on general health profile of the respondents and details of the food processing units like type of food processed, quantity, storage facility and marketing was assessed using a questionnaire. The questionnaire was pre-tested and standardized before administering among the respondents (Appendix II).

3.3.2 Construction of Food Safety Knowledge Test

A knowledge test to determine the knowledge level of the women food business operators about safe food, food quality and standards. Knowledge is a

body of understood information possessed by an individual or by culture, which is in accordance with established facts (Henersons *et al.*, 1987). In order to measure the knowledge level of the women food business operators regarding safe food, a knowledge test was developed by means of a simple teacher made objective type test constructed following the procedure adopted by Santhosh Kumar (1990) with slight modifications. Care was taken to ensure that the questions covered the entire range of subject matter selected for the study. An item pool of 60 statements relevant to food safety on selected areas such as food quality, processing, handling, storage and sanitary conditions was prepared. These statements were prepared from relevant literature. Both positive and negative statements were formed. Care was taken to use simple and clear statements with no ambiguity in language or idea to avoid confusion and doubts. A jury of subject experts analyzed the statements. In light of the suggestions made by experts, 50 statements were selected and were pre-tested. Based on the result of the pre-test, eight statements were discarded and remaining 42 items were selected for constructing the knowledge test.

The responses were collected in a dichotomous pattern i.e., Yes or No. Each correct response was given a score of one and the incorrect response was given a score of zero. Finally the scores were added up to get the knowledge score for each respondent. The maximum score for the test developed was 42 and the minimum score was 0. The constructed knowledge test administered is given in Appendix III.

3.3.3 Measuring Attitude of the Respondents Towards Food Safety

An attitude scale to assess the attitude of the women food business operators towards food safety and it's importance in processing area. Thurstone (1946) defined attitude as the degree of positive or negative effect associated with some psychological object towards which people can differ in varying degrees. As attitude cannot be directly measured and have to be inferred from the opinion and expression of the individual, it is imperative to have as many as clear and simple statements as to provide opportunity to the respondents to reveal the extremes of his or her attitude (Bagchi, 1999).

Attitude of the respondents towards food safety was measured by developing an attitude scale using Edward method (1957). For measuring the attitude of the respondents towards food safety an attitude scale was constructed. For these 40 statements showing both positive and negative attitude towards food safety were collected from available literature. These were later circulated among the faculty members and students for selecting the most appropriate statements for the scale. Finally thirty statements, twenty two positive and eight negative statements were selected for the attitude scale. Responses for each item were obtained on a five point scale ranging from 'strongly agree' to' strongly disagree'.

The scores assigned were "strongly agree-5", "Agree-4", "Undecided-3", "Disagree-2", "Strongly disagree-1". Negative statements were scored in the reverse manner. The attitude score of the respondents was obtained by adding up the score corresponding to their response pattern for each statement. There was thus a possibility for a respondent receiving a maximum score of 150 and a minimum score of 0. The attitude scale developed is presented in Appendix IV. The attitude scale developed was administered to the respondents.

3.3.4 Construction of Safe Food Practices Inventory

A safe food practices inventory to assess the sanitary conditions of the unit, food preparation, handling and storage were assessed by means of interview and observation. Care was taken to ensure that the questions covered the entire range of subject matter selected for the study. An item pool of 24 questions relevant to food safety practices to assess the sanitary conditions of the unit, food preparation, handling and storage were assessed by means of interview and observation. Care was taken to use simple and clear statements with no ambiguity in language or idea to avoid confusion and doubts. A jury of subject experts analyzed the questions. In light of the suggestions made by experts, 30 statements were selected and were pre-tested. Based on the result of the pre-test six statements were discarded and remaining 24 items were selected for constructing the practice test.

The responses were collected in a dichotomous pattern i.e., Yes or No. Each correct response was given a score of one and the incorrect response was given a score of zero. Finally the scores were added up to get the Practice score for each respondent. The maximum score for the test developed was 60 and the minimum score was 0.

3.4 FOOD RISK ASSESSMENT

Ten food processing units were chosen for the collection of samples. A total of ten processed food items commonly processed and sold by these units were selected for conducting food risk assessment through microbial and chemical tests.

3.4.1 Microbial Analysis

The items selected for microbial analysis were lemon pickle, grape squash, grape wine, narunandi squash, nutmeg syrup, mixed fruit jam, jackfruit halwa, narunandi syrup, jack fruit health tonic, and ginger lemon squash. These processed products were selected and subjected to microbiological evaluation within one day of collection. All the samples were collected in their own packaging materials and stored at ambient temperature. For the microbiological assay, 10/g or /ml of sample was weighed under aseptic condition, homogenized with 90 ml of sterile distilled water and mixed well (10^{-1} dilution). Serial dilutions were prepared and pour plate technique was used on appropriate selective media.

The selected food items for microbial analysis were brought to the laboratory under aseptic conditions, analyzed for total Bacterial count on Nutrient agar (NA), Coliforms on Eosin Methyline Blue Agar (EMB), Yeast and Moulds on Potato Dextrose Agar with Rosebengal (PDA with RB), Lactose fermenting and non fermenting on Macconkey agar (Mac). Standard procedures were followed for microbial analysis with the above respective media. All plates were incubated under aerobic conditions at 36±1°C for 24-72 hrs. The mean number of colonies counted was expressed as log colony forming units (cfu)/10 per gram.

Presence of coliforms was determined using Lauryl Tryptose Broth which is used for the detection of coliform bacteria in a variety of specimens. It is designed

to obtain rich growth and substantial amount of gas from coliform organisms and Kovax reagent was used for the indole production. Two to three characteristic colonies were labelled and transferred to lactose broth for further identification. After 24 hours, if gas production is observed, and for further confirmation and identification of the organisms biochemical tests were conducted. The composition of media is given in Appendix V.

3.4.2 Chemical Tests

The selected food samples such as lemon pickle, grape squash, grape wine, narunandi squash, nutmeg syrup, mixed fruit jam, jackfruit halwa, narunandi syrup, jack fruit health tonic, ginger lemon squash were subjected to chemical analysis such as acidity, moisture, TSS, preservatives and colours. Chemical analysis was done at the Government Food Analyst's Laboratory and the analytical results were compared with respect to prescribed standards as per regulation 2.12.1,3.1.2 (6) of FSS (Food Products Standards and Food Additives) Regulations 2011, were obtained. The methods of analysis followed for each food samples are given below.

Table 2. Chemical analysis of selected food items

FOOD ITEMS	QUALITY CHARACTERISTICS	NAME OF METHOD OF TEST USED
Lemon pickle	Synthetic food colour	DGHS Method
	Mineral acid	DGHS Method
	Sodium chloride content	DGHS Method
	Oil soluble colour	DGHS Method
	Benzoic acid	IS:3501:1966
	Acidity	IS 2860:1964
Grape squash	Total soluble solids	IS Method
	Saccharin	DGHS Method
	Acidity	IS 13844:2003
	Benzoic acid	ICMR Method
	Added synthetic food colours	ICMR Method

Grape wine	Total soluble solids Saccharin Acidity Benzoic acid Added synthetic food colours The alcoholic content	IS Method DGHS Method DGHS Method ICMR Method ICMR Method. IS: 3752
Narunandi squash	Total soluble solids Sugar content Saccharin Acidity Added synthetic food colours	IS Method DGHS Method DGHS Method IS 13844:2003 ICMR Method
Nutmeg syrup	Total soluble solids Sugar content Saccharin Acidity Added synthetic food colours	IS Method DGHS Method DGHS Method IS 13844:2003 ICMR Method
Mixed fruit jam	Total soluble solids Saccharin Added synthetic food colours	IS Method DGHS Method ICMR Method
Jackfruit halwa	Saccharin Sugar Benzoic acid Added synthetic food colours	DGHS Method DGHS Method DGHS Method ICMR Method
Narunandi syrup	Total soluble solids Added synthetic food colours Benzoic acid Saccharin Acidity	IS Method ICMR Method ICMR Method DGHS Method DGHS Method
Jackfruit health tonic	Total soluble solids Added synthetic food colours Benzoic acid Saccharin Acidity	IS Method ICMR Method ICMR Method DGHS Method DGHS Method
Ginger lemon squash	Acidity The sugar content Saccharin Total soluble solids	IS 13844:2003 DGHS Method DGHS Method IS Method

3.5 DEVELOPMENT OF ADULTERATION KIT AND EDUCATIONAL AIDS

3.5.1 Chart

Based on WHO software package (2007) on safe health practices for training food handlers, known as 'Five keys to safe health' a chart was prepared in Malayalam for conducting the intervention programme.

3.5.2 Booklet

A Booklet entitled "Aharapatharthangalile mayam engane kandupidikkam – oru kai pusthakam"was prepared in Malayalam. The booklet contains an introduction about safe food, food adulteration and it's consequences, a table showing common adulterated foods and the methods of detection of adulterants. A copy of the booklet is appended in Appendix VI.

3.5.3 Log Book

A log book was prepared in Malayalam with a table with different columns for name of the food articles tested, adulterants found if any, and remarks. This was supplied to the ten food processing units in order to test adulterants in the raw food materials purchased by them and record the adulterants present if any.

3.5.4 Adulteration Kit

Adulteration of food cheats the consumer and poses a serious risk to health. A common consumer may not have sufficient knowledge about purity and quality of food articles. Mere visual inspection does not serve the purpose especially when adulteration has assumed high degree of sophistication. With this view, Food Safety and Standard Authority of India has developed a manual entitled "Quick Test For Some Adulterants In Food" which helps the consumer to screen the day to day food articles for presence of adulterants if any. Based on this, an adulteration kit was developed, and supplied to the units for testing adulterants in the raw food materials used for processing. Chemicals such as Con.HCL, iodine solution, Con. sulfuric acid, Liquid paraffin and red litmus paper, lactometer, test tubes (five numbers of different sizes in each kit), filter paper, test tube holders, droppers,

Plate 1. Chart showing WHO "5 keys to safe food"

Plate 2. Adulteration kits

gloves, and cotton were included in each adulteration kit. A log book and manual were also included in the adulteration kit. Likewise, ten adulteration kits were developed and distributed to the ten food processing units in order to test adulterants in the raw food materials purchased by them and to record the adulterants present if any in the log book.

3.6 CONDUCT OF THE INTERVENTION PROGRAMME

The intervention programme was conducted for selected fifty women food business operators from ten food processing units. Based on the food risk assessment, consisting of microbial and chemical tests, a food safety intervention programme for two days duration was conducted for the respondents. The WHO software package(2007) on safe health practices for training food handlers, called '5 keys to safe health' was also utilized with necessary modifications to suit local conditions. As per the WHO package, the 5 keys to safe health handling are :

I. Keep clean
II. Separate raw and cooked
III. Cook thoroughly
IV. Cook food at safe temperature
V. Use safe water and raw materials

This package has been designed for use by personnel engaged in training of food handlers and can be downloaded for use. Awareness programme on safe food practices and demonstration of methods of detecting adulterants was conducted in the college under the supervision of the faculty of the department of Homescience. Food safety education was imparted during the programme following the "5 Keys to safe health" with the help of charts and booklet prepared. The training schedule followed for the programme is given below.

Table 3. The Training schedule for two days programme on food safety measures

Day & Time	Subject	Mode of conduct	Visual aids used
First Day **10.00 am - 1.00 pm**	Introduction on food safety measures	Lecture cum discussion	Chart, Booklet & Demonstration
	Personal hygiene and sanitation with special reference to food business operators		
	Food borne diseases and prevention methods		
Second Day **10.00 am –1.00 pm**	The WHO software package (2007) on safe health practices for training food handlers	Lecture cum discussion & demonstration	Chart, Booklet, Demonstration & Distribution of adulteration kit
	Adulteration, common adulterated foods and it's harmful health effects in humans		
	Demonstration methods used for detecting common adulterants present in foods		

3.7 IMPACT ASSESSMENT OF THE PROGRAMME AND THE EXTENT OF USE OF ADULTERATION KIT

The impact of the food safety intervention programme was assessed immediately after the programme and also one month after the conduct of the programme by studying changes in knowledge, attitude and adoption of safe practices in the food processing activities. The extent of use of the adulteration kit supplied was assessed by verifying the log book for recording adulterants present.

(A) First Day

(B) Second Day

Plate 3. Conduct of the intervention programme

Plate 4. Demonstration for detecting adulterants

Plate 5. Distribution of adulteration kits

The knowledge test , attitude scale and practice test were once again administered to the respondents for a post test and the scores were calculated as done earlier.

3.8 DATA PROCESSING AND ANALYSIS

The data collected were scored, coded, consolidated and subjected to statistical analysis and interpretations. The statistical procedures used in the present study were:-

(a) Percentage
(b) Mean Score
(c) Paired T-test
(d) ANOVA

Results

4. RESULTS

The objective of the present study is to conduct an intervention programme on food safety for women 'food business operators' based on food risk assessment and study the impact of the programme. A group of women food business operators were given awareness education through participatory approach by means of lectures, discussions, demonstrations, chart and booklet to improve their own as well as their families' health status.

The results obtained are presented under the following headings.

4.1 Personal and socio-economic characteristics of the respondents

4.2 Details of the food processing units

4.3 Food risk assessment

4.4 Conduct of the intervention programme

4.5 Impact assessment of the intervention programme

4.1 PERSONAL AND SOCIO – ECONOMIC CHARACTERISTICS OF THE RESPONDENTS

Personal and socio-economic characteristics of selected fifty respondents with reference to age, caste, type of family, area of residence, type of house, educational status, occupational status, type of self employment and income were assessed.

4.1.1 Age of the Respondents

Table 4, reveals that majority of the respondents (68 per cent) belonged to the middle age group (between 36-55 years), twenty four per cent of the respondents belonged to the young age group (up to thirty five years) and eight per cent constituted those in the old age group above fifty five years.

4.1.2 Caste of the Respondents

The caste wise distribution of the respondents as depicted in Table 4 proved that majority of the respondents (36 per cent) belonged to forward communities.

Thirty per cent were from Other Backward Communities and thirty four per cent respondents belonged to Scheduled Caste groups.

4.1.3 Type of Family

Table 4 depicts that majority of the respondents (80 per cent) belonged to nuclear family and twenty per cent belonged to joint family.

4.1.4 Area of Residence

Table 4 shows that majority of the respondents (86 per cent) were from urban area and about fourteen per cent belonged to rural area.

4.1.5 Type of House

Characteristic of the house is classified on the basis of roof and floor pattern. Table 5 shows that majority of the respondents (58 per cent) having concrete roof, twenty eight per cent having tin roof, twelve per cent having tiled roof and only two per cent having thatched roof house. And the floor pattern shows that about 48 per cent having concrete floor and about 42 per cent having mosaic floor and only ten per cent of the respondents having tiled floor.

4.1.6 Educational Status of the Respondents

The educational status of the respondents when assessed was seen to range from primary education to college level. The educational status of the respondents revealed that 18 per cent had studied up to pre-degree and 52 per cent had studied up to high school. Ten per cent had studied up to upper primary level, six per cent had studied up to primary education, 6 per cent had studied up to professional education and 8 per cent had studied up to degree level.

4.1.7 Occupational Status of the Respondents

Occupational status of the respondents revealed that majority of the respondents (82 per cent) were self employed. It was also observed that about

fourteen per cent were engaged in private sectors. Only 2 per cent were employed in government and 2 per cent were coolie.

4.1.8 Type of Self Employment

Type of self employment shows that hundred per cent of the respondents were doing food processing because the selected ones are from the food processing field. And from these about 32 per cent respondents were also doing tailoring, ten per cent were engaged in cattle/ poultry rearing and about 6 per cent were engaged in farming.

4.1.9 Monthly Family Income of the Respondents

Table 5 revealed that a considerable percentage (ie.,12 per cent) of the respondents had a monthly income within the range of Rs 7323-9787; 20 per cent of the respondents had an income ranging from Rs 4894-7322; 28 per cent of the respondents belonged to a low income category with a monthly income ranging from Rs 2936-4893; 38 per cent of the respondents belonged to the very low income range of Rs 980-2935 while 2 per cent of the respondents belonged to high income ranging from Rs 9788-19574 and no one belonging to very high income group.

Table 4. Distribution of respondents based on their personal characteristics (n=50

Variables	Category	Score	Number	Percentage
Age	Young ≤35 years	1	12	24
	Middle 36 – 55 years	2	34	68
	Old > 55 years	3	4	8
Caste	Forward caste	3	18	36
	OBC	2	15	30
	SC/ST	1	17	34
Type of family	Nuclear	1	40	80
	Joint	2	10	20
Area of residence	Urban	1	43	86
	Rural	2	7	14

Table 5. Distribution of respondents based on their socio-economic characteristics (n=50)

Variables	Category	Score	Number	Percentage
Type of house	a) Type of Roof			
	Tiled	1	6	12
	Thatched	2	1	2
	Tin roof	3	14	28
	Concrete	4	29	58
	b)Type of Flooring			
	Tiles	1	5	10
	Concrete	2	24	48
	Mosaic	3	21	42
Educational status	Illiterate	0	0	0
	Primary Education	1	3	6
	Upper Primary	2	5	10
	High School	3	26	52
	Plus Two	4	9	18
	Professional Education	5	3	6
	College level	6	4	8
Occupation status			1	2
	Employed in government	1	7	14
	Private jobs	2	1	2
	Coolie	3	41	82
	Self employed	4		
Type of self employment	Food processing	1	50	100
	Cattle / poultry rearing	1	5	10
	Tailoring	1	16	32
	Cultivation / Farming	1	3	6
Monthly income	>= 979	1	0	0
	980-2935	2	19	38
	2936-4893	3	14	28
	4894-7322	4	10	20
	7323-9787	5	6	12
	9788-19574	6	1	2
	<= 19575	7	0	0

4.2 DETAILS OF THE FOOD PROCESSING UNIT

Details of the food processing units like number of members, type of ownership, type of food processed, storage facility and marketing was assessed using an appropriate questionnaire.

4.2.1 Number of Members

In the selected ten food processing units, five units consisted of members between 11 – 15 members and thirty per cent of the units consisted of 5 – 10 members. Only twenty per cent of the units consisted of more than sixteen members.

4.2.2 Type of Ownership

From the survey it was also revealed that the majority of the food processing units (70 per cent) were running under joint owner ship and only thirty per cent of the units were run on family ownership. None of the units run under society or self ownership.

4.2.3 Location of the Units

The location of the food processing units revealed that about forty per cent of the units were functioning along with their home. Thirty per cent of the units were located in separate area outside and thirty per cent were located in friend's house. Majority of the food processing units were located in corporation area (60 per cent) and about forty per cent were located in panchayat area.

4.2.4 Production Details

Seventy per cent of the units processed products only on demand basis and 20 per cent of them processed products for melas and festivals. Only 10 per cent of them processed these products on regular basis.

Table 6. Details about the food processing units (10)

Variables	Category	Score	Number	Percentage
Number of members	5 - 10	1	3	30
	11 - 15	2	5	50
	16 – 20	3	2	20
Type of ownership	Society	1	0	0
	Joint	2	7	70
	Self	3	0	0
	Family	4	3	30
Location of the food processing unit	Separate area outside	1	3	30
	Alongwith the home	2	4	40
	Friends house	3	3	30
	Any other	4	0	0
Production of processed items	Regular basis	3	1	10
	On demand basis	2	7	70
	Formelas or festivals	1	2	20
Mode of packaging	Bottle	1	3	30
	Polythene cover	1	5	50
	Plastic container	1	2	20
Storage facilities	Good	1	7	70
	Poor	0	3	30
Fuels used	Electricity	1	1	10
	Gas	1	3	30
	Wood	1	4	40
	Kerosene	1	2	20
Sources of water supply	Pipe	1	6	60
	Pond	1	-	-
	Well	1	4	40
	River	1	-	-

4.2.5 Mode of Packaging

Details about the mode of packaging revealed that 50 per cent of the units were using polythene cover for packaging. Thirty per cent of the units used bottles for packaging and 20 per cent of the units used plastic containers for packaging processed products.

4.2.6 Storage Facilities

From the schedule it was also revealed that about 70 per cent of the units had good storage facilities. Among the selected respondents 70 percent of the respondents kept their vessels in clean and covered condition. Majority (50%) of the respondents used shelves for storing raw materials and vessels. Thirty percent of the respondents were found to keep both raw materials as well as vessels used for processing, on the floor itself.

4.2.7 Fuels Used in the Processing Units

Majority of the units (40 per cent) were using wood as fuel for processing, 30 per cent of the units were using gas, 20 per cent of them were using kerosene and only 10 per cent of the unit were using electricity for processing food products.

4.2.8 Sources of Water Supply

In the case of water used for processing units, it was seen that about 60 per cent of the units were using pipe water and forty per cent of the units were using well water for processing.

4.2.9 Specified Activities and Product Details by SHG's

Results of Table 7 revealed that majority of the units were commonly preparing products like jam, squash, pickle, and dried products.

Table 7. Specified activities and product details of SHG's

Sl. No	Name of the Self help group	Place	Activities
1	Sangamam food processing units	Manacaud	Jam, Squash, Jelly, Pickle, Dried products, Syrup
2	Devi food processing units	Vellayani	Jam, Squash, Jelly, Pickle, Dried products, Syrup
3	Viswas food processing units	Palapur	Jam, Squash, Jelly, Pickle, Dried products, Syrup
4	Amritha food processing units	Nemom	Jam, Squash, Jelly, Pickle, Dried products
5	Sowhrida food processing units	Peroorkada	Jam, Squash, Jelly, Pickle, Dried products, Syrup
6	Sooryodhaya food processing units	Pappanamcode	Jam, Squash, Jelly, Pickle, Dried products, Syrup
7	Narmadha food processing units	Thiruvallam	Jam, Squash, Jelly, Pickle, Dried products, Syrup
8	Navarathna food processing units	Ambalathara	Jam, Squash, Jelly, Pickle, Dried products, Syrup
9	Kalyani food processing units	Edava	Jam, Squash, Jelly, Pickle, Dried products, Syrup
10	Kairali food processing units	Kottarakara	Jam, Squash, Jelly, Pickle, Dried products, Syrup

4.2.10 Details about Training

Table 8. Details of training undergone by respondents

Variables	Category	Score	Number	Percentage
Whether members had undergone training	Yes	1	6	60
	No	0	4	40
Durationof training	Less than one week	1	4	40
	One week	2	2	20
	Two weeks	3	0	0
	One month	4	0	0

Table 8 shows that, in the selected ten food processing units only members from four units got training in food processing. The duration of training was less than one week for members of forty per cent of the units and members of 20 per cent of the units got training only for one week. It was found that none of the members from any of the units obtained training for two weeks and above.

4.2.11 Details about Marketing by the Units

Table 9. Marketing of the products by SHG's

Variables	Category	Score	Number	Percentage
Methods used for selling	Direct selling	1	7	70
	Through agents	1	3	30
Mode of marketing	Near by offices	1	0	0
	Near by schools and colleges	1	0	0
	Near by shops	1	3	30
	For melas	1	7	70

Table 9 shows that about 70 per cent of the units were using direct method for selling processed products, thirty per cent of the units were selling the processed products through agents. Seventy per cent of the units were marketing their products during melas and 30 per cent of the units were marketing their products through near by shops.

4.2.12 Details about Food Safety Measures

Table 10. Safe food measures followed in the processing unit

Sl.No	Safety measures	Percentage of use (%)
1	Use of gloves	0
2	Use of face mask	0
3	Use of cap on hair	0
4	Use of aprons	6
5	Tying up of hair during work	5
6	Use of tonsils	0
7	Use of detergents for cleaning	100
8	Use of waste management techniques	2
9	Daily mopping of processing units	10
10	Drying of vessels after washing	30

Table 10 shows that the safe food measures followed in the processing units were not adequate. It was found that none of them were using gloves, hair cap and face mask, only 6 per cent of them were using aprons, and only 5 per cent of them tied up their hairs during work. Majority of the respondents were using same clothes for mopping processing area and holding vessels. Only 2 per cent of the units had proper waste management systems, since they were making compost from wastes of the processing units. All the selected ten food processing units were using different detergents like dettol, lotions, lysole etc for cleaning their processing area. Majority (60 per cent) of them were mopping processing area

(A) With bare hands

(B) Without face mask, hair cap & apron

Plate 6. Unhygienic handling of food items observed

twice a week, 30 per cent were mopping thrice a week and only 10 per cent of the units were mopping daily. 30 per cent of them were drying their vessels after washing.

4.2.13 Production Details

Table 11. Details about production of processed food items

Items	Frequency of production of processed items (%)					
	Daily	**Weekly**	**Fortnightly**	**Monthly**	**Sometimes**	**Seasonally**
Jam	-	**10**	**60**	**30**	-	-
Squash	-	**20**	**10**	**70**	-	-
Pickle	-	**30**	**70**	-	-	-
Syrup	-	**30**	-	**50**	**20**	-
Jelly	-	-	-	**10**	**90**	-
Nectar	-	-	-	**20**	**80**	-
RTS	-	**40**	**10**	**50**	-	-

The table 11 shows the percentage of production of processed food items. In the selected ten food processing units 60 per cent of units processed jam fortnightly, 30 per cent processed jam monthly and 10 per cent of the units processed jam daily. In the case of squash production, 70 per cent of the units

processed squash on monthly basis, 20 per cent of the units processed weekly and 10 per cent of the units processed fortnightly. Seventy per cent of the units processed pickles fortnightly and 30 per cent of the units processed weekly. In the case of fruit syrup production fifty per cent of the units processed it on monthly basis, 30 per cent of them processed it weekly and 20 per cent of them processed fruit syrup sometimes only. Majority of the units (90 per cent) processed jelly sometimes and 10 per cent of the units processed jelly monthly. In the case of nectar production, 80 per cent of the units processed nectar sometimes and 20 per cent of the units processed monthly. In the case of RTS production fifty per cent of the units processed RTS on monthly basis, 40 per cent of the units processed RTS weekly and 10 per cent of the units processed RTS fortnightly.

4.2.14 Details about Use of Preservatives

Table 12. Details about use of preservatives

FOOD ITEMS	USE OF DIFFERENT PRESERVATIVES (%)		
	Citric acid	Sodium benzoate	KMS
Jam	75	-	-
Squash	25	-	75
Pickle	-	60	_
Syrup	-	-	40
Jelly	30	-	10
Nectar	-	-	30
RTS	50	-	20

Table 12 shows the preservatives used in different types of processed products prepared in ten selected food processing units. It was observed that 75 per cent of the units were using citric acid alone for jam preparation. Seventy five per cent of the units using KMS and 25 per cent were using citric acid for squash preparation. Forty per cent of the units were using KMS for syrup preparation, ten per cent of the units used it for jelly preparation, and thirty per cent for nectar preparation. Twenty per cent of the units were using KMS for RTS production and fifty per cent using citric acid for RTS production. Sixty per cent of the units were found to use sodium benzoate for preserving pickles.

4.2.15 Details about Work Simplifying Equipments

Table 13. Use of work simplifying equipments

WORK SIMPLIFYING EQUIPMENTS	PERCENTAGE OF USE (%)
Mixie	100
Gas stove	100
Pressure cooker	100
Scraper	80
Fridge	70
Peeler	40
Juicer	40
Sealing machine	20
Weighing Machine	20
Electric oven	0
Microwave oven	0
Food processer	0
Masher	0

This table shows the use of equipments among ten food processing units and it was seen that the essential equipments such as sealing machine and weighing machine were used only in 20 per cent of the units. Hundred per cent of the units were using equipments such as mixie, gas stove and pressure cooker, 80 per cent of the units were using scraper, 70 per cent of the units were using fridge and forty per cent of the units were using peeler and juicer. None of the selected units were using equipments such as electric oven, microwave oven, food processer and masher.

4.2.16 Details About Labeling Techniques

Table 14. Details of labels used in the processed products

Parameters	Numbers	Percentage
Manufacturing date	10	100
Expiry date	6	60
Use of added colours	-	-
Ingredients	5	50
Preservatives	-	-
Weight	10	100

Table 14 shows the details of labels used in processed products of the processing units studied. It was seen that all the selected ten units were using labels for their products. Only hundred per cent of the units mentioned about the manufacturing date and weight of the processed products. Sixty per cent of the units mentioned about the expiry date and 50 per cent of the units mentioned about ingredients. None of the units mentioned about the use of artificial colours and preservatives used in the processed products.

4.2.17 Hygienic Aspects of Processing Units

Table 15. Details regarding hygienic aspects of processing units (n = 10)

Facilities available	Availability	
	Number	Percentage
Adequate lighting and ventilation	8	80
Proper drainage facilities and waste disposal measures	3	30
Proper food handling and hygienic practices	2	20
Potable water availability	10	100
Proper storage facilities	7	70
Proper washing and cleaning of processing utensils	6	60

Table 15 shows the details regarding the hygienic aspects of the processing units. The table 13 revealed that all the selected ten units had potable water availability. Eighty per cent of the units were found to have adequate lighting and ventilation, seventy per cent of the units had proper storage facilities and sixty per cent of the units had proper washing and cleaning of processing utensils. And only 20 per cent of the units had proper food handling and hygienic practices and thirty per cent of the units had proper drainage facilities and waste disposal measures.

4.2.18 Awareness of Respondents Towards Food Safety Laws

Table 16. Awareness of food safety laws of respondents (n = 50)

Food safety laws	Percentage (%)
Fruit product order (FPO)	20
Prevention of food adulteration Act (PFA)	20
Bureau of Indian Standards (BIS)	2
AGMARK	18
FSSI	40

Plate 7. Food processing units visited

In the present study it was revealed that awareness about food safety laws was found to be very low amongst the respondents. Awareness about PFA was found only in 20 per cent, awareness about FPO only in 20 per cent, while awareness about BIS was only 2 per cent, AGMARK (18 per cent) and FSSI (40 per cent).

4.2.19 Details about General Health Profile of the Respondents

Table 17. Details about general health profile of the respondents

Type of contagious diseases (percentage)				
Frequent fever	Throat infections	Skin infections	Asthma	Allergy
2	15	30	10	5

Table 17 shows the general health profile of the respondents. Thirty per cent of the respondents were suffering from skin infections, fifteen per cent of the respondents had throat infections, ten per cent were suffering from asthma, 5 per cent of the respondents have allergy and two per cent of the respondents were suffering from frequent fever at the time of data collection.

4.3 FOOD RISK ASSESSMENT

Ten food processing units were chosen for the collection of samples. A total of ten processed food items commonly processed and sold by these units like Lemon pickle, Grape squash, Wine, Narunandi squash, Nutmeg syrup, Mixed fruit jam, Jackfruit halwa, Narunandi syrup, Jack fruit health tonic, and Ginger lemon squash were selected for conducting food risk assessment through microbial and chemical tests.

4.3.1 Microbial Analysis

The selected processed foods were subjected to microbial analysis by serial dilution technique using different media like Potato Dextrose Agar with Rose

bengal (PDA with RB), Nutrient Agar (NA), Eosine Methylene Blue Agar (EMB), and Mac Conkey (Mac). Data are presented in table showed that maximum significant bacterial (159.5 x 10^4 cfu/ml) and fungal (67.0 x 10^3 cfu/ml) population was recorded in jackfruit health tonic. Products such as jackfruit halwa (130.5 x 10^4 cfu/ml), grape squash (127.5 x 10^4 cfu/ml) , narunandi syrup (127.0 x 10^4 cfu/ml), nutmeg syrup (127.0 x 10^4 cfu/ml), also recorded maximum bacterial population. And they are on par. The samples, mixed fruit jam and narunandi squash recorded bacterial population of 92.5 x 10^4 cfu / ml. The lowest bacterial population was recorded in lemon pickle (22.5 x 10^4 cfu/g) and ginger lemon squash (18.5 x 10^4 cfu/ml). The product grape wine was free from bacterial contamination. Next to jackfruit health tonic, the maximum fungal growth of 60.0 x 10^3 cfu/g was recorded in mixed fruit jam. The products like narunandi squash (50.5 x 10^3 cfu/ ml), jackfruit halwa (30.5 x 10^3 cfu/g), nutmeg syrup (29.5 x 10^3 cfu/ml), grape squash (28.5 x 10^3 cfu/ ml), narunandi syrup (25.5 x 10^3 cfu/ml), and ginger lemon squash (14.5 x 10^3 cfu/ml) also recorded fungal growth. The lowest fungal growth of 4.5 x 10^3 cfu/g was recorded in lemon pickle.

To detect the presence of coliforms, samples were also plated on EMB and MacConkey Agar. In EMB media, the maximum bacterial growth was recorded in mixed fruit jam (150.5 x 10^5 cfu/g), which was followed by grape squash (125.0 x 10^5 cfu/ml), nutmeg syrup (54.0 x 10^5 cfu/ml), narunandi syrup (28.5 x 10^5 cfu/ml) and jackfruit halwa (11.5 x 10^5 cfu/g). The lowest growth was recorded in jackfruit health tonic (3.5 x 10^5 cfu/ml) and narunandi squash (3.0 x 10^5 cfu/ml). The samples lemon pickle, ginger lemon squash and wine were free from bacterial growth in EMB media. The presence of maximum pink coloured, lactose fermenting colonies were recorded in Grape squash (92.5 x 10^5 cfu/ml). The samples like narunandi squash (16.0 x 10^5 cfu/ml), nutmeg syrup (40.0 x 10^5 cfu/ml), mixed fruit jam (11.5 x 10^5 cfu/g), jackfruit halwa (5.0 x 10^5 cfu/g), narunandi syrup (8.0 x 10^5 cfu/ml), jack fruit health tonic (20.5 x 10^5 cfu/ml) also showed pink coloured colonies.

Table 18. Total microbial count in selected processed food samples, cfu/ ml or g

SAMPLES	BACTERIA x(10^4)	FUNGI x(10^3)	TOTAL Coliforms (EMB x(10^5))	GROWTH ON MACCONKEY x(10^5)	
				PINK	WHITE
Mixed fruit jam	92.5^{d}	60.0^{b}	150.5^{a}	11.5^{e}	73.0^{c}
Jackfruit health tonic	159.5^{a}	67.0^{a}	3.5^{e}	20.5^{c}	28.0^{f}
Narunandi syrup	127.0^{bc}	25.5^{d}	28.5^{d}	8.0^{f}	48.5^{e}
Nutmeg syrup	127.0^{c}	29.5^{d}	54.0^{c}	40.0^{b}	57.5^{d}
Grape squash	127.5^{bc}	28.5^{d}	125.0^{b}	92.5^{a}	89.5^{b}
Lemon pickle	22.5^{e}	4.5^{f}	0.0^{e}	0.0^{h}	0.0^{g}
Jackfruit halwa	130.5^{b}	30.5^{d}	11.5^{e}	5.0^{g}	29.0^{f}
Narunandhi squash	92.5^{d}	50.5^{c}	3.0^{e}	16.0^{d}	95.0^{a}
Ginger lemon squash	18.5^{e}	14.5^{e}	0.0^{e}	0.0^{h}	0.0^{g}
Wine	0.0^{f}	0.0^{f}	0.0^{e}	0.0^{h}	0.0^{g}
CD VALUE (0.05)	**10.486**	**5.525**	**12.760**	**2.228**	**3.827**

Table 19. Standard specifications of lactose fermenting organisms

Organisms	**Growth**	**Gas production**	**Indole production**
Escherichia coli	Good	+ve	+ve
Enterobacter aerogenes	Good	+ve	-ve
Salmonella typhimurium	Good	-ve	-ve

Table 19 shows the standard specifications of lactose fermenting organisms. If gas production and indole production is positive, it can assumed that the organism is *Escherichia coli.* Similarly if there is gas production and negative indole production, the organism present is presumed to be *Enterobacter aerogenes.* When both gas and indole production are negative, it can be confirmed that the organism is *Salmonella typhimurium.*

Table 20. Results of presumptive test using lauryl tryptose broth

SAMPLES	**GAS PRODUCTION**	**INDOLE PRODUCTION**
Mixed fruit jam	+ve	-ve
Jackfruit health tonic	+ve	-ve
Narunandi syrup	+ve	-ve
Nutmeg syrup	+ve	-ve
Grape squash	+ve	-ve
Jackfruit halwa	+ve	-ve
Narunandi squash	+ve	-ve

The results of presumptive test using lauryl tryptose broth shows whether the organisms found in the samples were *E.coli* or not. The samples such as mixed fruit jam, jack fruit health tonic, narunandi syrup, nutmeg syrup, grape squash,

jackfruit halwa and narunandi squash showed gas production and indole is negative. Hence the organisms found in the samples were assumed to be *Enterobacter aerogenes.* Inorder to confirm the results, biochemical tests were conducted.

Table 21. Biochemical characters of *Enterobacter aerogenes*

Characters	Results
Catalase	+ ve
Indole	-ve
Citrate	+ ve

The table 21 shows the biochemical characters of *Enterobacter aerogenes.* Since the samples were catalase positive, indole negative and citrate positive, it was concluded that the pink coloured colonies found in the samples were *Enterobacter aerogenes.*

Table 22. Classification of processed products based on criteria developed for microbial load (West *et al.,* 1987)

Extent of growth	Average colony count	Remarks	Results of ten products
No growth	0	Excellent	Wine
+	<30	Good	Lemon pickle, Ginger lemon squash
++	30 – 100	Satisfactory	Narunandi squash
+++	>100	Unsatisfactory	Mixed fruit jam, Jackfruit health tonic, Narunandi syrup, Nutmeg syrup, Jackfruit halwa, Grape squash
++++	countless	Highly unsatisfactory	-

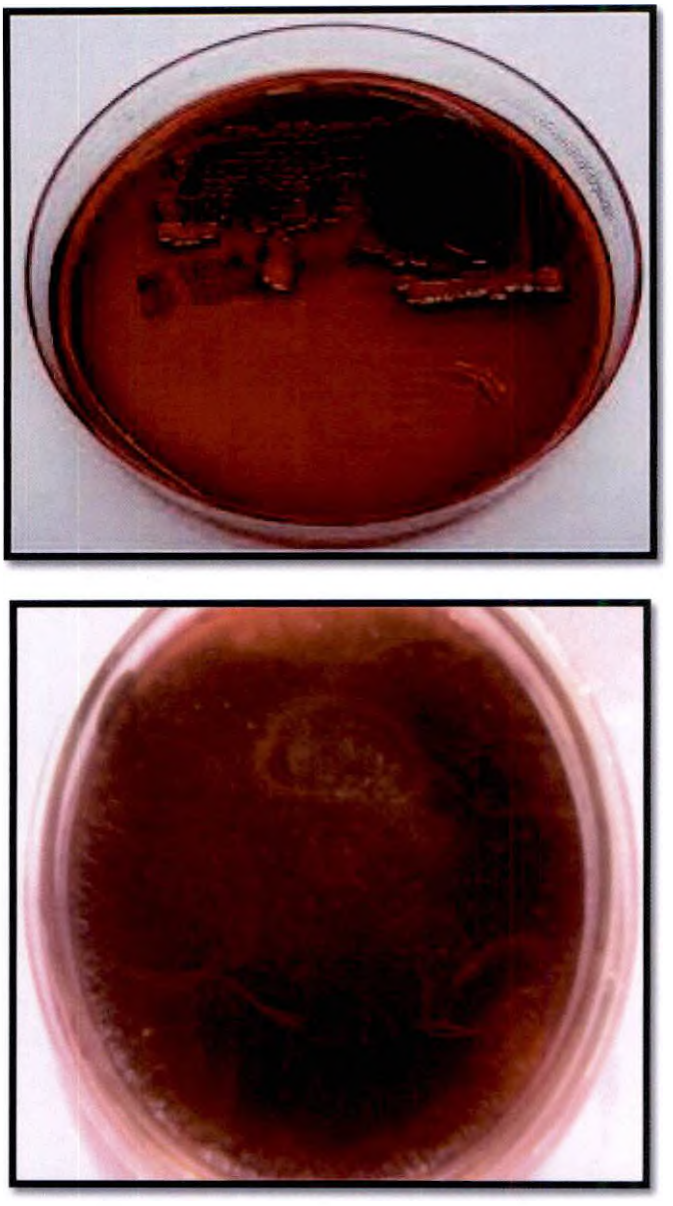


Plate 8. Presence of *Enterobacter aerogenes* in food samples

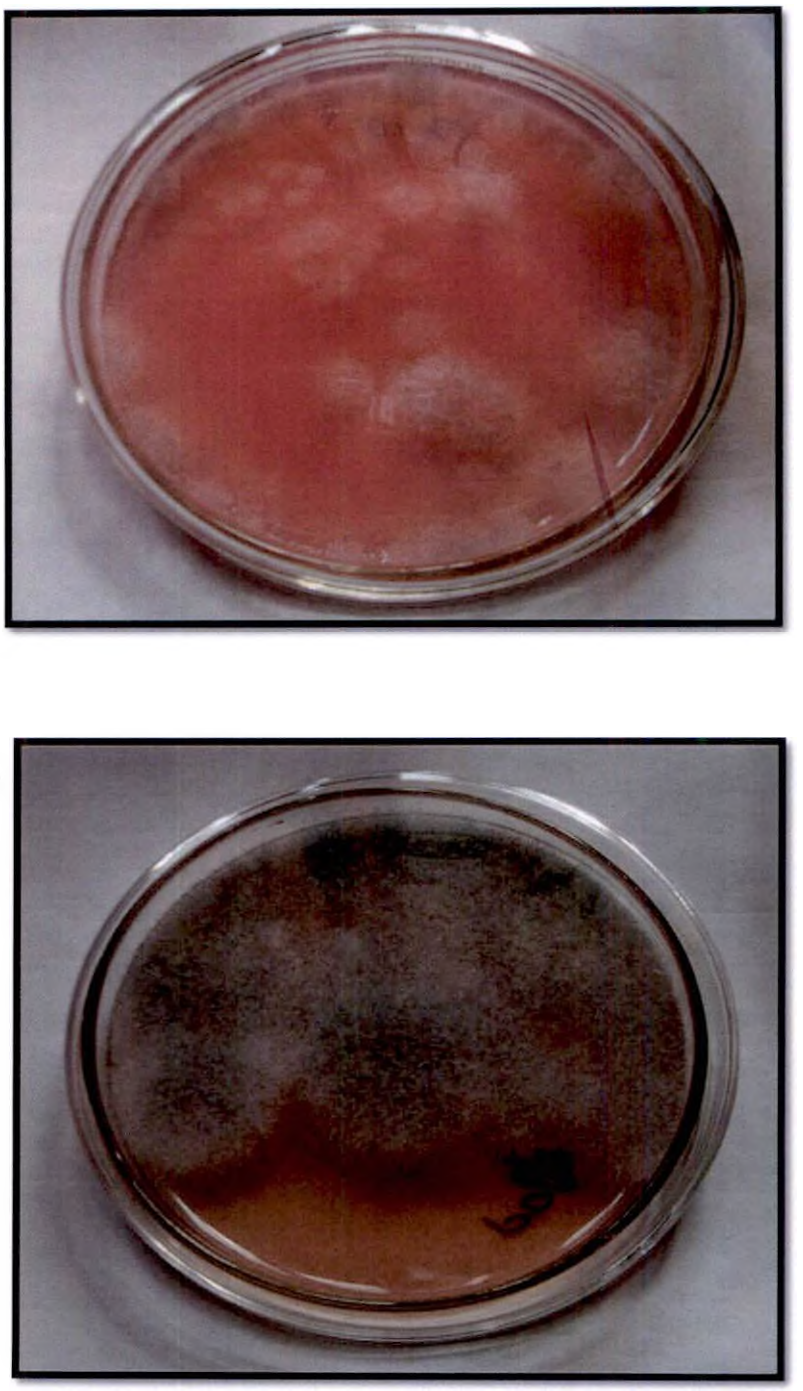


Plate 9. Presence of fungal growth in food samples

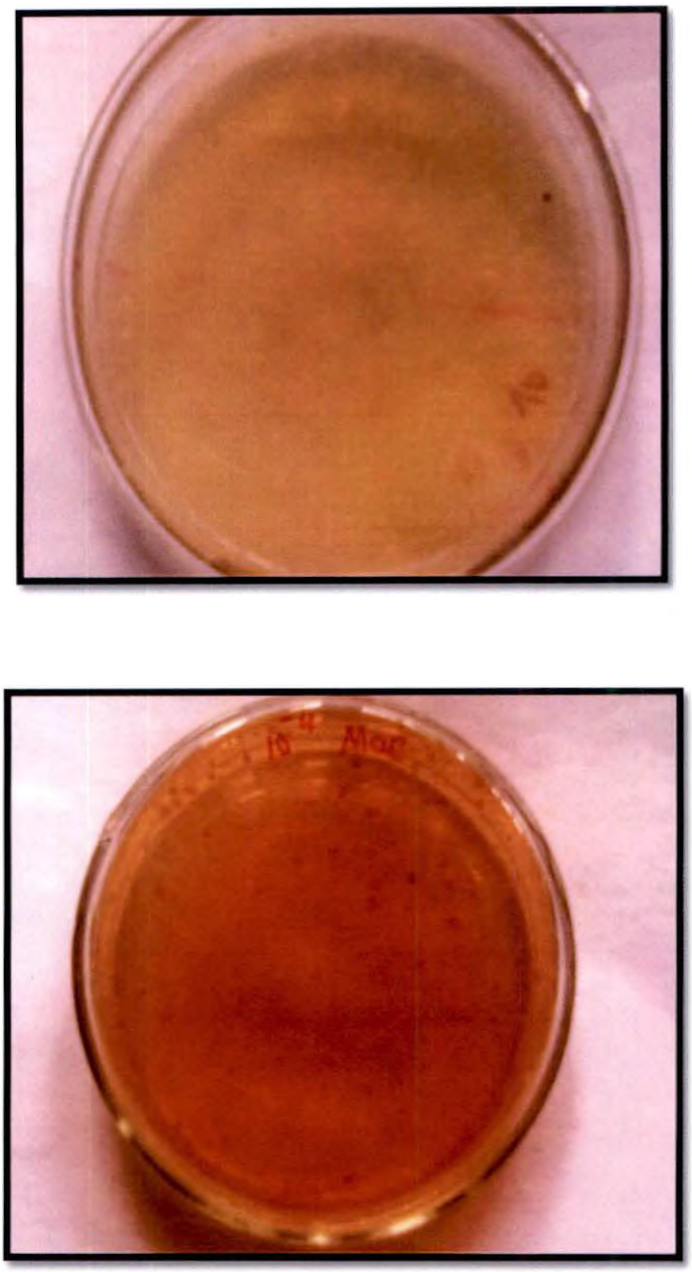


Plate 10. Presence of bacterial contamination in food samples

Food risk assessment conducted on the products sold by these units through microbial analysis revealed presence of bacterial and fungal contamination in 9 out of 10 samples studied. *Enterobacter aerogenes* was detected in 7 samples. Based on criteria developed by West *et al.* (1987) for microbial load of processed products only one product (Grape wine) was graded as excellent, while two products (Lemon pickle and Ginger lemon squash) were graded as good, one product (Narunandi squash) graded as satisfactory and 6 products (Mixed fruit jam, Jackfruit health tonic, Narunandi syrup, Nutmeg syrup, Jackfruit halwa, Grape squash) were graded as unsatisfactory.

4.3.2 Chemical Analysis

Chemical analysis was done at the Government Food Analyst's Laboratory and the analytical results were compared with respect to prescribed standards as per regulation 2.12.1,3.1.2 (6) of FSS (Food Products Standards and Food Additives) Regulations 2011.

Table 23. Results of chemical analysis of selected processed food samples

FOOD ITEMS	QUALITY CHARACTERISTICS	NAME OF METHOD OF TEST USED	RESULTS	PERMISSIBLE LIMITS
Lemon pickle	Synthetic food colour	DGHS Method	Absent	-
	Mineral acid	DGHS Method	Negative	-
	Sodium chloride content	DGHS Method	7.52 per cent	-
	Oil soluble colour	DGHS Method	Absent	-
	Benzoic acid	IS:3501:1966	**1840.94 ppm**	**250.0 ppm**
	Acidity	IS 2860:1964	3.24 per cent	-
Grape squash	Total soluble solids	IS Method	53.7 per cent	40.0 per cent
	Saccharin	DGHS Method	Negative	-
	Acidity	IS 13844:2003	**1.23 per cent**	**3.5 per cent**
	Benzoic acid	ICMR Method	Negative	-
	Added synthetic food colours	ICMR Method	139.2 ppm	200.0 ppm

Grape wine	Total soluble solids	IS Method	22.8 per cent	-
	Saccharin	DGHS Method	Negative	-
	Acidity	DGHS Method	0.63 per cent	-
	Benzoic acid	ICMR Method	Negative	-
	Added synthetic food colours	ICMR Method.	Negative	-
	The alcoholic content	IS: 3752	23.2 per cent	-
Narunandi squash	Total soluble solids	IS Method	64.2 per cent	40.0 per cent
	Sugar content	DGHS Method	Positive	-
	Saccharin	DGHS Method	Negative	-
	Acidity	IS 13844:2003	**0.88 per cent**	**3.5 per cent**
	Added synthetic food colours	ICMR Method	Negative	-
Nutmeg syrup	Total soluble solids	IS Method	42.2 per cent	65.0 percent
	Sugar content	DGHS Method	Positive	-
	Saccharin	DGHS Method	Negative	-
	Acidity	IS 13844:2003	**0.8 per cent**	**3.5 per cent**
	Added synthetic food colours	ICMR Method	Negative	-
Mixed fruit jam	Total soluble solids	IS Method	66.4 per cent	65.0 percent
	Saccharin	DGHS Method	Negative	-
	Added synthetic food colours	ICMR Method	7.7 ppm	100.0 ppm
Jackfruit halwa	Saccharin	DGHS Method	Negative	-
	Sugar	DGHS Method	Positive	-
	Benzoic acid	DGHS Method	Absent	-
	Added synthetic food colours	ICMR Method	Negative	-
Narunandi syrup	Total soluble solids	IS Method	63.8 per cent	40.0 per cent
	Added synthetic food colours	ICMR Method	Negative	-
	Benzoic acid	ICMR Method	Negative	-
	Saccharin	DGHS Method	Negative	-
	Acidity	DGHS Method	0.86 per cent	3.2 per cent
Jackfruit health tonic	Total soluble solids	IS Method	22.5 per cent	65.0 per cent
	Added synthetic food colours	ICMR Method	Negative	-
	Benzoic acid	ICMR Method	Negative	-
	Saccharin	DGHS Method	Negative	-
	Acidity	DGHS Method	1.33 per cent	3.5 per cent
Ginger lemon squash	Acidity	IS 13844:2003	3.45 per cent	3.5 percent
	The sugar content	DGHS Method	Positive	-
	Saccharin	DGHS Method	Negative	-
	Total soluble solids	IS Method	49.4 per cent	40.0 percent

The table 23 shows the chemical analysis results and it revealed that the use of preservatives exceeding the prescribed limits was found only in one sample (lemon pickle), while TSS content was lesser than prescribed standards in 4

products like Nutmeg syrup, Mixed fruit jam, Narunandi syrup and jackfruit health tonic. In the case of acidity majority of the samples contained less acidity than permissible limits.

4.4 CONDUCT OF THE INTERVENTION PROGRAMME

Based on the results of the food risk assessment consisting of microbial and chemical tests, a food safety intervention programme of two days duration was planned and conducted for fifty women food business operators from the ten food processing units. The WHO software package(2007) on safe health practices for training food handlers, called '5 keys to safe health' was utilized with necessary modifications to suit local conditions. Awareness classes on safe food practices and demonstration of methods of detecting adulterants in food was also included in the intervention programme. The intervention programme was conducted using suitable educational aids on food safety and its importance to health. An adulteration kit along with a log book was supplied to the food processing units in order to test adulterants in the raw food materials purchased by the respondents and to record the adulterants present if any.

4.5 IMPACT ASSESSMENT OF THE INTERVENTION PROGRAMME

The impact of the food safety intervention programme was assessed immediately after the programme and also one month after the conduct of the programme by studying changes in knowledge, attitude and adoption of safe practices in the food processing activities. The extent of use of the adulteration kit supplied was also assessed by verifying the log book for recording adulterants present.

4.5.1 Distribution of Respondents Based on Their Knowledge Score

Knowledge gain of respondents was assessed by using a set of 42 closed ended questions about food safety before and after the intervention programme. Each question was given a unit score of one for correct answer and zero for wrong

answer. The difference between pre and post test score was taken as knowledge gain of an individual. The possible knowledge gain was between 0 and 42.

Table 24. Knowledge of respondents on different aspects of food safety

Areas of food safety	Number of statements	Knowledge of respondents on different aspects of food safety (%)
Adulteration & quality of processed foods	8	52
Food handling & Cooking practices	18	70
Food storage & pest control	6	35
Personal hygiene	10	68

Table 24 shows the knowledge of respondents on different aspects of food safety. Majority of the respondents (70 per cent) had correct knowledge of food handling and cooking practices in the processing sector, 68 per cent of the respondents had correct knowledge about personal hygiene and only 52 per cent of the respondents had correct knowledge of adulteration and quality of processed foods. Only few respondents (35 per cent) had correct knowledge on food storage and pest control.

4.5.2 Distribution of Respondents Based on Their Attitude Score

Change in attitude was measured using a check list of thirty statements including both positive and negative statements were given before and after the training programme. The maximum score of 150 and a minimum score of 0.

Table 25. Distribution of respondents based on attitude towards different aspects of food safety

Areas of food safety	Number of statements	Attitude of respondents towards food safety (%)
Adulteration & quality of processed foods	5	35
Food handling & Cooking practices	10	37
Food storage & pest control	3	20
Personal hygiene	12	47

Table 25 shows the attitude of respondents on different aspects of food safety. About 47 per cent of the respondents had favorable attitude towards personal hygiene, 37 per cent of the respondents had positive attitude towards food handling and cooking practices. Only 53 per cent of the respondents had favorable attitude towards adulteration and quality of processed foods and only 20 per cent of the respondents had favorable attitude towards food storage and pest control.

4.5.3 Distribution of Respondents Based on Their Practice Score

Change in practice was measured using a check list of thirty five statements. The responses were collected in a dichotomous pattern i.e., Yes or No. Each correct response was given a score of one and the incorrect response was given a score of zero.

Table 26. Distribution of respondents based on practice score

Areas of food safety	Number of statements	Percentage of respondents following correct practices in different areas of food safety
Adulteration & quality of processed foods	10	25
Food handling & Cooking practices	15	73
Food storage & pest control	5	35
Personal hygiene	5	58

Table 26 shows percentage of respondents following correct practices in different areas of food safety. Majority of the respondents (73 per cent) had good food handling and cooking practices, while only 25 per cent of the respondents followed correct practices regarding adulteration and quality of processed foods, 35 per cent of the respondents followed correct practices about food storage and pest control. About 58 per cent of the respondents followed good personal hygiene practices.

Table 27. Distribution of respondents based on mean knowledge score

Category	Distribution of respondents based on mean score
K0 (pre test)	31.94
K1 (post test)	38.12
K2 (after one month)	37.36

The above table shows the distribution of respondents based on mean knowledge scores. Before the intervention programme the mean knowledge score of the respondents was 31.94 and the mean knowledge score of the respondents immediately after the programme was 38.12. Impact assessment of the programme after one month showed that the mean score was 37.36.

Table 28. Gain in knowledge of the respondents (n = 50)

Category	Mean score	't' value
K0 (pre test)	31.94	14.097**
K2 (after one month)	37.36	

From table 28 it can be seen that the mean score for knowledge for pre test was 31.94 while for the post test it increased to 37.36. Result of the paired t- test shows that the gain in knowledge was significant at 1 per cent level.

Table 29. Distribution of respondents based on mean attitude score

Category	Distribution of respondents based on mean score
A0 (pretest)	123.8
A1 (posttest)	135.42
A2 (after one month)	134.92

This table shows the distribution of respondents based on attitude score. Before the intervention programme the mean attitude score of the respondents was 123.8 and the mean attitude score of the respondents immediately after the programme was 135.42. Impact assessment of the programme after one month showed that the mean score was 134.92.

Table 30. Change in attitude of the respondents (n=50)

Category	Mean score	t value
A0 (pre test)	123.8	12.557**
A2 (after one month)	134.92	

From table 30 it could be seen that the mean score of attitude for pre test was 30.84 while for the post test it has to increase upto 34.64. Result of the paired t-test showed that the change in attitude was significant at 1 per cent level. An estimated 't' value of 16.938 revealed that training programme had a significant effect on the attitude of respondents.

Table 31. Change in practice of the respondents

Category	Distribution of respondents based on mean score	t value
P0 (pre test)	30.84	16.938**
P2 (after one month)	34.64	

The above table showed the distribution of respondents based on practice score. Before the intervention programme the mean practice score of the respondents was 30.84 and the mean practice score of the respondents after one month was 34.64. Study of impact of the programme showed that there was a significant difference between pre test and after one month of the programme. An estimated't' value of 16.938 revealed that training programme had a significant effect on the practice of respondents.

The extent of use of the adulteration kit supplied was assessed by verifying the log book for recording adulterants present. About 70 per cent of the respondents reported that the milk they used was adulterated with water, 20 per cent of them reported that ghee was adulterated with vanaspathy, and 10 per cent of them reported that honey was found to be adulterated with water.

Discussion

5. DISCUSSION

The findings of the study entitled "Impact of an intervention programme on food safety among women 'food business operators' in Trivandrum & Kollam" were statistically analysed and presented in the previous chapter. These findings with relevant research support are discussed in this chapter under the following headings.

5.1 PERSONAL AND SOCIO – ECONOMIC CHARACTERISTICS OF THE RESPONDENT

In the present study socio- economic and personal variables such as age, religion, caste, type of family, type of residence, type of house, type of floor, educational status, occupation, type of self employment and monthly income were taken in to consideration. Majority of the respondents (68 per cent) were in the age group 36 - 55 years, out of this 24 per cent fell In to the age group $\leq$ 35 years and 8 per cent account for the age >55 years. Gowri *et al.* (2010) reported that majority of the women engaged in SHG's comes under the age group of 38 – 50 years.

On assessing the social background of the respondents it was found that 36 per cent belonged to forward caste, 34 per cent belonged to SC/ST and 30 per cent of the respondents belonged to OBC. As per NFHS (2005), the majority of households in Kerala have household heads who are Hindu (60 per cent), about one fourth (23 per cent) of household heads are Muslims and one-sixth (17 per cent) are Christians. The majority of Kerala's household heads (56 per cent) do not belong to the scheduled castes, scheduled tribes, or other backward classes.

Type of residence shows that about 86 per cent of the respondents were coming from urban area and only 14 per cent of the respondents were from rural area. This is mainly because the respondents were selected from corporation area of Trivandrum and KVK kollam. One-third (34 per cent) of Kerala's households are in urban areas, and the remaining two-thirds are in rural areas (NFHS, 2005)

Saxena (2000) reported that the nuclear type families were considered to be generally better than joint type families for the healthy development of children. In

the present study it was found that 80 per cent of the respondents were from nuclear type families. In kerala joint family system is not very common now a days, even though 20 per cent of the respondents were found to be from joint family. it is observed that the concept of nuclear family is becoming more common and the joint family system is on the eclipse. Similar reports have been given by Krishnaroopa (2003), Renjini (2008) and Sheethal (2011) in their studies done in Thiruvananthapuram district. Nuclear family has become a prevalent norm in Kerala as reported by Buliyya *et al.* (2002) and Gupta and Tripathi (2006). NFHS-2 Survey (2001) conducted in Kerala found that just over half of all households are of nuclear type.

In this study it was also revealed that the houses of majority (58 per cent) of the respondents were concreted. According to NFHS, (2005) also it has been reported that eighty-five percent of households in Kerala live in a pucca houses.

The family educational status is an important aspect, which influences the family members outlook towards life and determines the quality of life of its members. Assessment of family educational status of the respondents in the present study revealed that 52 per cent of the respondents had high school level of education. It was also observed that 18 per cent of respondents had education up to pre-degree level. Beghin (2003) pointed out that educational level of women is a major factor which influences the growth and development of children. Other studies carried out by Dhyani (1994) states that education and family income strongly associated with consumer's awareness. The high educational status of the respondents in a way reflects a typical picture of the Kerala population with its high literacy levels. The study also found that none of the respondents were illiterate. National Family Health survey (2005-2006) also has reported that only four per cent of the population in Kerala are found to be illiterates.

Occupational status of the respondents revealed that majority of the respondents (82 per cent) were self employed. It was also observed that about fourteen per cent were engaged in private works. Two per cent were employed in government and 2 per cent were engaged in casual labour.

Type of self employment shows that hundred per cent of the respondents were doing food processing. This may be due to the fact that the respondents selected for the study were all members of food processing units under self help groups. In addition about 32 per cent of the respondents were also doing tailoring, about ten per cent were engaged in cattle/ poultry rearing and about 6 per cent were engaged in farming.

A considerable percentage (ie., 28 per cent) of the respondents belonged to a low income category with a monthly income ranging from Rs 2936-4893; 38 per cent of the respondents belonged to the very low income range of Rs 980-2935 while 2 per cent of the respondents belonged to high income ranging from Rs 9788-19574 and no one belonging to very high income group. Based on classification of HUDCO, (2000) 30 percent were below poverty line, 40.1 per cent belonged to low income group, 21 per cent of women SHGs belonged to middle income group and only 9 per cent of the respondents belonged to high income group.

5.2 DETAILS OF THE FOOD PROCESSING UNIT

The present study has been designed with the aim to create awareness amongst women who are involved in food processing trade in unorganized sector with regard to various parameters like adopting food safety and hygienic method, food safety laws for food production. So, 50 SHG women in 10 SHGs who are involved in food processing trade, eight units from Trivandrum and two units from Kollam were selected for the study.

Self Help Groups (SHGs) form the basic constituent unit of the microfinance movement in India. An SHG is a group of a few individuals - usually poor and often women (Gowri *et al.*, 2010). In the present study 50 per cent of the units consisted of 11 – 15 members, thirty per cent of the units consisted of 5 – 10 members and 20 per cent of the units consisted of 16 – 20 members.

Majority of (70 per cent) the respondents were found to have joint ownership and about 40 per cent of the units were located along with the home. Seventy per cent of the respondents prepared processed products only on demand basis, 20 per

cent prepared them for melas and festivals and only 10 per cent of them were doing on regular basis. A study conducted by Gowri *et al.* (2010) on self help groups revealed that forty two percent (42 per cent) of the members concentrated on seasonal products and (16 per cent) sixteen percent of the group members alone prepared regular products.

The details about packaging materials used by the processing units showed that bottles, polythene cover, and plastic containers were most commonly used. Details about the mode of packaging revealed that 50 per cent of the units were using polythene cover for packaging. Thirty per cent of the units were using bottles for packaging and 20 per cent of the units were using plastic container for packaging of processed products. Gowri and Vasantha Devi (2012) reported in their study that 40 per cent of the units were using plastic containers for storage purpose.

Details about fuels used by the units showed that majority of the units (40 per cent) were using fuel wood as fuel, 30 per cent were using cooking gas. NFHS – 3 survey (2005) reported that in Kerala 26.5 per cent of the respondents are using LPG and 47 per cent of them were using wood.

In Kerala, more than two-thirds of households get their drinking water from wells, mainly from protected wells. Sixty-nine percent of households use an improved source of drinking water (77 per cent of urban households and 65 per cent of rural households), but only 13 per cent have water piped into their dwelling and 12 per cent get drinking water from a public tap or standpipe. Eighty-three percent of households treat their drinking water to make it potable, 76 per cent boil the water, 1 per cent strain the water through a cloth, 3 per cent use a ceramic, sand, or other water filter, and the remaining treat the water in some other way (NFHS, 2005). In the present study it was also seen that about 60 per cent of the units were using pipe water and forty per cent of the units were using well water for processing.

In the present study it was revealed that, only 60 per cent of the respondents got training and the duration of the training was less than one week. A postal survey of manufacturing, retail and catering food businesses by Mortlock *et al.*

(2000) revealed that less than 10 per cent had failed to provide some food hygiene training for staff. Vendors are often poorly educated, unlicensed, untrained in food hygiene, and they work under crude unsanitary conditions with little or no knowledge about the causes of food borne disease (Barro *et al.*, 2007).

With regard to methods used for selling processed products and mode of marketing, it was found that about 70 per cent of the units were using direct method for selling and marketing their products through melas. Thirty per cent of the units were selling these processed products to near by shops through agents.

The safe food measures followed in the processing units was not adequate. It was found that none of them were using gloves, hair cap and face mask. Only 10 per cent of the units were mopping the processing area daily. Only 40 per cent of the vessels used by the respondents were found to be clean. Only fifty per cent of the respondents either wiped or dried their vessels after cleaning the vessels. Among the selected respondents 30 per cent of the respondents kept their vessels in clean and covered condition. Gowri and Vasanthadevi (2012) found similar results in their study on self help groups engaged in food processing activities.

Details about frequency of production of processed food items studied showed that in the selected ten food processing units, majority ie 60 per cent processed jam fortnightly. In the case of fruit squashes, majority (ie; 70 per cent) of the units processed them only on monthly basis. Majority of the units (70 per cent) of the units processed pickles fortnightly. In the case of fruit syrup production majority of the units (50 per cent) were found to prepare on monthly basis alone. Majority of the units (90 per cent) processed jelly sometimes only as per demand. In the case of fruit nectar production, 80 per cent of the units processed nectar sometimes only as per demand. In the case of RTS production fifty per cent of the units processed RTS on monthly basis. It can be concluded that pickle, syrup, squash, jam and RTS were the products prepared most frequently by the units since these food items are more in demand.

The type of preservatives used in different types of processed products prepared by the ten selected food processing units, were studied. It was found that most frequently used preservatives are citric acid, sodium benzoate and KMS.

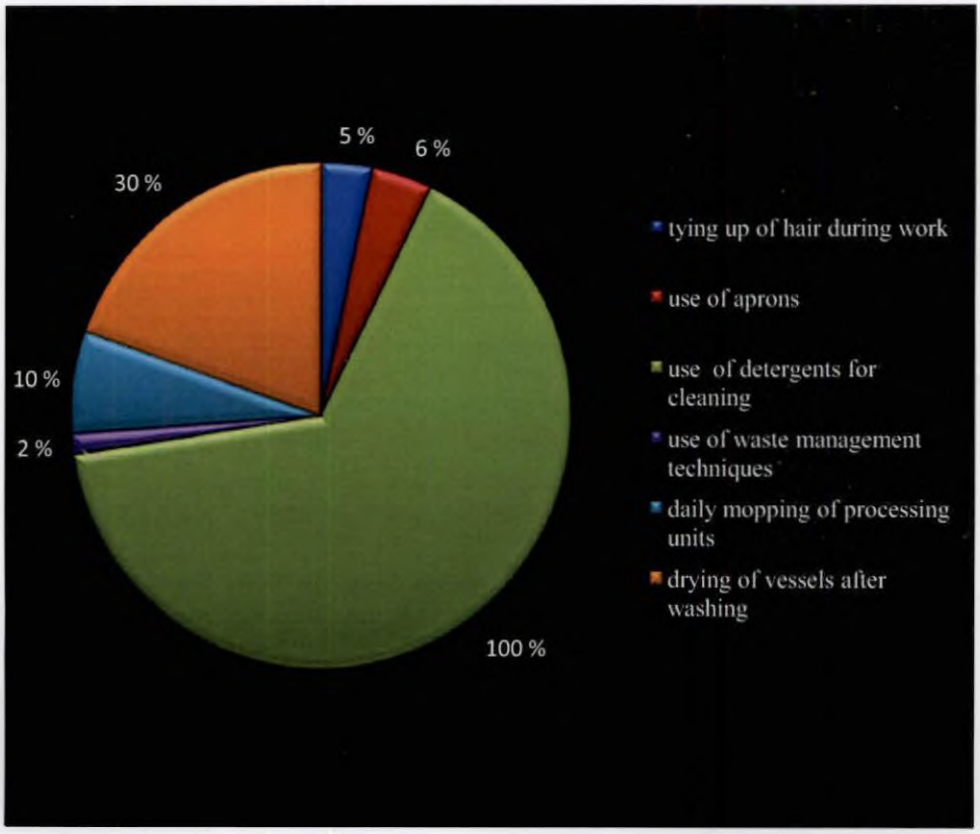


Figure 1. Safe food measures followed in the processing unit

Only 60 per cent of the units were using sodium benzoate as preservative in pickles.

Study of the use of equipments among the ten food processing units revealed that the essential equipments such as sealing machine and weighing machine were used only in 20 per cent of the units. Hundred per cent of the units were using equipments such as mixie, gas stove and pressure cooker. None of the selected units were using equipments such as electric oven, microwave oven, food processer and masher. The use of these work simplifying equipments helps to save time and energy. Sundari and Kamalakanthan (1968) reported a saving of one hour and 27 minutes of cooking time in the preparation of the reference meal by using selected labour saving devices. In this study, sealing machine, peeler, juicer and refrigerator which are highly essential for any food processing enterprise were found to be inadequate.

In the present study, details of labels used in the processed products revealed that hundred per cent of the units alone mentioned about the manufacturing date and weight of the processed products. Sixty per cent of the units mentioned the expiry date and 50 per cent of the units mentioned the ingredients used. Studies among south Indian women indicated although women see the label on packed food for manufacture and expiry date but many of them are not aware of quality symbols (Sudhershan *et al.*, 2008). None of the units were mentioning about the use of artificial colours and preservatives used in the processed products. In another study done in south India, it was found that 68 per cent read label for date before expiry while only half of respondents checked the ingredient of food label (Sudhershan *et al.*, 2008) Literacy is more in South India but still they are unaware of nutritional values. According to a survey conducted by NIN (2009) only 21 per cent of Indian food had used local language so most of consumers are not able to understand the food labels.

In the present study it was revealed that awareness about food safety laws was found to be very low amongst the respondents that is PFA (20 per cent), FPO (20), BIS (2 per cent), AGMARK (18 per cent) and FSSI (40 per cent). According to Bruhn, (1997) educational efforts should also focus on high risk groups as well as

those preparing food. A study conducted by Khapre *et al.* (2011) reported that 40 per cent of respondents know about Agmark, FPO, and ISI as quality marked product but only 23.9 per cent are able to recognize symbol on food label which is similar to another study carried in slum area of Hyderabad (Sudhershan, 2008).

Details regarding hygienic aspects of processing units was collected from all the selected ten food processing units. It was found that all the selected ten units had potable water availability. Only 20 per cent of the units followed proper food handling and hygienic practices and thirty per cent of the units had proper drainage facilities and waste disposal measures.

In the present study it was observed that 30 per cent of the respondents selected for the study suffered with skin infections, 15 per cent were suffering from throat infections,10 per cent suffered from asthma, 5 per cent suffered from allergy and 2 per cent suffered from frequent fever at the time of data collection. In a study on food handlers WHO (2002) reported that contagious diseases of the food handlers was one of the risk factor of contamination in food items. Contamination of street food with *S. aureus* was significant at 16 per cent which might be occurring through infected wounds, running hands through hair or scratching the scalp, cuts, burns and dirty clothing of the vendors (Muleta and Ashenafi, 2001; Ghosh *et al.*, 2007). Salmonella and Proteus sp. could have contaminated the foods through contaminated water, sewage and soil, handling of food by infected workers, vendors, and consumers in the market place (Adams and Moss, 2002).

5.3 FOOD RISK ASSESSMENT

Samples from ten food processing units were selected for conducting food risk assessment and a total of ten processed food items commonly processed and sold by these units like lemon pickle, grape squash, grape wine, narunandi squash, nutmeg syrup, mixed fruit jam, jackfruit halwa, narunandi syrup, jack fruit health tonic and ginger lemon squash was selected for conducting food risk assessment through microbial and chemical tests.

5.3.1 Microbial Analysis

Food risk assessment study of the products sold by these units through microbial analysis revealed presence of bacterial and fungal contamination in 9 out of 10 samples studied. *Enterobacter aerogenes* was detected in 7 samples of the products studied. *Enterobacter* infections can include bacteremia, lower respiratory tract infections, skin and soft-tissue infections, urinary tract infections (UTIs), endocarditis, intra-abdominal infections, septic arthritis, osteomyelitis, and ophthalmic infections. Based on the criteria developed by West *et al.*, 1987 for microbial load, only one product ie, grape wine was graded as excellent, while lemon pickle and ginger lemon squash, narunandi squash, mixed fruit jam, jackfruit health tonic, narunandi syrup, nutmeg syrup, jackfruit halwa, grape squash were graded as unsatisfactory and contaminated with bacteria and fungi. Results of the microbial test revealed that total bacterial count in nine samples varied between 18.5 - 159.5x10^4 cfu/ g and fungal contamination varied between 4.50 – 67.0 x 10^3 cfu/ g. The bacterial count is high compared to fungi in selected food products. High degree of contamination in unprocessed foods and semi processed foods has been reported earlier by Poojara and Krishna (2012). Gowri and Vasantha Devi (2012) in their study on microbial quality of food products sold by SHG'S revealed that low bacteria counts which may be the result of high standard of personal hygiene and quality maintenance of good manufacturing practices observed during the food formulation process. The presence of microorganisms indicated contamination of the processing water as well as the prevailing unhygienic conditions related to the location of the food stalls and especially in dusty road side locations (Suneetha *et al.*, 2011). According to Ezeama (2008) the presence of microbes in food can be linked to a number of factors such as improper handling and processing, use of contaminated water during washing and dilution, cross contamination from rotten fruits and vegetables, or the use of dirty processing utensils like knife and trays.

In the present study it was found that four units (40 per cent) were using well water for processing raw fruits and vegetables. It was also found that water purification measures were not followed regularly by these units also. This may be

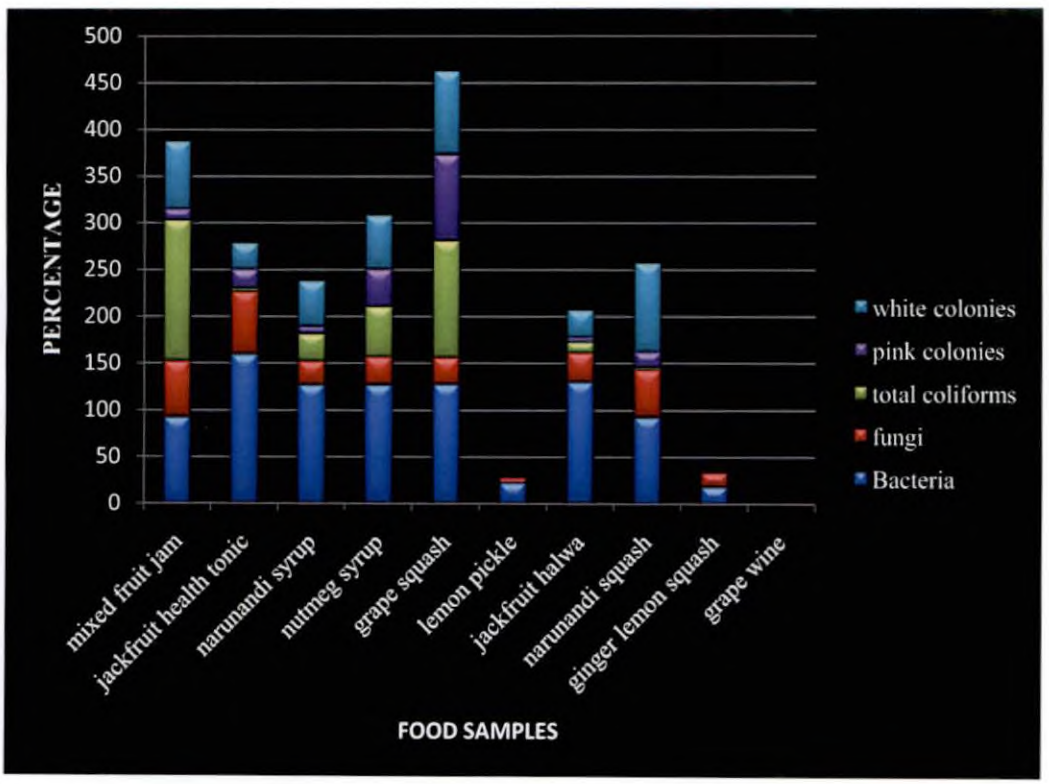


Figure 2. Percentage distribution of bacterial and fungal contamination in food samples

the reason for the high bacterial contamination of the products. Bhaskar *et al.* (2004) observed that bacteria from dirty dish washing waters and other sources can adhere to utensil surfaces and constitute a risk for contamination in foods.

Contamination of foods may also occur from improper storage, inadequate lighting, improper washing and cleaning of fruits and vegetables and processing utensils. In this study, it has been found that proper drainage and waste disposal measures were available only in 30 per cent of the units while 70 per cent did not have proper drainage and waste disposal measures. The chances of contamination of food increase greatly due to extremely poor environmental condition in which they are prepared and served (Sheth *et al.,* 2005).

Defective personal hygiene can facilitate the transmission of these pathogenic bacteria found in environment and on people's hands via food to humans (Tambekar *et al.*, 2008). In a study on handlers' hygiene practices in small restaurants of Vadodara it was found that most food handlers exhibited poor personal hygiene and poor personal habits. E. coli 0157:H7 was detected in two out of three knife samples and table mop cloth samples; Salmonella was detected in one of the table mops cloths and two hand towel samples, respectively. Two of the table mop cloth samples also indicated presence of Shigella (Sheth *et al.*, 2011). It was also observed that eighty per cent of the units were not following proper food handling and hygienic practices. All these factors may be together responsible for the bacterial and fungal contamination of the products prepared in these units.

5.3.2 Chemical Analysis

The chemical analysis results revealed that the use of preservatives exceeding the prescribed limits was found only in one sample (lemon pickle), which contained benzoic acid at the level of 1840.94 ppm, while the permissible limits of benzoic acid is 200 ppm as per the reccomandation of FSSI. TSS content was lesser than prescribed standards in 4 products like nutmeg syrup (42.2 per cent), mixed fruit jam (66.4 per cent), narunandi syrup (63.8 per cent) and jackfruit health tonic (22.5 per cent). In the case of acidity also, majority of the samples contained less acidity than permissible limits. With regard to grape squash (1.23 per cent),

grape wine (0.63 per cent), narunandi squash (0.88 per cent), nut meg syrup (0.8 per cent), narunandi syrup (0.86 per cent), jackfruit health tonic (1.33 per cent) contained lesser acidity than prescribed standards.

Earlier the microbial food risk assessment showed that the lemon pickle is comparatively low in bacterial and fungal contamination, which may be due to the higher levels of preservative (benzoic acid) present. The use of preservatives in processed food products helps to delay or prevent the microbial contamination (Srilakshmi, 2001). The use of preservatives may be increase the shelf life of the products and retard the bacterial and fungal growth but the excess use of preservatives in processed products is harm to the health of humans who consume it. The jack fruit health tonic showed very high level of bacterial and fungul contamination, this is because of low level of TSS present as compared to the required level.

5.4 CONDUCT OF THE INTERVENTION PROGRAMME

Food safety education should be launched to women and repeated at specific intervals to ensure that learnt information is put in to the daily life practices (Singh *et al.*, 2012). Suneetha *et al.* (2011) reported that proper facilities and training should be given to the food vendors. Critical control points should be detected and measures should be taken to reduce the contamination. Local authorities can then go through planning, investment, mass media and campaign regulations. Abbot *et al.* (2012) reported that the campaign significantly increased self-ratings of food safety knowledge and skill, actual food safety knowledge, food safety self-efficacy, stage of change for safe food handling, and reported hand washing behaviors of a geographically and racially diverse group of college students.

The study conducted by Rao *et al.* (2009) revealed that the anganwadi workers were the preferred source for food safety education and need to equip this women workforce to spread the knowledge. There was lack of awareness amongst the SHG Women involving in food processing trade (Gowri *et al.*, 2010). There is need for basic science training related to food quality and safety issues at school level to make them understand technical specifications and also medias such as

radio, television can also be used effectively for the quality education (Daniel *et al.*, 2000). According to Gavaravarapu, 2009 food safety is a multi-stakeholder activity which requires effective and focused communication campaign.

A study on improvisation of existing physical facilities, sanitation hygiene and work schedule of a private canteen in Coimbatore indicated that educating and training the personnel brought about a greater awareness among the personnel which in turn improved the canteen (Pappi and Murugesan, 2004). With this objective, an awareness programme on food safety was planned and conducted for the respondents based on the food risk assessment.

5.5 IMPACT ASSESSMENT OF THE INTERVENTION PROGRAMME

The present study revealed that majority of the selected respondents reported low knowledge, attitude and adoption of safe food practices prior to the conduct of the intervention programme. The intervention programme was designed including awareness class using charts, evaluation was conducted to find out the change in the knowledge and attitude of the respondents towards food safety, as well as change in adoption of safe food practices and also extent of use of the adulteration kit by the respondents.

With regard to the knowledge of respondents on different aspects of food safety, only 52 per cent of the respondents had correct knowledge towards adulteration and quality of processed foods and only 35 per cent of the respondents had correct knowledge regarding food storage and pest control. Poor personal hygiene conditions like dirty clothing, improper cleaning of dishes, unhygienic handling and serving practices, contaminated hands of vendor, and lack of knowledge of hygienic practices and safety of food products (Tambekar *et al.*, 2006). According to Chumber *et al.* (2007), unhygienic surroundings like sewage, improper waste disposal system, inadequate water supply attracts houseflies or fruit flies, which further increases food contamination.

The attitude of respondents on different aspects of food safety revealed that about 47 per cent of the respondents had favorable attitude towards personal hygiene, 37 per cent of the respondents had positive attitude towards food handling

and cooking practices. Only 53 per cent of the respondents had favorable attitude towards adulteration and quality of processed foods and only 20 per cent of the respondents had favorable attitude towards food storage and pest control. Potential health risks are associated with contamination of food by *E.coli, Salmonella typhi, Pseudomonas sp., Staphylococcus aureus or Proteus sp* during preparation, post cooking and other handling stages (Hanoshiro *et al.*, 2004; Ghosh *et al.*, 2007). Proper garbage removal facilities are not available, thus leading to poor environmental condition (Chakravarthy, 2003).

The percentage of respondents following correct practices in different areas of food safety showed that, majority of the respondents (73 per cent) followed good food handling and cooking practices, while only 25 per cent of the respondents followed correct practices regarding adulteration and quality of processed foods, 35 per cent of the respondents followed correct practices about food storage and pest control and about 58 per cent of the respondents had good personal hygiene practices. Street foods are frequently associated with diarrhoeal diseases due to improper handling and serving practices (WHO, 2002; Bhaskar *et al.*, 2004; Barro *et al.*, 2006). The clothes used to clean dishes also present hazards to food safety (Hanoshiro *et al.*, 2004). Other findings also show a high incidence of E.coli (21 per cent), which might be occurring through contaminated water supplies or through poor hand washing and contamination of utensils (Tambekar *et al.*, 2006, 2007).

5.5.1 Change in Knowledge of the Respondents

A knowledge test was administered to the participants before exposing them to the intervention, immediately and also one month after the exposure to measure increase in their knowledge levels. The respondents were exposed to various aspects of the prevention and control measures of the food safety during .two days programme. The present study has indicated the knowledge gained was increased after the education programme. This may be because of the effectiveness of programme. It was seen that the mean pre knowledge score obtained by the respondents was 31.94 out of a maximum of 43. After the intervention programme

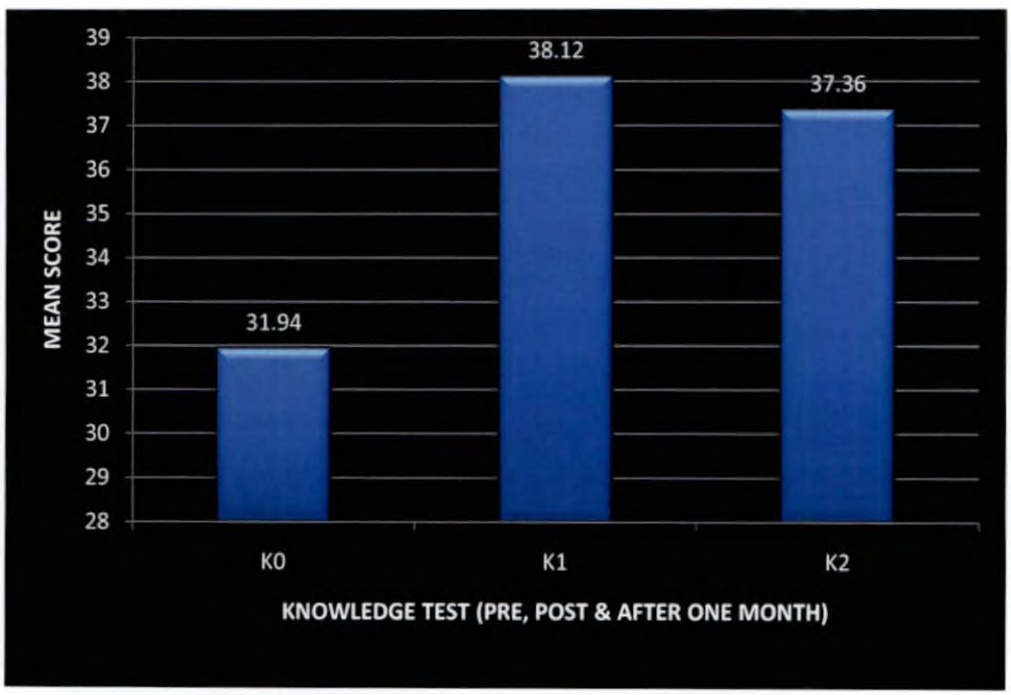


Figure 3. Gain in knowledge of the respondents

was conducted, the post test (immediately after the programme) revealed that the mean knowledge score was 38.12 out of 43. The post test (after one month of the programme) revealed that the mean knowledge score was 37.36 out of 43 (Figure 3). From the score obtained for post test it is clear that there was significant gain in their knowledge immediately after the programme and also one month after the programme. The respondents were exposed to various visual aids like charts which enabled them to understand the importance of food safety. The respondents were also given a hand out (booklet) on methods for detection of adulterants in raw foods for further guidance and follow- up. The intervention also included demonstration methods in order to test adulterants in the raw food materials purchased by the respondents and record the adulterants present if any. Earlier study conducted by Razeena (2000) has been proven that the actual impact of educational programme was the adoption of the gained knowledge and it was found that teaching had significance effect on the adoption of good practices.

Several studies have shown that nutrition education and intervention increases the nutritional knowledge of the respondents (Morris *et al.*, 2002; Razeena, 2000; Kaur and Maini, 2006). Meenambigar and Seetharaman (2003) in their study on role of media in rural communication concluded that an appropriate combination of communication media can make people apply knowledge as well and motivate them to seek more information.

5.5.2 Change in Attitude of the Respondents

An attitude test was administrated to the respondents before and immediately after and also one month after the intervention to measure their attitude towards food safety. The pre test revealed that the mean attitude score was only 123.8 out of a maximum of 150. The post test conducted immediately after the intervention revealed that the mean attitude score was 135.42. The post test conducted after one month of the intervention revealed that the mean attitude score was 134.92 showing the impact of the programme on the attitude of the respondents (Figure 4). From the score obtained for the post test it is clear that teaching method has significant influence in changing wrong attitudes and wrong beliefs of the respondents.

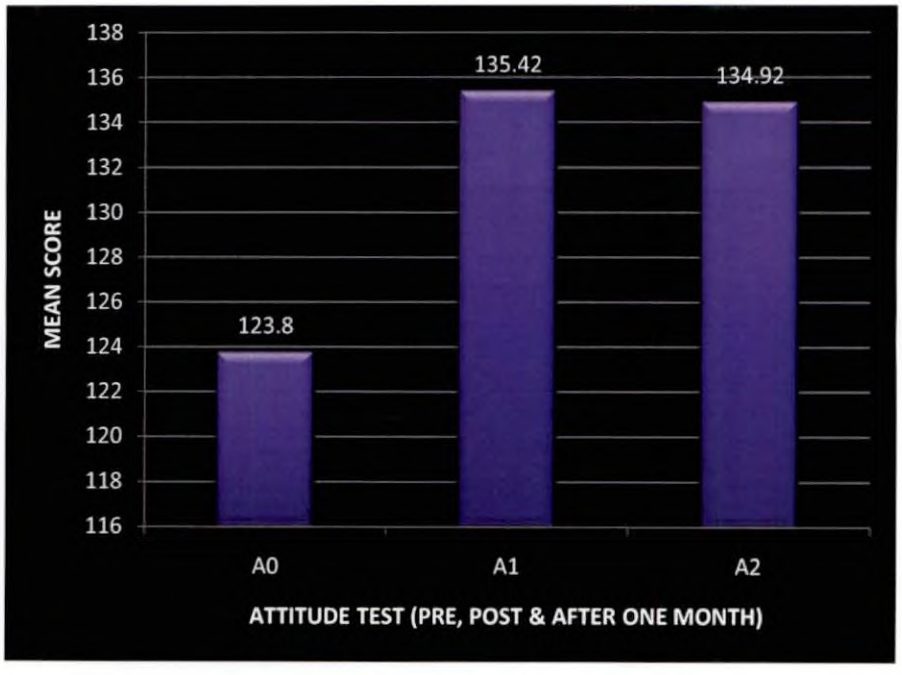


Figure 4. Change in attitude of the respondents

The findings of the study are supported by the observations of Suresh (2001) in her study on effect of training on food safety measures to the anganwadi helpers of ICDS. A study conducted by Shiny (2004) on assessment of nutrition cognition of selected rural youth and the nutrition related practices of their families revealed that effective nutrition education programmes can change the attitude of the respondents. Based on the findings of the present study it may be concluded that changes in attitudes and levels of knowledge obtained from acceptance of new ideas from effective intervention programme will ultimately lead to practice what is being learnt. Cicil (2000) reported that the impact of educational programme had significant positive role at all levels in terms of nutritional knowledge gained and change in attitude. Data collected after a training programme by Suresh (2001) also revealed that majority of respondents had shifted to highly favorable attitude.

5.5.3 Change in Adoption of Safe Food Practices of the Respondents

A practice test was administrated to the respondents before and one month after the intervention to measure safe food practices of the respondents. The pre test revealed that the mean practice score was only 30.84 out of a maximum of 35. The post test conducted after one month of the intervention revealed that the mean attitude score was 34.64 (Figure 5).

Waggoner (2004) reported that there was a significant change in food safety practices of food recovery agency workers before and after food safety training programme. Egon *et al.* (2006) reported the effectiveness of food safety and food hygiene training in the commercial sector of the food industry.

Surveys conducted in many countries to evaluate the food safety practices of consumers have been reviewed by Redmond and Griffith (2003). Data on the food handling practices are usually limited to the collection of data concerning consumer awareness and knowledge rather than actual food handling practices (Kennedy *et al.*, 2005; Kosa *et al.*, 2007; Lagendijk *et al.*, 2008).

According to Morrison *et al.* (2004) to help minimize the spread of pathogens, it is important to follow proper hygienic practices. Most of the studies show that food handlers were directly involved in some stages of food processing.

Figure 5. Change in practice of the respondents

These studies emphasized the need to educate food handlers on GMP/GHP and also that application of HACCP in the Indian context is possible and would yield the desired results of improving the safety of food (Sharma *et al.*, 2000).

5.5.4 Change in Extent of Use of Adulteration Kit by the Respondents

Food adulteration in India includes both willful adulteration and substandard food which do not confirm to prescribe food standard. Rarely any food item is spared from malicious practice of food adulteration. According to a news article published in year 2002, in The Times of India Hyderabad: "There might be iron filings in the sugar you use, including what is distributed through fair price shops all over the state (Rao *et al.*, 2010). In a shocking revelation, the Food and Drug administration (FDA) Mumbai in 2007, has said that "nearly 25 per cent of the milk produced in the state is adulterated" (Naik, 2010) National health account 2004-05 shows that minimal of 0.3 per cent of International classification of health accounts (ICHA) functions is spent on prevention of food adulteration, though it leads to spectrum of disease from minor health problem like diarrhea to serious problem like cancer, from curable to incurable disease that can ruin ones lifestyle and life.

In the present study, the extent of use of the adulteration kit supplied was assessed by verifying the log book for recording adulterants present. Majority (70 per cent) of the respondents reported that the milk they used was adulterated with water, while 20 per cent of them reported that ghee was adulterated with vanaspathy. All the selected units were found to be using the kit to test for adulterants. Khapre (2011) reported that all the selected food items for the study were adulterated ranging from 76 per cent to 11 per cent. According to Roday (2002), adulteration is high in small cities and villages due to low purchasing power and consumers ignorance about their rights for safe food. Gupta and Punchal (2009) repoted that the respondents had low awareness related to food adulteration. The adulteration problem in India has attained massive dimensions. Intentional adulteration is a willful act on the part of adulterator who intends to increase the margin of profit.

Summary

6. SUMMARY

The present study entitled "Impact of an intervention programme on food safety among women 'food business operators' in Trivandrum and Kollam" was conducted in selected ten food processing units. The objective of the study was to conduct an intervention programme on food safety for women 'food business operators' based on food risk assessment conducted in the foods processed by them and study the impact of the programme.

Food safety has emerged as an important global issue and food adulteration is also a major public hazard which affects the quality of life of people. As consumers we all are concerned about the quality of the food that we consume. In the present times all of us consume a lot of processed foods which are sometimes processed in home level or in cottage level. At present, in Kerala, self help groups (SHG) are implementing a large number of village cottage industries, especially food processing industries. Many studies conducted in different parts of the country point out that in the absence of quality control measures, poor quality packaging material, improper transport of foods, use of contaminated water, high turn-over of food handlers, lack of personal hygiene and non judicious use of colorants and preservatives of these units pose considerable food safety hazards. Only limited studies have been carried out in Kerala to understand the wholesomeness of food prepared by self help groups of women at cottage level and also the hygienic practices followed as well as their knowledge on food safety.

Fifty women food business operators were selected from ten food processing units of Trivandrum and Kollam forming the study sample. Fifty per cent of the units consisted of about 11-15 members. Majority of the respondents belonged to the age group 36 – 55 years and majority (86 per cent) were staying in urban areas.

Study on fruit and vegetable processing units revealed lack of specific space for processing activities in all the units. Infrastructure facilities such as lack of adequate space, adequate sanitary facilities especially drainage and waste disposal were found to be poor in all the units studied. Only ten per cent of the units studied were found to process fruit and vegetables as a continuous activity. Majority (70

per cent) of them were processing only on demand basis while 20 per cent of the units were found to prepare processed items during melas alone.

Food risk assessment conducted on the products sold by these units through microbial analysis revealed bacterial and fungal contamination in 9 out of 10 samples studied. *Enterobacter aerogenes* was detected in 7 samples. Based on criteria developed for microbial load of processed products only one product was graded as excellent, while two products were graded as good, one product graded as satisfactory and 6 products were graded as unsatisfactory. Chemical analysis revealed that the use of preservatives exceeding the prescribed limits was found only in one sample, while TSS content was lesser than prescribed standards in 4 products. It was also seen that only 25 per cent of respondents followed correct practices with regard to adulteration and quality of processed food. Lack of proper infrastructure facilities, adequate waste disposal measures and the lacuna in the knowledge of the respondents with regard to appropriate processing methods of fruits and vegetables may be the reasons for the bacterial and fungal contamination in ninety per cent of the samples studied and also the indiscriminate use of preservatives.

Based on the results of the food risk assessment, a food safety intervention programme of two days duration was conducted for the food business operators selected for the study. Prior to the conduct of the intervention programme, the existing knowledge, attitude and practice followed by the respondents were assessed, so as to find out the impact of the intervention programme. Results of the pre test on knowledge conducted before the intervention programme revealed that the mean knowledge score of the respondents was only 31.94 out of a maximum of 42. Knowledge of respondents about food storage and pest control measures was found to be the least among the different aspects of food safety that was included in the knowledge test. Study on attitude of the respondents prior to the intervention programme revealed that the mean attitude score of the respondents was 123.8 out of a maximum of 150 and their attitude towards food storage and pest control measures was poor. With regard to study on the practices followed by the respondents prior to the programme it was found that the mean practice score

obtained by the respondents was 30.84 out of maximum of 35. Only twenty five per cent of respondents were found to follow correct practices with regard to adulteration and quality of processed foods.

The impact of the food safety intervention programme assessed immediately after the programme and also one month after the conduct of the programme showed that there was significant change in knowledge, attitude and practices among the respondents showing the positive impact of the programme. Verification of the log book after one month revealed that the respondents started using the adulteration kit to detect the presence of adulterants in certain food articles used by them for processing.

Based on the study, following recommendations are put forward,

- Since the study revealed lack of proper infrastructure facilities and adequate space in the units for processing of foods, a common space for processing foods by self help groups should be provided at panchayat or municipal levels.

- The study revealed that majority of the respondents were processing fruits and vegetables only on demand basis and also during melas due to lack of adequate marketing facilities. Hence marketing facilities have to be strengthened so as to ensure a steady income for the self help groups engaged in food processing.

- The study revealed that the respondents did not have adequate knowledge and attitude about food processing and food safety to be followed in the processing units. Hence intervention programmes should be planned and conducted in the different areas of food processing and food safety, so as to prevent bacterial and chemical contamination of the foods.

- Food risk assessment of the foods processed and sold by different women self help groups should be conducted, and a mechanism for checking quality of such foods should be brought in to effect by food safety authorities for ensuring food safety with regard to such processed foods.

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Appendices

APPENDIX- I

Interview schedule to elicit information on personal and socio-economic characteristics of the respondents

1. Name of the respondents :
2. Age :
3. Address :
4. Phone number :
5. Religion/Caste :
6. Type of family : Nuclear / Joint
7. Area of residence : Urban/ Rural
8. Type of house

   a) Type of Roof : Tiled/ Thatched/ Tin roof/ Concrete/ Any other

   b) Type of Flooring : Tiles/ concrete/ Mosaic/ Any other

9. Educational qualification

   a. Illiterate
   b. Primary Education
   c. Upper Primary
   d. High School
   e. Plus Two
   f. Professional Education
   g. College level

10. Occupation

    a. Employed in government
    b. Private jobs
    c. Coolie
    d. Self employed

11. If self employed what type of income generating activity are you involved

    a. Food processing
    b. Cattle raring/ poultry raring

c. Tailoring
d. Cultivation or Farming

12. Monthly income

a. >= 979
b. 980-2935
c. 2936-4893
d. 4894-7322
e. 7323-9787
f. 9788-19574
g. <=19575

13. Details about the family :

Sl.No	Name of the members	Relation to respondent	Sex M/F	Educational qualification	Job	Income
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
TOTAL						

APPENDIX- II

Schedule to collect details about the processing unit and practices followed

1. Name of the processing unit and total number of members :

2. Which type of ownership is for your processing sector :

   a) Society
   b) Joint
   c) Self
   d) Family

3. Where the food processing unit situated

   a) Separate area outside
   b) Along with the home
   c) Friends house
   d) Any other

4. Unit placed in the location of : panchayat / coorperation

5. Details about production of processed items :

   Regular basis / On demand basis / For melas or festivals

Items	How many times					Amount processed
	Daily	Weekly	Monthly	Sometimes	Seasonally	
Jam						
Squash						
Pickle						
Syrup						
Jelly						
Nectar						
RTS						

6. If any other food items, Specify :

7. Details about production cost of processed item

Sl.no	Raw material	Quantity purchased
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

8. Income obtained from it :

9. What are the products that are most in demand by the consumers. Write in order of preference :

a)

b)

c)

d)

10. Does anyone help in preparation of food items : Yes / No

11. If yes, write whom, and in what all activities :

Whom	Chopping / Cutting	Grinding	Cooking	Cleaning	All activities
Mother					
Daughter					
Neighbour					
Husband					
Son					

12. Tick whether any of the work simplifying device are used :

Mixie	
Gas stove	
Eletricoven	
Microwave oven	
Food processer	
Fridge	
Pressure cooker	
Scraper	
Peeler	
Masher	
Juicer	
Pulper	
Sealer	
Weighing Machine	

13. Are all equipments used in working condition : Yes / No

14. Is the roof of the processing unit safe : Yes /No

15. Is the ventilation of the processing unit is good : Yes / No

16. Electricity of the processing unit is good : Yes / No

17. Storage facilities for raw food materials : Yes / No

18. If yes, Specify it :

19. Storage facilities for processing equipments : Yes / No

20. If yes, Specify it :

21. Storage facilities for processed foods : Yes / No

22. Which type of containers are used for storing processed products

: Steel/Plastic/aluminium

23. For what period do you usually stock the processed products before marketing :

24. Do you process the raw materials immediately after purchasing : Yes / No

25. If no. when do you process them? What is the reason :

26. Do you wash the raw (fruits & vegetables) materials : Yes / No

27. When do you wash the raw (fruits & vegetables) materials

: After cutting/ Before cutting/ Any other

28. Do you use any preservatives while processing : Yes / No

29. If yes, Which?

Materials	Preservatives used
Jam	
Pickle	
Squash	
Syrup	
Wine	

30. Do you use labels : Yes / No

31. Do you include below mentioned details in labels (Tick)

a) Date of manufacturing
b) Expiry date
c) Colours used
d) Ingredients used
e) Preservatives
f) Weight

32. Any specific name for your processed products : Yes / No

33. Which type of packaging materials are use

a) Bottles
b) Plastic covers
c) Tin
d) Plastic container
e) Any other

34. Which type of methods are used for sailing

    a) Direct selling
    b) Through agents
    c) Near local shops
    d) Through govt outlets

35. Where do you selling these items

    a) Near by offices
    b) Near by schools and colleges
    c) Near by shops
    d) For melas

36. Do you check the qualities of these products before packing and selling

    : Yes / No

If yes how?

37. which type of fuels are used for food processing?

    a) Electricity
    b) Gas
    c) Wood
    d) Keros ene

38. sources of water supply : pipe/pond/well/river/any other

39. If well water is used , do you purify the water : Yes / No

40. If yes, how do you purify the water :

41. Do you use water filter : Yes / No

42. While cooking, which type of holders are used

    : Clothes/ Iron holder/ Any other

43. Do you wear gloves during packing : Yes / No

44. Do you use any separate dress / uniform while doing processing work

    : Yes / No

45. Proper waste management system : Yes /No

46. Is waste water flowing near processing area : Yes/ No

47. If not, where it is situated :

48. Is proper waste processing system in processing area : Yes / No

49. How do you process the waste :

50. Where do you kept the waste

a) Near processing area
b) Outside pit
c) Outside
d) Far away from processing area

51. How often do you mop the processing area

a) Daily
b) Thrice in a week
c) Twice in a week
d) Once in a week

52. Do you use any cleaning agents : Yes / No

53. If yes, what are the cleaning agents used?

54. Do you clean and cut your nails before processing : Yes / No

55. Do you tie up your hair before processing : Yes / No

56. Do you use head cap for protecting from hair falling during processing

: Yes/ No

57. Which are the hygienic measures taken before processing

a) Bathing
b) Hand washing
c) Wearing gloves

58. Do you suffering from any communicable diseases : Yes / No

If yes, Which?

59. Do you suffering from any Skin diseases : Yes / No

If yes, Which?

60. Do you wear mask during processing : Yes / No

APPENDIX- III

Interview schedule to elicit information on knowledge of the respondents towards food safety

Name of the respondent:

Address:

SL.NO	Statements	YES	NO
1	The towels used in the processing area should be washed everyday to prevent contamination		
2	Separate slippers should be used in the processing area		
3	The used vessels should be washed immediately after use		
4	FPO rules are important in fruits and vegetable processing		
5	The hands should be washed properly before handling food		
6	The dustbin in the processing area should be tightly closed		
7	There is no need to put up the hair of the worker during preparation and serving of food		
8	The nails should be cut short and kept clean		
9	BHC is to be used in the processing area to kill ants		
10	Worm infestation can be controlled by keeping surroundings clean		
11	Packaging materials should contain PFA/ BIS/ agmark.		
12	The water from wells can be used for drinking without boiling		

13	There is no loss of nutrients due to cooking of vegetables and fruits		
14	Nutrient loss is high due to steaming of foods		
15	Storing raw and cooked food in the fridge is not harmful		
16	Typhoid is transmitted through contaminated food and water		
17	Food materials get easily spoiled due to heat		
18	FSSAI is newly inacted law		
19	Processed and preserved fruits and vegetables can be stored for a long time		
20	Fruits and vegetables can be used for the production of traditional food items		
21	Processing of fruits and vegetables decreases the family income		
22	Processing of fruits and vegetables is a profitable activity for women in village		
23	It is less expensive to start a food processing unit		
24	Processing increase the quality		
25	Seasonally available fruits and vegetables can be used for the production of variety of products		
26	Processed fruit products is more expensive than raw fruits		
27	Selling of processed product is very easy in markets		
28	FSSA license is essential for processing by small scale industry as well as large scale industry		
29	There is no need for adding preservatives in to fruit products		
30	Attractive and good packaging helps to increase the quality of products		

31	Some fruit items like Bilumbi, passion fruit, Champa etc are not good for processing		
32	Processing area should be kept clean and safe		
33	Processing area should have proper water, power supply and waste management system		
34	Processing and preservation should be done to ensure the health of the consumer		
35	The windows and doors of the processing area should be provided with netting to prevent flies from entry		
36	Food quality can be tested in govt laboratories		
37	Groundnut, coconut, cereals etc when stored in moist condition develop a poisonous fungus		
38	The clothes used for wiping processing area cause spreading of microorganism		
39	Cooked and raw foods cannot store together		
40	There is no need to reheat cooked foods		
41	Refrigerated foods contain very low amount of micro organisms		
42	Pure water can be detected through vision		

APPENDIX- IV

Interview schedule to elicit information on attitude of the respondents towards food safety

Name of the respondent:

Address:

SA- Strongly Agreed
A - Agreed
UD - Undecided
D - Disagree
SD- Strongly Disagree

SL. NO	Statements	SA	A	UD	D	SD
1	Microbial growth is faster in summer than winter					
2	Microorganisms cannot be destroyed in chill tray of refrigerater					
3	Microorganisms cannot grow in freezers					
4	Manufacturing and expiry date is essential for packaging					
5	Inadequately reheated cooked food can cause food poisoning					
6	Food handling should be avoided during illness					
7	To prepare safe food, hands should be properly cleaned					
8	To prepare safe food nails should be short and clean					

9	Cooked food should not be tasted using fingers					
10	Food poisoning can be prevented by personal cleanliness					
11	There is no need to wear separate dresses while doing food processing work					
12	Stagnant water should not be present in the processing area					
13	Processed food should contain specified amounts of food additives like preservatives and colours					
14	The bathrooms and latrines should be cleaned regularly and made free from pathogenic organisms					
15	The waste should be dumped far away from the processing area					
16	Fruit and vegetable waste materials can be converted in to vermi compost					
17	Do not encourage spitting near processing area					
18	Rat droppings are not very dangerous					
19	Water filters do not remove all microorganisms from water					
20	Ant eaten foods can be safely consumed by human beings					
21	Cockroaches are harmless and do not cause any food borne diseases					
22	Once used oil can be used to prepare other food items					

23	Flies can be prevented from getting in to the processing room by using netted doors and windows					
24	Food service personnel should use gloves when they have cuts and wounds in their hands					
25	Hand washing need not be strictly followed while doing processing work					
26	Vessels used for processing should be dried in the sunlight after washing					
27	The processing area should be airy and well ventilated					
28	All foot wears should be kept outside the processing area					
29	Processed products obtained from the market may have excessive levels of chemicals					
30	Products obtained from the market are more expensive than home made processed products					

APPENDIX- V

Composition of media for microbial analysis

1. Nutrient Agar Medium

Peptone	- 5g
Nacl	- 5g
Beef extract	- 3g
Agar	- 20g
Distilled water	- 1000 ml

2. EMB Medium

EMB	- 36 g
Distilled water	- 1000 ml

3. Mac – Conkey Agar Medium

Mac Conkey	- 55.07g
Distilled water	- 1000 ml

4. PDA with Rose Bengal Medium

Potato	- 200g
Dextrose	- 20g
Agar	- 20 g
Distilled water	- 1000 ml
Rose Bengal	- a pinch

APPENDIX- VI

Teaching aid used in intervention programme (BOOKLET)

ഭക്ഷണപദാർത്ഥങ്ങളിലെ മായം എങ്ങനെതിരിച്ചറിയാം?

ഒരു കൈപുസ്തകം

തയ്യാറാക്കിയത്

അനില. എച്ച്. എൽ
പി.ജി വിദ്യാർത്ഥിനി

ഡോ. പ്രസന്ന കുമാരി
അസോസിയേറ്റ് പ്രഫസർ

ഡോ. സോഫി ചെറിയാൻ
അസോസിയേറ്റ് പ്രഫസർ

ഗാർഹിക ശാസ്ത്രവിഭാഗം
കാർഷിക കോളേജ്, വെള്ളയാണി

IMPACT OF AN INTERVENTION PROGRAMME ON FOOD SAFETY AMONG WOMEN 'FOOD BUSINESS OPERATORS' IN TRIVANDRUM AND KOLLAM

by

Anila, H. L.
(2012 - 16 - 101)

Abstract of the
thesis submitted in partial fulfillment of the requirement for the degree of

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DEPARTMENT OF HOME SCIENCE
COLLEGE OF AGRICULTURE
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ABSTRACT

The study entitled "Impact of an intervention programme on food safety among women 'food business operators' in Trivandrum and Kollam" was conducted in the Department of Home Science, College of Agriculture, Vellayani during 2013 – 2014. The objective of the study was to conduct an intervention programme on food safety for women 'food business operators' based on food risk assessment conducted and study the impact of the programme.

The study was conducted in ten food processing units, selling fruit and vegetable processed products, selected randomly from the list of processing units maintained by Trivandrum Corporation and KVK Kollam. Fifty women food business operators were selected from these food processing units forming the study sample. Fifty per cent of the units consisted of about 11-15 members. Seventy per cent of the units were found to process fruit and vegetables, only on demand basis , 20 per cent of them processing items for sale during melas and only 10 per cent of them preparing processed items on regular basis. Observation of hygienic aspects in the units revealed lack of adequate sanitary facilities in majority of the units.

One processed product from each unit was selected for conducting food risk assessment through microbial and chemical tests. Thus a total number of ten processed food items sold by these units were selected for conducting food risk assessment. Results of the microbial test revealed that total bacterial count in nine samples varied between 18.5 - 159.5x10^4 cfu/ g and fungal contamination varied between 4.50 – 67.0 x 10^3 cfu/ g.

With regard to food risk assessment through chemical tests, it was found that only one product (lemon pickle) contained higher level of preservative than permissible limits and in four products (narunandi squash, nutmeg syrup, grape wine and jack fruit health tonic) it was seen that the total soluble solids content was lesser than the prescribed standards as per food safety regulations (FSSAI).

Based on the results of the food risk assessment, a food safety intervention programme of two days duration was conducted for the food business operators selected for the study. The impact of the food safety intervention programme assessed immediately after the programme and also one month after the conduct of the programme showed that there was significant change in knowledge, attitude and practices among the respondents. Verification of the log book after one month showed that the respondents started using the adulteration kit to detect the presence of adulterants in certain food articles used by them for processing.

The study highlights the need for conducting food risk assessment of small scale processing units, and also conducting awareness programmes for the food business operators for maintaining quality of processed foods.