Food Adulteration - Its Impact on Health and Consumer Awareness

By

Surekha. P. M

(20PFN025)

Thesis submitted to
Avinashilingam Institute for Home Science and
Higher Education for Women,
Coimbatore – 641 043.

In Partial Fulfilment of the Requirements for the

Master of Science in Food Science and Nutrition

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Certified as a Bonafide Research Work

Signature of the	**Signature of the**
Supervisor	**Head of the Department**

DECLARATION

I hereby declare that the dissertation entitled "Food Adulteration- Its Impact on Health and Consumer Awareness", submitted to the Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, in partial fulfillment of the requirement for the award of the Degree of Master of Science in Food Science and Nutrition is a record of original research work done by me under the supervision and guidance of Dr. (Mrs). S. Thilakavathy, Assistant Professor (SG), Department of Food Science and Nutrition, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore and that it has not formed the basis for the award of any degree/Diploma/Associateship/Fellowship or similar title to any candidate of any other University and it represents entirely an independent work on the part of the Candidate.

S. Thilakavathy

Signature of the
Supervisor

Signature of the
Candidate

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INTRODUCTION

I INTRODUCTION

Food is a stuff of either plant or animal origin which in raw, processed or semi-processed form is taken into the body in order to support the different biochemical and physiological activities of our body. Most of the times, these foods are prone to food fraud and adulteration, and put health disorder to consumers. The term food fraud encompasses the deliberate substitution, addition, tampering or misrepresentation of food, food ingredients or food packaging, or false or misleading statements made about a product for economic gain. The specific type of fraud is the fraudulent, addition of fake substances or removal or replacement of genuine substances without the purchaser‟s knowledge for economic gain by the seller (Alauddin, 2012).

The term adulterated food in legal term is used to mean that a food product fails to meet federal or state standards. Adulteration can also be the addition of a non-food item to increase the quantity of the food in raw or prepared form, preservation purpose, and improvement of appearance which can be done either intentionally or unintentionally. Also included are any poisonous or deleterious substances which may render the food injurious to health. Examples would be adding water to milk or animal carcasses to meat products other than the animal meat to be consumed, stones, gravel sand, insects, or animal hairs to grain products. So, one among the definitions of food adulteration is that it is an act of intentionally debasing the quality of food offered for sale. Consumers are always sufferers of being cheated or even victims of disease as a result of adulteration of food stuffs and death to the worst. So, knowing common types of foods being adulterated, common adulterants and health implications of the different adulterants are very important to the consumer (Anita, G. and Neetu, S., 2013).

Adulteration has historically been common in societies with few legal limits on food quality. Individuals have altered the state of food during prehistory to extend its longevity or to improve its taste. Approximately 300,000 years ago, early humans preserved meat by cooking and preserving it using fire. Later on, salt was discovered to preserve meat without cooking. Wine was often mixed with honey, herbs, spices and even saltwater, chalk or lead, which served as both a sweetener and a preservative in ancient Rome and Greece. The act of adulterating food for economic gain began to emerge as time goes on. During the Middle Ages, imported valuable and highly priced spices were of high demand and limited supply. Thus, merchants sometimes started to combine it with nutshells, pits, seeds, juniper berries, and stones or dust. Accordingly, contemporary accounts of adulteration date from the 1850s

to present day. Adulteration was thought to be first investigated in 1820 by the German chemist Frederick Accum, who identified many toxic metal colorings in foods and drinks. Later, physician Arthur Hill Hassall carried out extensive research in the early 1850s, which led to the 1860 food adulteration act and further legislations (Manasha, M. and Janani, 2016).

Food adulteration is the addition or removal of any substances to or from food, so that the natural composition and quality is affected. Adulterated food is impure, unsafe and not wholesome. (Aamna et al., 2016). Inappropriate food handling and packaging methods can also result in adulteration (Sudershan R, 2013). Intentional food adulteration is usually done for financial gain, whereas natural adulteration occurs due to the presence of certain chemicals, organic compounds or radicals naturally occurring in foods which are injurious to health and are not added to the foods intentionally or unintentionally (Zarina S and Zara T, 2012). In spite of strict measures against adulteration, it is still practiced just for profit putting human lives in danger (Singh N, 2012).

Adulteration consists of a large number of practices e.g. mixing, substitution, concealing the quantity, putting up decomposed foods for sale, misbranding or giving false labels and addition of toxicants. Some of the common adulteration practices are - ergot is mixed in cereals, chalk powder in flour, chicory and tamarind seed powder is mixed in coffee powder, papaya seeds in pepper, brick powder is added to chili powder, metanil yellow is added in turmeric for bright color and wood powder to dhaniya powder, etc. Adverse health effects of adulterants range from acute symptoms such as vomiting, abdominal pain, allergy, asthma, and headache and to even mental retardation, cardiac arrest and cancer. Any person whether by himself or any other person manufactures a food article with the knowledge of selling it to the consumer, sells unsafe food which can injure the person or lead to the death of the person shall be liable to pay the fine which may exceed to ten lakh rupees and may be imprisoned for not less than seven years (Suba R, 2013).

The addition of wheat flour to powdered ginger with enough capsicum to restore the pungency and enough curcuma to maintain the natural color is a typical example of intentional adulteration. This is also known as sophistication, which means no stone is left untouched to produce a food item which would probably look even better than a naturally grown/produced food and food products. This is more serious, which is affecting the health of citizens, including innocent children. The problem of adulteration persists at every level of food from preparation to consumption. Most of the food manufacturers, processors, restaurant owners and so forth are all involved in one way or another in this unethical practice of

adulteration. Foods are adulterated by using various harmful chemicals and toxic artificial colors. Rotten and perishables foods are stored, sold and served to consumers. Uses of poisonous chemicals in perishable foods are evident in highest degrees which are endangering the lives of the people (Derek, 2013).

Adulterants can also be elaborated as chemical substances which should not be contained within a given food or beverage; but, may be intentionally added to more expensive substances to increase visible quantities and reduce manufacturing costs, or for some other deceptive or malicious purpose (Anita, G. and Neetu, S., 2013). Food adulteration is still becoming one of the significant public health issues in different countries. The malpractice of adding harmful chemicals in food items is not only impacting on consumers health but also destroying the nutritional compositions of food (Lakshmi, V., 2018).

Food adulteration is a social evil and major problem of every society. Food laws play an important role in the quality control strategy. A number of laws have been enacted in the country for the purpose of laying down quality standards. There are two kinds of food laws and orders in our country first one is for monitoring safety standards, compulsory in nature and second quality standards mostly voluntary. Thus, the overall aim of food laws is to maintain food quality and quantity keeping all pros and cons of welfare and harm to consumer first and which may not be interfering in fair trade or food procedure business. It is the constituted duty of every Government to take care about health and living status of the public and at the same time to allow food business to grow and develop according to increasing demands (Vasireddi, 2013).

The quality of different foods has been a great challenge in various countries of the world including India. Currently, adulteration of milk is of major concern as around 80% of milk is found to be adulterated with many harmful chemicals in India. It is mentioned that in rural areas of India, about 8 to 13% milk is adulterated whereas in cities around 60 to 68% of milk supply is adulterated. These adulterants have harmful effects on the health of human beings. Adulteration of food not only constitutes a considerable economic problem but also may lead to serious health issues for consumers. Adulteration of food is widely prevalent in many developing countries of the world including India, China, Ethiopia, Mexico, Pakistan, Bangladesh, Vietnam, Indonesia, Afghanistan, Somalia and others (Pal, 2017). Food adulteration ultimately deceives consumers and leads to various health risks. Nowadays, it is very difficult to find a sector of food industry which is free of adulteration. Because of that it is important for the consumer to know the common adulterants and their effect on health

since the increasing number of food producers and the outstanding amount of food stuffs import enables the producers to mislead and cheat consumers. The motivation for food fraud is economic, but the impact is a real public health concern (Singh & Gandhi, 2015).

Adulterated food is dangerous as it may be toxic and effect health, it could deprive nutrients required to maintain proper health and it may cause intoxication or problems such as allergy in sensitized individuals. A variety of chemical, biological and physical hazards are the major causes of food safety problems. Among these the bacterial contaminants, environmental contaminants including pesticide residues, mycotoxins and adulterants have been reported to be responsible for causing large-scale outbreaks of food poisoning and smaller incidents. These include various "food poisonings" reported in newspapers in India from time to time, outbreaks of Lathyrism, epidemic dropsy, venoocculsive disease, various mycotoxicoses and food borne disease due to chemical toxins. Although not all food incidents are injurious to health, nevertheless they undermine consumer confidence in food safety and are costly to individual companies and national economies. Novel foods, such of unapproved varieties of genetically modified foods (e.g. star link variety of maize) have in the past posed problems of food allergenicity.

Table: 1 presents list of some of the food products being adulterated by food adulterants and their harmful effects on human health.

TABLE I

FOOD ADULTERANTS AND THEIR HARMFUL EFFECTS ON HEALTH

S. No	Food Products	Respective Food Adulterants	Health Hazards in Humans
1.	Milk	Water, Starch, urea, extraction of fat	Digestive system disorders
2.	Sugar	Chalk powder	Stomach infections
3.	Tea	Artificial pigments/dye, already used leaves, iron fillings	Liver disorders, Cancer
4.	Coffee powder	Tamarind and date seed powder, saw Dust	Diarrhoea
5.	Salt	White powder, stone, rawa	Stomach disorders
6.	Chilli powder	Artificial colors, brick powder, Sudan dye	Blood and lung cancer
7.	Turmeric	Lead chromate, saw dust, Metanil Yellow	Carcinogenic

8.	Mustard seed	Seeds of prickly poppy- argemone	Epidemic dropsy, Glaucoma, Cardiac arrest.
9.	Black pepper	Dried papaya seeds	Injurious to health
10.	Pulses	Kesari dal, Metanil yellow, clay, stone, gravel	Lathyrism, carcinogenesis, stomach disorders
11.	Butter	Oleo, margarine, starch	Food poisoning
12.	Honey	Fructose syrup/ cane sugar	Stomach disorder
13.	Sweets, juices	Coal tar dye/ metanil yellow	Cancer, toxin released
14.	Rice, Wheat	Mud grits, soapstone bits, sand, Ergot	Poisonous due to poisonous compound in the fungus Ergot
15.	Green chillies/green peas	Malachite green	Cancer, genetic mutations, harm the reproductive system
16.	Vegetable oil	Argemone and mineral oil	Heart diseases, skin infection and cancer
17.	Ghee	Ghee essence, vanaspati, sweet potato, mashed-potato and other starches of edible oils	Cancer, acute renal failure
18.	Carbonic drinks	Aluminium leaves	Asthma, lung disorder
19.	Ice-creams	Detergent powders	Skin and lung diseases
20.	Sea food	Mercury, Arsenic	Stomach and brain disorder

(Bansal et al., 2015)

It is found that there are various chemicals and colors used in fruits and vegetables which prove disastrous for digestive system, eyes and liver which also results in vomiting and diarrhea in children, kidney failure. Chemicals such as calcium carbide used in mangoes, bananas, copper sulphate used to ripen fruits faster and oxytocin can lead to brain damage, a hormone used for faster growth of pumpkin, watermelon, brinjal, gourds, cucumber. Wax adds shine on apples and pears. Cheap green colors containing chemicals such as metallic lead applied to bitter gourd and leafy vegetables to give fresh color. Some Adulterated foods in market are:

Turmeric, dals and pulses such as moong or channa: Adulterant is Metanil Yellow and Kesari Dal (added to enhance the yellow colour of a food substance). It's harmful effect is that it is highly carcinogenic and if consumed over a continuous period of time it can also cause stomach disorders.

Green chillies, green peas and other vegetables: Adulterant is Malachite Green (To accentuate the bright, glowing green colour of the vegetable). Argemone seeds (used to add bulk and weight) that it is a coloured dye that has proven to be carcinogenic for humans if consumed over a long period of time.

Mustard seeds and mustard oil: Adulterant is Argemone seeds (used to add bulk and weight). Papaya seeds (used to add bulk) that the consumption of these could cause epidemic dropsy and severe glaucoma. Young children and senior citizens with poor immunity are more susceptible to this.

Paneer, khoya, condensed milk and milk: Adulterant is starch (used to give it thick, rich texture). It‟s harmful effect is that it is unhygienic, unprocessed water and starch can cause stomach disorders. Starch greatly reduces the nutritional value of the ingredient.

Ice cream: Adulterant is pepperonil, ethylacetate, butraldehyde, emil acetate, nitrate, washing powder etc are not less than poison. Pepper oil is used as a pesticide and ethyl acetate cause diseases affecting lungs, kidneys and heart (Jyothi Gurupadappa, 2017).

Food adulteration is a major threat, which is regularly faced by everybody. Therefore, detection of adulteration in food is an essential requirement for ensuring the safety of foods consumed by people globally. The sophisticated laboratory techniques are available to check adulteration but they are costly and time consuming. Hence, it is imperative to develop simple, rapid, sensitive, specific, low price screening tests, which can be widely employed by poor resource nations to detect commonly used adulterants in various types of foods for the safety of consumers (Pal, 2015).

Customer behavior is an important issue in controlling food adulteration in a country. The consumer buying behavior involves the nature and outlook of the market and offers a rational way of managing the overwhelming range of knowledge about factors affecting purchasing practices (Popovic I et.al.,2019). Buying practices include deciding the type, price, and quantity of products purchased by the buyer through market agencies. In general, customer behavior remains unchanged, but they need to be dynamic. The buyer needs to figure out the ideal quality of the sold products at reasonable prices. Buying takes a significant amount of time, energy, and resources. Successful purchasing includes advanced

knowledge of the products, material, their resources, and their use (Grewal et al., 2015). In India most of the adulteration is carried out for financial gains or because of lack of awareness or carelessness in processing, storing, transportation and marketing foods according to hygienic requirements. Ultimately, it is the consumers who have to pay the price for adulteration as they either pay a higher price for substandard food or they suffer because adulteration affects their health. To ensure the safety of consumers, the FSSAI has laid down norms for food safety. Food Safety Officershave begun to book adulterants right on the spot especially for foods that are consumed on a daily basis like milk, vegetable, spices etc. Food samples are also sent to the variouslaboratories for testing (FSSAI, 2012).

The world is facing a potential crisis in terms of food security, due to lack of production and supply of safe and nutritional food. Adulteration seems to be getting deadlier and serious problem present in over society that should be eradicated (Yamuna, M et al., 2014). The purpose of this study is to identify the knowledge of consumers about food adulteration and create awareness on food adulteration and its health impacts among the consumer and also to identify the factors influencing the consumers to consume adulterated food. To achieve this objective, data has been collected from primary sources via survey through Google form. Nutrition education was given to the selected 200 subjects and post data was collected. Data analysis and interpretation was made effectively for comparing pre-data and post-data by using tools like percentage, chi square test and t test.

Hence the present study entitled “Food Adulteration- Its Impact on Health and Consumer Awareness” was conducted with the following objectives

- To assess the knowledge of people about food adulteration and its impact on health.
- To create awareness among people about food adulteration and their ill effects.
- To study the impact of adulterants in selected area among people of different age, sex, education and background.
- To provide nutrition education to a selected group of people to improve their knowledge on food adulteration and its impact on health.

REVIEW OF LITERATURE

II REVIEW OF LITERATURE

The review of literature pertaining to the study entitled “Food Adulteration- Its Impact on Health and Consumer Awareness” is presented under the following headings

I. History and reasons for food adulteration
II. Food adulteration as a threat to consumers
III. Types of food adulteration
IV. Adulterants used in food items and their health effects
    A) Adulteration in food grains, oils and fats
    B) Adulteration in fruits and vegetables
    C) Adulteration in tea, coffee and spices
    D) Adulteration in milk and milk products
    E) Adulteration in bakery, confectionaries, sweets and savories
V. Ill effects of food adulteration
VI. Consumer awareness regarding food adulteration

I. HISTORY AND REASONS FOR FOOD ADULTERATION

In the 18th and 19th centuries, food adulteration was a common incident in European and North American cities. In Europe, rural to urban immigration increased and urban populations grew rapidly. Small-scale food production that had existed in earlier medieval towns became impossible, and consumers depended entirely on providers who were middlemen, or were middlemen to other middlemen. Food swindlers were especially common among the large immigrant population of urban society as they often were the poorest and most powerless (Schell, L. M. et al., 2012).

Among the first to draw public attention to food adulteration was Frederick Accum. In 1820 he published an exposé, Adulterations of Food and Culinary Poisons, which was a seminal event in the history of adulteration and reform. The book itself features a small skull and cross-bones motif on the cover with the underlying words, “There is death in the pot”, summarizing Accum's conclusion. A professional chemist better known in his day for work demonstrating the safety of gas illumination in comparison to candlelight, Accum exposed numerous examples of dangerous food adulteration. By devising methods to detect chemical additives, he proved their common existence in a large variety of foods. Among the problems he observed were the frequent use of metals to color or modifies food. Candies and sweets generally were marketed in bright colors, some of which were achieved using red lead or

copper, both poisonous. Pickles and many green vegetables were made greener with copper washes. Imitation tea was boiled with verdigris (produced by the oxidation of copper) and painted with it to secure the impression of real tea. Complaints of stomach ailments were often heard and fatalities were noted in newspaper accounts of the day. The reasons for these complaints are well known now. Copper and lead are toxic at the high doses that were used in food adulteration. Each produces a wide range of effects depending on dose including death, neurotoxicity, kidney and liver damage, as well as mundane stomach upset (nausea, vomiting) (Wilson, 2008).

As indicated by El-loly et al.(2013) and Afzal et al.(2012), reasons for adulteration of food products are to fetch higher cash income and/or to increase shelf life. The main reason that attracts adulteration is for boosting their cash income by increasing its volume. Even though adulteration is initiated by some selfish producers, processors, and retailers for increasing their profits, the main cause for adulteration is dishonesty and lack of accidental quality assessment on products suspected (Asrat and Zelalem, 2014).

Several causes of adulteration in milk and other foods include tainted moral of the society, demand and supply gap, perishable nature of milk and dairy products, little purchasing power of the customer, spoiled socioeconomic structure, unorganized condition of dairy industry and other food processing units, lack of strict and effective regulatory system, shortage of appropriate, rapid and definite tests (Kamthania et al., 2014).

Another reason for faking and adulteration of goods and services is outsourcing to offshore producers. Outsourcing became possible because comparatively labor is cheap in some countries and this is also what makes product faking easy since the cost of producing is far less compared to the super normal profits being made (Sicpa, 2012). Cofie (2012) argues that counterfeiting thrives on the whole process of globalization. Similarly, any break in steady supply of original product or service could induce the introduction of fake and adulterated ones in order to meet the demand by users. Here, the new sources may not be immediately differentiated or identified and therefore the stringent measures which original producers are subjected to would have been avoided.

In general foods and drinks are adulterated for the following six reasons as reported by Narayan D. (2014). These are

1. When the demand is more than the supply in the market,

2. To come at par with the market competitors by lowering the cost of production,

3. The greed for increased profit margins,

4.The common man cannot afford food items with their original constituents,

5. Lack of trained manpower with outdated food processing techniques and

6. No idea about the disease outbreaks caused due to adulterated food products.

Now a days, “Adulteration is health menace”. Thus, food adulteration takes many forms: mixing, substitution, abstraction, concealing the quality sale of decomposed foods and using false labels. Even educated consumers do not pay attention to the menace of adulteration. Many of the spices, ready to eat ground masalas and commonly used products are found contaminated/adulterated. The adulteration problem in India has attained massive dimensions (Faraz, A. et al., 2013).

II. FOOD ADULTERATION AS A THREAT TO CONSUMERS

Though food legal guidelines that exist are akin to worldwide ones, there's little or no interest on the floor degree to reveal or come across adulterated ingredients with inside the marketplace or punish the guilty. Milk is stated as one of the pinnacles adulterated merchandise however the USA beat the ingenuity of the Indian fraudsters in evolving milk absolutely without a cow or a buffalo, the usage of elements like detergents, urea, reasonably-priced oil and many others that compete with real milk with inside the marketplace with entire impurity (Gupta et al., 2013).

The problems of adulteration make the food items used in our daily life unsafe and unhygienic for use due to poor handling (Asrat, A., Ermias, B., & E. 2015). In the past few decades, adulteration of food has become one of the serious problems and consumption of adulterated food causes serious diseases like cancer, diarrhea, asthma, ulcers. In general, adulteration of food items has a very serious impact on producers/farmers, processors or manufacturers/enterprises, consumers and government.

Impact on consumers

Hazardous effects of food adulteration is associated with diarrhea, abdominal pain, nausea, vomiting, eyesight problem, headache, cancer, anemia, insomnia, muscular paralysis and brain damage, stomach disorder giddiness, joint pain, liver disorder, dropsy, gastrointestinal problems, respiratory distress, edema, cardiac arrest, glaucoma carcinogenic effects, kidney failure, digestive system disorders, etc. It is found that there are various chemicals and colors used in fruits and vegetables which are very poisonous for health.

Calcium carbide used in mangoes, bananas, copper sulphate used to ripen fruits faster, oxytocin a hormone used for faster growth of pumpkin, watermelon, brinjal, gourds, cucumber. Wax adds shine on apples and pears. Cheap green colors containing chemicals such as metallic lead applied to bitter gourd and leafy vegetables to give fresh color. Pesticides & herbicides used excessively for growing fruits and vegetables. Consumption of chemical-laden fruits and vegetables can prove disastrous for digestive system, eyes and liver. It can also result in vomiting and diarrhea in children. (Faraz et al.,2013).

Enterprises are impacted by a loss of consumer confidence in their products, recalls and destruction of contaminated products, complaint expenses and increases of insurance premiums and costs related to equipment replacement or cleaning. A supplier's fault is inevitably reported in the mass media, casting doubt on that company's reputation (Pandpal et al., 2012). A producer that depends on a banned imported foodstuff not only suffers economic loss to the impacted product but also faces lost sales caused by lossof public confidence. The resulting brand damage can be devastating, and recovery can require significant time and expense when consumers have moved on to other suppliers‟ products (Ibens, 2014). People have lost their trust in the products. For example, about 40 to 60% of consumers either ceased or were unwilling to purchase domestic milk products, whereas those who purchased imported milk powder increased from 34% to 47% in China due to milk adulterating by melamine as (Qian et al.,2011).

III. TYPES OF FOOD ADULTERATION

(Biresaw, A. D., Woldemariam, H. W. and Abera, B. D., 2015) defined adulteration as the act of debasing product with the objective of counterfeiting a pure or genuine commodity or of substituting an inferior article for a superior one in order to gain an illegitimate profit. In addition, the authors list four ways of adulteration. These are: Addition of extraneous matter, example, addition of sand to food grains and water to milk; Mixing inferior quality material with a superior one, example mixing used/spent tea leaves with fresh tea leaves. Thus, food is said tobe adulterated if any of the following happened to it

- A substance is added which decreases its value or makes it injurious.
- Less expensive or inferior substances are substituted wholly or in part.
- Any valuable constituents have been subtracted either entirely or in part. In case it is counterfeiting (imitation).
- In case colored or otherwise treated to improve its appearance with stuff injurious to health No matter what the reason is, if its quality is below the standard.

Food in general is adulterated for different reasons. Some organizations or individuals in food supply chains are adding adulterants to foods for improving the appearance to get better price by cheating buyers of the products. Food can also be adulterated for increasing volume, preserving or others. Generally, adulterations can be intentional and unintentional.

Intentional Adulteration

Intentional food adulteration is purpose fully performed type of adulteration and is usually done for financial gain. The most frequent type of adulteration of this category is color adulteration. The examples of the intentional adulteration are the addition of water to liquid milk, extraneous matter to ground spices, or the removal or substitution of milk solids from the natural product. It includes, adding things like sands, marble chips, stones, mad, other filth, chalk powder, water, mineral oil, and harmful color to earn some unfair profit (Mansuri, 2011). Addition of water or urea to liquid milk, extraneous matter to ground spices, addition of argemone seeds to mustard seeds, washing powder to ice creams, chalk to sugar, water to honey, chicory to coffee, white powered stone to common salt, argemone oil to groundnut oil are all intentional adulterations reported from different parts of the world. It is dangerous because, amounts of nutrients deducted and extraneous substances added into food items that are done by business oriented people just forgetting the humanity behind of money making mentality (Awasthi, S. et.al., 2014). According to, (Laura Schumm, 2014) olive oil, milk, honey, saffron, orange juice, coffee and apple juice are the seven most likely food to be targets for intentional or economically aggravated use of adulterants in food. Calcium carbide used inmangoes, bananas, copper sulfate used to ripen fruits faster, oxytocin a hormone used for faster growth of Pumpkin, watermelon, gourds, cucumber, wax to add shine on apples and pears, cheap green colors containing chemicals such as metallic lead applied to bitter gourd and leafy vegetables to give fresh color, pesticides and herbicides used excessively for growing fruits and vegetables can all be considered adulterants if not well communicated to consumer.

Incidental/Unintentional Adulteration

Unintentional (incidental) adulteration is a result of ignorance or the lack of facilities to maintain food quality. This may be caused by leak out effect or from pesticides and fertilizers. Inappropriate food handling and packaging methods can also result in these type of adulterations. Accidental food adulteration as the name imply occurs accidentally without our knowledge. Pesticide residues, droppings of rodents, larvae infoods are examples of adulterants under this category (World Health Organization, 2017). This type of adulteration

is brought due to lack of proper hygienic conditions of foodproducts and drinks throughout production site to consumption table. Here, the producers or traders are not in position to add different adulterants but the ways the products are produced,handled, passed, and processed, stored, transported and marketed may be the places where they were contaminated or adulterated since any substance without its original is extraneousto the product and hence is considered adulteration. These includes: residual pesticides, tin from cans, rodent droppings, preservatives, mercury from effluents, lead from water, etc., (Asrat, A. and Yilma, Z., 2014).

Metallic Contaminants

Metallic contaminants may enter the food supply chain through environmental contamination or during food production process and they may be present in food in trace amount. Arsenic from pesticides, lead from water, and effluent from chemical industries, tin from cans are some of the metallic contaminants which could be considered another incidental type of adulterants in foods. The mercury from effluents, lead from water and similar contaminants are also among metallic contaminants (Deepti Narayan,2014).

Natural Adulteration

The natural adulteration is also another type of adulteration which could take place in foods due to the presence of different chemicals, organic compounds or radicals naturally occurring in foods which are injurious to health and are not added to the foods intentionally or unintentionally. From different types of natural adulterations, some examples are toxic varieties of pulses, mushrooms, green and other vegetables, fish and seafood which might be called as anti-nutrients in some of cases. Many varieties from species of marine fish are known to be toxic of which many are among edible varieties. The act of food adulteration can also be categorized as replacement, addition or removal. Replacement can be absolute or partial substitution of a food component or valuable authentic constituent with less expensive substitute with the intention of circumventing on origin and false declaration of the process in general. Addition on the other hand is the inclusion of small amount of non-authenticated substances to mask inferior quality ingredient. The removal type of adulteration is taking away of authentic and valuable constituents without purchasers‟ knowledge. These all are done for the economic gain. Adulteration can also occur during production of organic, genetically modified, irradiating foods (World Health Organization, 2017).

Adulteration in Organic Foods

In case the food is claimed to be organic, it needs to be grown and manufactured in a manner that adheres to standards set by the respective country they sold in. In an organic type of farming there is no use synthetic pesticide into the environment. The most common pesticides, accepted for restricted use by most organic standards, include BT, pyrethrum and rotenone. Therefore, any food claimed organic and not fulfilling the standards is adulterated (Mansuri, Z. 2011).

Adulteration during Irradiating the Foods

In food irradiation, ionizing radiation like radionuclide Cobalt-60 is applied to food for destroying and checking the multiplication of microorganisms, bacteria, viruses, or insects that might be present in the food and for sprout inhibition, delay of ripening and improvement of rehydration as well. When irradiating foods, the quantity of dosage is very much important. In ionizing radiation, there are disruptions of internal metabolism of cells, DNA cleavage, and formation of free radicals. In the process, there are disruption in chemical bonds, possible development of resistant microorganisms, inadequate analytical procedures to detect irradiation in food, and public resistance. If this irradiation is used at the level that it can be over dosed, then, it is obvious that it will be severe health hazards. Therefore, all these acts without knowledge of consumer can be considered adulteration (Mahindru, S. N., 2013).

Adulteration during Production of Genetically Modified Foods

Genetically modified organisms (GMOs) are organisms in which the genetic material (DNA) has been changed in a manner that does not happen in nature. It is often called modern technology or gene technology. Combining genes from different organisms is said to be genetic modification. The GM products include medicines, vaccines, food and food ingredients, feeds and fibres. Though GM foods are developed and marketed because there is some perceived advantage either to the producer or consumer of these foods; there are safety issues including allergens, transfer of antibiotic resistance markers, and unknown effects can happen. Thus, unless communicated to users, GM food could be one form of adulterations (Matute, A.I. et al.,2017).

IV. ADULTERANTS USED IN FOOD ITEMS AND THEIR HEALTH EFFECTS

Almost every food-item from milk to fruits, from vegetables to grains is adulterated at some level. Some adulterants enter via agricultural steps, as they are not cleaned well. These are visible adulterants like stones, leaves, soil, sand and dust to name a few. They are generally harmful for the health and most of them lead to serious health problems like cancer. Even animal feed like cake as protein supplement for lactating animals is adulterated accounts about 90 percent of un-branded loose forms (Alauddin, 2012).

Depending on the types of foods and drinks adulterated it is possible to see adulteration in four major categories like milk and milk products, fats and oils, food grains and others (animal and plant originated foods) adulteration respectively.

A) Adulteration in food grains, oils and fats

Food grain adulteration involves mixing sand or crushed stones to increase the weight of food grains. Cereal grains and pulses are mixed with plastic beads that resemble grains in color and size. Very often, water is also sprayed on grains to increase the weight.

It is easy to adulterate oils and fats. Majority of fats, oils and butter are paraffin wax, castor oil and hydrocarbons. But it is difficult to detect such adulteration. Ghee is often mixed with hydrogenated oils and animal fats. Synthetic colors and flavors are added to other fats to make them appear like ghee (Anikta choudhery et.al, 2020).

Ghee essence is used in cheaper oils and passed off as pure ghee. This type of ghee will not solidify like normal ghee. It may also not have that grainy texture of pure ghee. Oleomargarine or lard is added to butter. The argemone oil used to adulterate ghee and butter is highly toxic. It causes a disease known as dropsy. Watery fluid collecting in some parts of the body is the main symptom. It affects the normal functioning of the body. It may also paralyze the limbs (Ghona Ali, 2015).

B) Adulteration in fruits and vegetables:

To improve the appearance, taste, and output of fruits, harmful chemical items like oxytocin and Saccherin are known to be introduced. Oxytocin and Saccherin are two common adulterants found in fruits and vegetable waxes, as well as petroleum-derived wax colors. It increases the growth of watermelon, brinjal, gourd, and cucumber, which increase the look of fruits, and vegetable, induces sweetness in fruits such as muskmelon and watermelon and speed up the ripening process. The Food Safety and Standards Administration of India (FSSAI) has released a document titled DART, which stands for

detecting adulteration with rapid test and summarizes straightforward and simple procedures for consumers to detect food adulteration. Adulteration of fruits, particularly mangoes, involves the use of artificial ripening agents and these fruits are being ripened with calcium carbide. There are reports that injectable dyes are used as adulterants in watermelon, brinjal, capsicum to enhance their flavor and color(Moore J.C et al., 2012).

The mounting focus of consumers toward a healthier diet including a lot of fruits and vegetables, has driven the evolution of the juice market which has been steadily growing across developing and developed countries. Apart from orange juice, which remains the most popular and widely consumed fruit juice produced in the largest volume worldwide, other fruit juice types, such as pomegranate or berry-based juices have gained a high reputation and are being sold as high-quality food items, due to their remarkable health benefits, including prevention against cancer and cardiovascular disease (Twohig M, et al., 2012).

The most frequent adulteration practices within the fruit juice industry involve dilution with water, addition of sugars, pulp wash or other additives and juice-to-juice adulteration, defined as the undeclared addition of a juice of lesser value to a product. All such forms of adulteration result in lost value for the consumer and may even jeopardize consumers‟ health causing allergic reactions (Zora Zandric and Andrew Cannavan, 2014).

C) Adulteration in tea, coffee and spices

As spices are agricultural products, they are prone to microbial spoilage and claimed that due to higher prices of spices powder, there is higher possibility of adulteration with physical and chemical commodities. They are generally adulterated with less expensive materials, e.g. cassia or cinnamon is mixed with a variety of different materials, such as ground hulls from various fruits, sawdust, ground fruit seeds and nutshells, and other readily available waste materials. Ground spices such as curry powder, garam masala, chili powder and turmeric powder are others, which are easily adulterated. Chili powder were adulterated with artificial color, common salt was adulterated with insoluble impurities, tea powder adulterated with iron fillings and artificial color (Abidfaheem T.K., et al, 2013).

(Bhatt Shuchi R et al 2012) in their study found that “coriander powder was adulterated with horse dung, soil and leaf powder”. (Mohamed Ziyaina et al 2014) in their study found “lead and cadmium in turmeric powder”. “Label declaration on packed food is very important in order to know the ingredients and its nutritional value”.

D) Adulteration in milk and milk products

In developing countries, the industrialization brought a series of problems along with the much appreciated progress, with the mass collection and distribution of milk from various sources playing the role of potential vehicle for disease transmission. In olden days, milk was collected from small groups of animals in farms and it was supplied to a small number of people living nearby (Chanda et al., 2012). But with the advent of industrialization, population growth and urbanization, the demand increased drastically. Milk supply through the small farms no longer met the increasing demand (Dehinenet et al., 2013). Hence commercialization of the milk industry ultimately took place (Revathi et al., 2012). Milk adulteration involves adding water to milk and removing the beneficial fats from milk. The producers deliberately adulterate milk and its products in order to promote the level of these essential nutrients after reduction of a given amount and/or to mislead the consumers to increase their profit margin by several chemicals like urea, starch, flour, cane sugar, vegetable oils, detergents etc (Faraz et al., 2013).

Various preservatives like formalin and some antibiotics are also added in milk toincrease its shelf life (Awan et al., 2014). This addition decreases the nutritive value of milk (El-loly et al., 2013) and its incidences are at increase over the years according to (Alauddin 2012). Although milk is produced throughout the year yet the supply and demand of milk are related to the seasonal fluctuations (Afzal et al., 2011) due to this milk used by the people for consumption is adulterated to such an extent that there is very less nutritive value in it. Dairy foods are made from milk, and their components are the same as those of milk, except butter being comprised mainly of milk fat, but in varying amounts (Faraz et al., 2013) are also adulterated in one or another forms (Khan et al., 2018). Milk and its products can be exposed for adulteration at different points such as at farm and procurement level, while transporting and processing, in view of the fact that fresh milk is pure when it comes out of the udder and free of adulterants and microbes but can be contaminated by bacteria, yeast, fungi and dust, water, different chemicals or adulterants and animal hair due to livestock keepers‟ unhygienic milking, handling and storage practices, some dishonest producers retailers and manufacturers (Singuluri and Sukumaran, 2014).

E) Adulteration in bakery, confectionaries, sweets and savories

Bakery products are one of the most adulterated commodities and have gained importance in the food industry. Cakes are the most preferred bakery product. There are numerous kinds of cakes with different formulas, and these are associated with particular organoleptic characteristics in the consumer’s mind. Fat, sugar, egg and flour are the essential

ingredients of cake. Therefore, inter-esterified or hydrogenated margarines/shortenings, and edible oils or butter are the main fat fraction in cakes. Butter is a common raw material for many food products, which contains partially saturated animal milk fat, whereas shortenings involve refined and artificially saturated vegetable oils. The shortenings are much cheaper than butter because of the lower cost of the vegetable oils. Butter is sometimes illegally mixed with these saturated oils for use in adulteration (Ghotra BS, et al., 2012).

Honey is defined as the natural sweet substance produced by honeybees. Adulterants are invert sugar or Jaggery, metanil yellow color and sugar solutions or water in honey. The metanil yellow colour, chalk powder, washing soda and sodium bicarbonate are adulterants present in Jaggery (Faheem et al., 2014). Sugar is a sweet, crystalline food supplement extracted from sugar beet and sugar cane. Starch, chalk powder and washing soda are analyzed adulterants in sugar or sugar powder (Abhirami and Radha, 2015).

Brown sugar is a sugar cane based traditional sweetener of Pakistan. The starch, metanil Yellow, chalk powder and washing soda are adulterants in brown sugar. Candies are confectionery products having adulterants as non-permitted artificial colors and saccharin in candies. Adulteration on bakery items and dairy products may have tremendous effects on a child's health. Such as cream-filled foods, cereals, cream sauces causes increased salivation, abdominal cramp, vomiting and prostration. Improperly processed milk and canned meat may cause food poisoning and abdominal pain (FSSAI, 2012).

V. ILL EFFECTS OF FOOD ADULTERATION

It is mentioned that adulteration lowers the quality of food and also cause health hazards. Adulterated food is impure, unwholesome and unsafe for human beings. Humans are very sensitive to food adulteration, and sometimes exhibit immediate side effects, such as diarrhea, dysentery, and vomiting. It is mentioned that 57 % of people (32% children and 25% adult) developed health problems due to ingestion of adulterated and contaminated foods worldwide The consumption of adulterated foods can lead to various illnesses like stomach disorder, heart problem, brain damage, paralysis, anemia, liver disorder, indigestion, nausea, vomiting, giddiness, diarrhea, dysentery, acidity, ulcer, autism, cancer, kidney malfunction, joint pain, asthma, metabolic dysfunctions, food poisoning, eye sight problem, skin disorders etc. The polluted water acts as vehicle for pathogens that cause diseases in susceptible persons. It is reported that unhygienic water is most commonly added in the milk, and ingestion of water adulterated milk can result in many diseases of multiple etiologies that include viruses, bacteria, protozoa, and helminthes (Pal, 2017).

Consumption of adulterated food items may cause asthma, sore throat, larynx constriction, bronchitis, skin infections, allergic reactions, diarrhea, hematuria, circulatory failure, numbness, dizziness, kidney failure, stomach cancer, liver cancer, nervous disorders and many other diseases (Rahman et al., 2015). Researchers have revealed that consumption of formalin directly through food can cause different types of cancers, especially the lung cancer (Wooster et al., 2015). After consumption of adulterated food items, thousands of people are becoming sick. Children are the worst victims. About three million people suffered from diarrhea during 2005-2009 and about 15% of children died in 2011 as reported by the Directorate General of Health Services. The long term effects are also very severe especially the incidence of renal failure, liver damage and cancer which are increasing alarmingly in Bangladesh. Heavy metals, such as lead, chromium and arsenic accumulate in the body that might cause kidney and liver damage and develop abnormality among children (Khan, 2014).

Textile dyes for short term use may cause diarrhea and gastrointestinal problems but in the long run, these materials accumulate in the body with serious health hazards. The burnt oil developed after repeated cooking severely affects the digestive system. In case of very young children, the liver is not matured enough to metabolize and break down the toxins. This may affect the development of immune system. So, our children are at high risk due to such adulteration. According to the general information regarding food risk published by WHO, human exposure to chemicals at toxic levels as well as nutritional imbalances are known or suspected to be involved in causing cancer, cardiovascular diseases, kidney and liver dysfunctions, hormonal imbalance, reproductive disorders, birth defects, premature births, immune system suppression, musculoskeletal diseases, impeded nervous and sensory system development, mental health problems, urogenital diseases, old-age dementia and learning disabilities. Therefore, the protection of diet from these hazardous conditions is essential to protect public health (WHO, 2017).

The adulterated food substances if used regularly can cause some symptoms like headache, gastro-intestinal disorders, muscular pain, drowsiness etc. For example, the argemone oil used to adulterate ghee and butter is highly toxic as it causes a disease known as dropsy characterized with the symptom of the presence of fluid collecting in some parts of the body. Dropsy affects the normal body function and may result into paralysis of the limbs. Another adverse effect of food adulteration is metanil yellow used to brighten the color of pulses, turmeric powder and sweet meats is a coal-tar dye, which may cause cancer. Some people may experience intestinal disorders after regular use of powdered sugar and other food items being adulterated with washing soda. These food adulterations incidents are

very harmful to the humans and they should be seriously dealt in by both the consumer organizations and consumers (Swami, 2019).

A chunk of the green leafy vegetables sold in Chennai is found to contain toxic metals that have the potential to harm various organs of the body. It is common in almost all developing countries. And their ugly faces is come out in the form of its harmful effects as stomach disorder, giddiness and join pain, diarrhea, liver disorder, dropsy, gastrointestinal problems, respiratory diseases, cardiac arrest, glaucoma, carcinogenic effects, paralysis etc. Therefore, health concern related to food adulteration as can be understood from this review includes food poisoning, stomach ache, indigestion, loose stools, cough, fever, vomiting or nausea, apthae in mouth, out of infection from adulterated food, and etc (Mansuri, Z. 2011).

VI. CONSUMER AWARENESS REGARDING FOOD ADULTERATION

(Vyralakshmi and Jayasheela, 2017) in their study reported about Indian practice of food adulteration. In Chennai, Tamil Nadu food were contaminated and adulterated which are consumed by the consumers. Food coloring are done by using highly chemical mixed colors which are not permitted to use in food items which are not good for our health and it may lead to food-borne diseases. Contamination of mycotoxins, metals and pesticides in food items which we consume daily such as milk, rice, etc. which were found to be highly toxic and carcinogenic. It is desirable to prevent adulteration and contamination of food items, if the consumers are aware of health hazards.

(Preethi, and et al. 2014), in their study tried to explore the condition of adulterations. Adulteration in food is normally present in its most crude form; prohibited substances are either added or partly or wholly substituted. In India normally the contamination/adulteration in food is done either for financial gain or due to carelessness and lack in proper hygienic condition of processing, storing, transportation and marketing. This ultimately results that the consumer is either cheated or often become victim of diseases. However, adequate precautions taken by the consumer at the time of purchase of such products can make him alert to avoid procurements of such food. It is equally important for the consumer to know the common adulterants and their effect on health.

(Dhanvijay and Ambekar 2015) conducted a study on assessment of student's awareness about Food Adulteration. It was found that before the education program, 100.00% respondents were aware that milk is adulterated with water and cereals with mud grits and stones. Eighty per cent and above were found to be aware about adulteration of urea to milk, colorants to spices, roasted nuts and pulses and adulteration of used tea leaves to tea.

Respondents were found to be less aware (1.00% to 27.00%) about common adulterants to food such as milk products, ghee, sago and coffee. However, after the program, the awareness of the respondents about common food adulterants was found to be increased up to 95.00% to 100.00%. Majority 96.00% and 95.00% respondents had low awareness about the procedure for consumer complaints and laws pertaining to food adulteration respectively, followed by 85.00% respondents about detection of food adulteration. The study findings gave a conclusion that the student's awareness was low.

(Nagvanshi 2015) conducted a study on common food adulterants and knowledge about adulteration among women of Rae Bareli District. Out of all respondents, only 72.00% subjects had knowledge about the adulteration of foods and the remaining respondents had no knowledge about maximum adulterants. Majority of subjects knows about AGMARK certification and do not have knowledge about diseases related to adulteration of foods. Majority of the subjects (31.00%) thinks that if any article does not have a government certification it affects their health (35.00%), and it may be an adulterated one. Only a few respondents (25.00%) knew that if the two above options are present, along with a less price and less quality of the product, it may be adulterated. Maximum subjects (50.00%) think that if any fruits and vegetables have normal size and normal colors it may not be adulterated. Majority respondents (38.00%) observed the milk adulteration by the smell of milk. The data also revealed that majority of the respondents have knowledge about adulterants of wheat and rice Bengal gram and red gram dhal, green pea, Black pepper, asafoetida (hing), Dalchini, Cumin Tejpattaand honey adulterants. Majority of the respondents had no knowledge about adulterants of wheat flour, liquid milk, and vegetable oils, vegetable fats, gram flour, Turmeric, coriander seed powder, chili powder, cloves, sugar powder, coffee and common salt. Maximum subjects (71.00%) had no knowledge about sacrin adulterant which is used for increasing sweetening of sugar and fruits.

(Prasanti 2014) did a surveillance of quality and adulteration of milk sold in and around Hyderabad and its public health significance. The awareness about chemical and microbiological quality, milk-borne diseases, adulterants, synthetic milk, thickening agents, preservatives, neutralizers and heat effect was high in adult woman compared to adult men and among them, it was high in high level of education followed by middle-level literates and least in illiterates. Among the student's awareness was high at the college level, least at primary school and moderate from high school. Among the milk consumers; Gastrointestinal, Nervous, Kidney, Cardiovascular, Muscular, Orthopaedic, Visual, Reproductive, Respiratory and Skin problems was reported from dairy farms; traditional vendors; from parlor selling

unpacked milk, from branded sachets; and from unbranded sachets, cooperative chilling centers; from private chilling centers and from restaurants respectively.

(Abid Faheem et al. 2013) conducted a study on family's knowledge on Food Adulteration in the selected village of Udupi Taluk, Karnataka, India and surveyed about 75 families. The study findings showed that the majority (60.00%) of the subjects had moderate knowledge on food adulteration. They found a significant association of knowledge score on food adulteration with age and educational status of the respondents. They suggested that the awareness of the public with relation to food adulteration should be ongoing especially to the general public with a lower level of education.

(Gupta and Panchal, 2019) in their study on the extent of awareness and food adulteration detection in selected food items purchased by homemakers found that education, family income and occupation are major factors that affect the extent of awareness about food adulteration and overall education shows the highest impact. Regarding consumer awareness the result depicted that majority, that is, two-thirds of the respondents were moderately aware about their rights and responsibilities related to food quality and food adulteration. Little less than half of the respondents have sometimes or other faced problem of adulterated food, one-fifth of the respondents have never come across adulterated food or maybe they were not aware about adulterated food.

(Thakur et al. 2019) conducted a study on the Impact of health education package on knowledge and practices of women regarding food adulteration (n=100). 52.00% of the subjects were aware of the adulteration and even 15.00% of them reported to have experienced it. A majority (80.00%) of the subjects were aware of water used as an adulterant and one third were aware of the starch as the adulterant of milk. 57.00% of the subjects were able to name stone and twigs as a common adulterant of pulses, where as one-third of them even reported Makki ka Atta as the adulterant in Basin during pre-test. But, after the intervention knowledge of the subjects increased significantly, except gain in knowledge for asbestos powder as the adulterant. Apart from this, the study results also depicted that none of the subjects was aware of the physical and chemical test employed to detect to adulterant. But after the intervention, a significant gain in the knowledge of the subject was observed, except for two adulterants (colour and kesari dal), the partial gain in knowledge was observed. During pre-test more than half (55.00%) of the subjects reported that adulterated food items when consumed is hazardous to health. Weakness, Nausea, Vomiting and Diarrhea were the health hazards reported by 17.00%, 21.00%, 23.00% of the subjects respectively in the pre-test.

METHODOLOGY

III METHODOLOGY

The methodology followed for the present study entitled, "Food Adulteration- Its Impact on Health and Consumer Awareness" is presented under the following headings

PHASE: I

A. Selection of locale

B. Selection of samples

PHASE: II

A. Formulation of questionnaire for data collection

B. Conducting the survey among the selected subjects

PHASE: III

A. Imparting nutrition education to the selected subjects

PHASE: IV

A. Statistical analysis and Interpretation of data

PHASE: I

A. SELECTION OF LOCALE

Selection of area is the first and important phase of research study. The study was conducted in Salem and Erode districts which include both urban and rural areas. Salem, one of the districts of Tamil Nadu has thirteen taluks viz., Attur, Gangavalli, Edapadi, Kadayampatti, Mettur, Omalur, Pethanaickenpalayam, Salem, Salem west, Salem south, Yercaud, Valapady, Sankakiri and Thalaivasal. Erode district consists of ten taluks viz., Erode, Modakkurichi, Kodumudi, Perundurai, Bhavani, Anthiyur, Gobichettipalayam, Sathyamangalam, Thalavadi and Nambiyur.

Salem and Erode districts were chosen as the place of study due to the investigator"s familiarity with place, people and resources. The study was conducted in online mode through google form. Thus, easy accessibility and co-operation of the subjects made this place conductive for the study.

FIGURE – 1

SALEM DISTRICT MAP

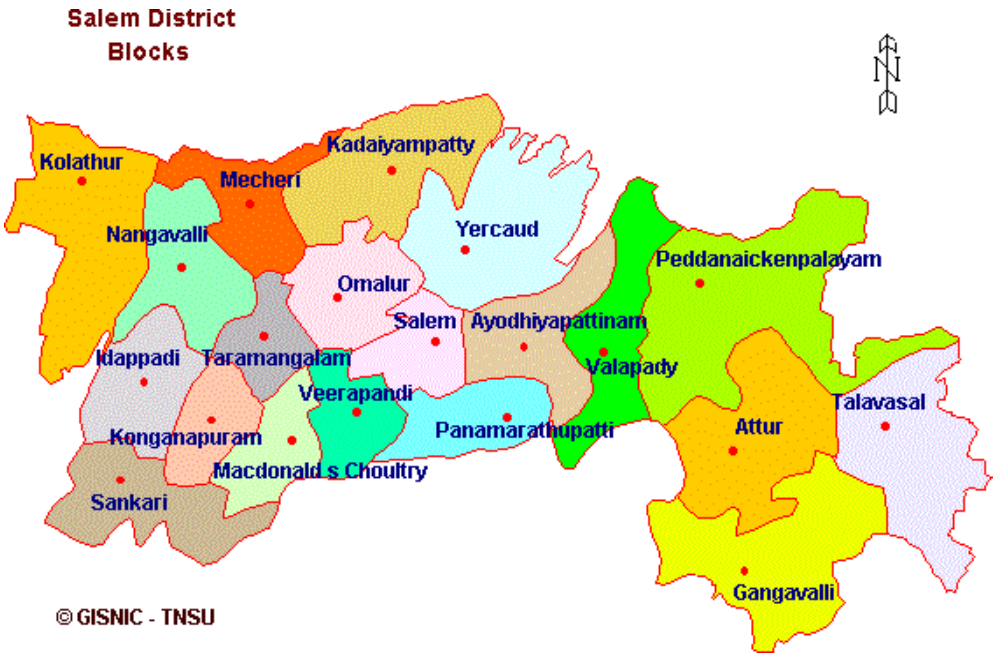
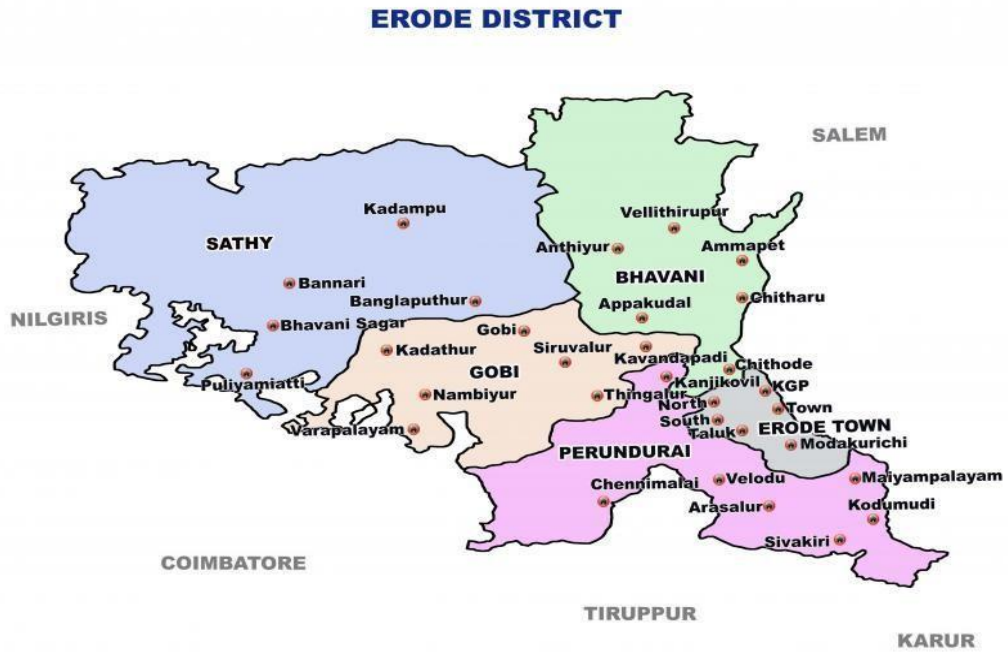


FIGURE-2

ERODE DISTRICT MAP



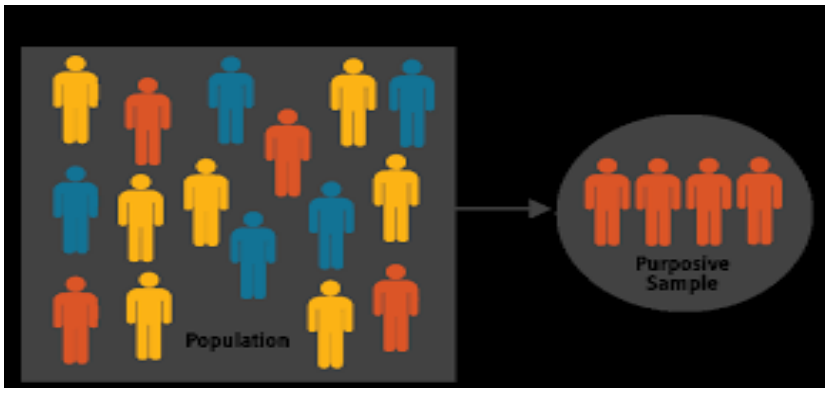
B. SELECTION OF SAMPLES

Sampling is an essential part of all scientific research. Sampling is a process of obtaining information about the entire population by examining only part of it (Sujay Mistry, 2021). The sample selection was done depending upon the feasibility and practicability for the research situation. Based on this, the samples selected were between 18 to 40 years of age, including both men and women. The samples selected were mainly college students, entrepreneurs, housewives and people who are working in different sectors like IT, manufacturing, sales, services and etc. In selection of samples, age group was considered because people between 18 to 40years are the emerging citizens who should be more aware of food adulteration and their health impacts. Samples of women who are housewives were selected as they have the purchasing power of groceries for their family and they should be more aware about the adulterated food products. Hence, survey was conducted among these age group of people to assess their knowledge about food adulteration and consumer awareness.

The sample for the study was selected by purposive sampling method. According to Black, k. (2010), purposive sampling is a non-probability sampling method and it occurs when "elements selected for the sample are chosen by the judgment of the researcher. Researchers often believe that they can obtain a representative sample by using a sound judgment, which will result in saving time and money". It helps to reduce the variation in data to get focused results. When selecting members of the population to participate in surveys, researchers use their own judgment. The sample was selected in such a way that it enables to gather a lot of information out of the data that have been collected.

FIGURE- 3

PURPOSIVE SAMPLING METHOD



Sample Size

The target samples were selected from both Salem and Erode districts, comprising of 50 students, 50 individuals working in different sectors, 50 members who were entrepreneurs doing either medium or small business and 50 women who were housewives.

The samples were selected based on the following inclusion and exclusion criteria

Inclusion Criteria

- Adults -18 to 40 years of age
- Adult men and women
- Students, entrepreneurs, Working person and Housewives
- The participants willing to cooperate for the study

Exclusion Criteria

- People above 40years
- People below 18years
- The participants not willing to cooperate for the study

PHASE: II

A. FORMULATION OF QUESTIONNAIRE FOR DATA COLLECTION

According to Kothari (2004) in dealing with any real-life problem, it is often found that data on hand are inadequate, and hence, it becomes necessary to collect the appropriate data. No survey can achieve success without a well-designed questionnaire, which is effective mechanism for the efficient collection of certain kinds of information. Survey method was used in the present study with a structured type questionnaire as the data-collecting instrument.

A questionnaire consists of a number of questions printed or typed in a definite order on a form or set of forms (Kothari, 2004). Before finalizing the questionnaire, the questionnaire was pilot tested and modifications were made to the questions. Questionnaires may be used as the sole instrument for the collection of survey data, or in combination with other instruments of data collection. The degree to which a questionnaire produces data that is relevant and valid to a study's goals and objectives will depend on how well the questionnaire is designed, how well the questions are constructed and how well it is administered. A valid questionnaire measures what it claims to measure. For example, a self-completed questionnaire that seeks to measure food intake may be invalid because it

measures what participants say they have eaten, not what they have actually eaten (Boynton, PM, 2004). Careful consideration of the aims and objectives of the study is crucial if the questionnaire is to yield responses that are both valid and reliable.

Perhaps the most important guidance at the design stage is „KISS" ["keep it short and simple"] (Durand M and Chantler T., 2014).

The questionnaire framed for the study is presented in Appendix-II. The questionnaire was prepared by including the following considerations:

- A well-designed questionnaire was drafted meeting all of the study's goals and objectives.
- A formal standardized questionnaire was formulated with prescribed phrasing and order of questions, to ensure that each respondent receives the same impulse.
- The questionnaire's length was reviewed because too many questions will discourage respondents from filling it out.
- The questionnaire was also written in a short and easy manner so that respondents would have the best opportunity of understanding it.

The frame of schedule was made after suggestions from experts of the subject, from literature available on the subject, and from statistic experts to get the effective and useful data for the study. The time of one schedule filling was minimum 15 minutes.

The revised questionnaire was divided into following sections

- Personal information of respondent's
- Specific knowledge of respondents about food adulterants
- Knowledge of consumer rights regarding food adulteration.

Personal information of respondents included questions that were related to respondent's age, family structure (nuclear/joint), occupation, total family income and educational profile.

Questions about specific knowledge of respondents about food adulterants were based on purchasing behavior, Knowledge about adulterants, testing methods used for identification of adulterants and effect of adulterants on health.

Knowledge regarding consumer rights on food adulteration questions were about prevention of food adulteration Act (PFA), consumer related programs, consumer forum, basic concepts of food standards and consumer behavior.

B. CONDUCTING ONLINE SURVEY AMONG THE SELECTED SUBJECTS

The study was conducted in phases with the prime objectives of assessing the knowledge of people about food adulteration and consumer awareness. The study was conducted in online mode by preparing a well-designed questionnaire satisfying the aims and objectives of the research. The online mode of survey was selected considering the pandemic condition and hence to avoid direct contact. Online surveys are a great way to reach and engage with the subjects. Online surveys are helpful in reaching the target respondents fast and response rates are high. The questionnaire prepared was shared among the selected population through google forms by using various social media platforms like whatsapp, Instagram and mail. The questionnaire was shared in the form of link created in google form. The data filled by the respondents are stored in it which is linked to a given Mail Id. Totally 50 questions were used for assessing the nutritional knowledge about food adulteration and consumer awareness.

The target population was in consistent follow up when they were filling the questionnaire and when respondents reach in case of any doubts, it was immediately cleared and further proceeded. Survey method was very cost- effective and was administered remotely via online, mobile devices and mail. Survey method has also helped collecting data from a large number of respondents in a relatively easy manner.

Advantages of Online Survey

- The overall convenience of online surveys bring in a high response. Respondents havethe freedom to answer questions on their own time and at their own speed.
- Since respondents are more likely to open up because they are not giving their answers directly to another person, whereas interviewers may in some situations influence responses. This has a beneficial impact on both response and completion rates, both of which are critical to survey success.

C. Obtaining Ethical Clearance of the Study

The research study and the protocols used in the research was presented to the Institutional Ethical Committee and Ethics Clearance was obtained and it is presented in Appendix I. The approval number given by the ethical committee is AUW/IHEC/FSN-21-22/XPD-25.

PHASE: III

A. IMPARTING NUTRITION EDUCATION TO THE SELECTED SUBJECTS

Nutrition education is the dissemination of nutrition-related knowledge to empower individuals, families, and communities to make healthy food decisions. Most major health promotion and illness prevention initiatives include nutrition education as a key component. “Knowledge and awareness about adulterated foods, laws and its rights related to adulterated food is crucial in a society where technology heightens opportunities for perpetrators of fraud deception and misrepresentation” (Garman and Jonest, 1992).

Nutrition education is combination of educational strategies, accompanied by environmental supports, designed to facilitate voluntary adoption of food choices and other food and nutrition behaviors conducive to health and well-being. Nutrition education delivered through multiple venues involves activities at the individual as well as community level. Nutrition education is any set of learning experiences designed to facilitate the voluntary adoption of eating and other nutrition related behaviors conductive to health and well-being (Martin and Oakley, 2008).

The nutrition education was conducted among the selected 200 subjects in the age group of 18-45yrs, with the objective of educating the subjects about food adulteration and its health effects. The nutrition education was conducted in online mode using audio-visual aids. Audio-visual aid helps to make learning process more effective and conceptual. It builds interest and seek attention of the subjects. Initial nutritional knowledge about food adulteration- its impact on health and consumer awareness was assessed through online survey via Google form. The nutrition education was conducted considering the results obtained from the survey to create awareness among the subjects about the unknown facts and information regarding food adulteration and their health impacts.

The audio-visual aid used for educating the subjects was YouTube videos. A total of six videos were prepared about food adulteration such that each video describes about a specific topic apparently. The topics covered in the Nutrition education videos include the following heads:

Session: 1 - Introduction About Food Adulteration

The first session of nutrition education was the introductory video about food adulteration. This video includes basic contents about how food adulteration came into our society, definition of food adulteration, modes of adulteration of food like addition of foreign substance and etc, effects of consuming adulterated food, reasons behind adulteration and FSSAI data on food adulteration. Since it was an introductory video, only basic contents about food adulteration were included so that the subjects would feel easy and understand better. The time length of the introductory video about food adulteration was about 3 minutes and 3 seconds.

Video link: **https://youtu.be/0u7EWHNyyV0**

PLATE- 1

INTRODUCTION TO FOOD ADULTERATION

Session: 2 - Types of Food Adulteration

The session 2 was completely about types of food adulteration. There are different types of food adulteration like intentional adulteration, incidental adulteration, natural adulteration, metallic adulteration and packaging hazards. The definition of each type of food adulteration, and detailed explanation on each aspect of adulteration along with suitable examples were included in the second session of the nutrition education video. The time length of the session 2 nutrition education video was about 2 minutes and 27 seconds.

Video link: **https://youtu.be/gRVor21wJfk**

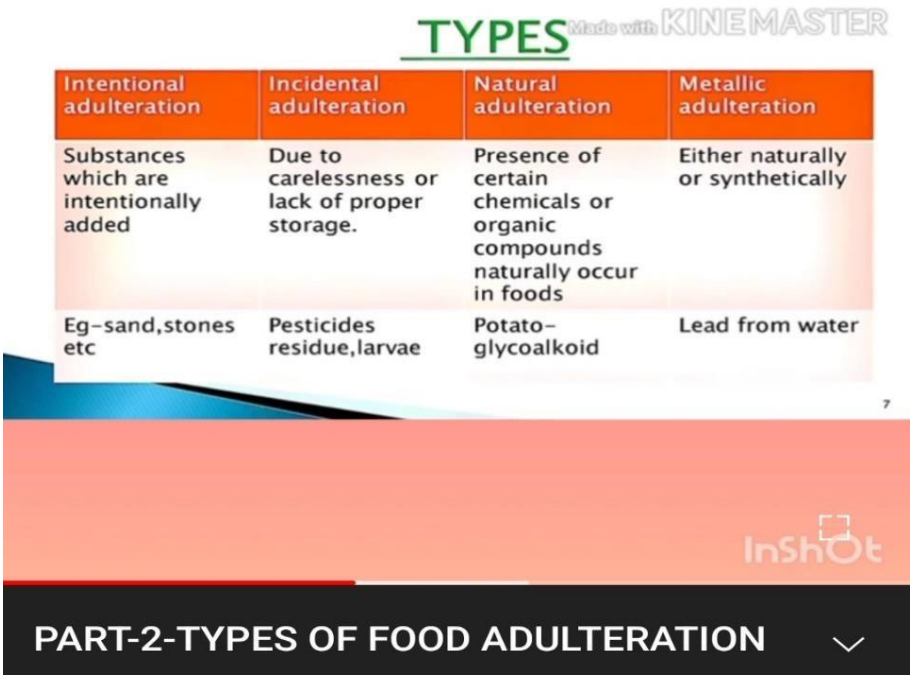


PLATE – 2

TYPES OF FOOD ADULTERATION

Session: 3 - Food Products Prone to Adulteration

The session 3 video included different types of food products which are prone to adulteration. The various food products under each food group such as milk and milk products, vegetable oils and fats, spices and condiments, pulses, sweetening agents and soft drinks, beverages and miscellaneous was presented in tabular form. The major food products under each food group along with their adulterants are mentioned in the tabulation form. This video was presented in the form of tabulation in order to facilitate the understanding of the subjects and they can capture it easily. The time length of the session 3 nutrition education video was about 2 minutes and 17 seconds.

Video link: **https://youtu.be/VvLR8t52y9O**

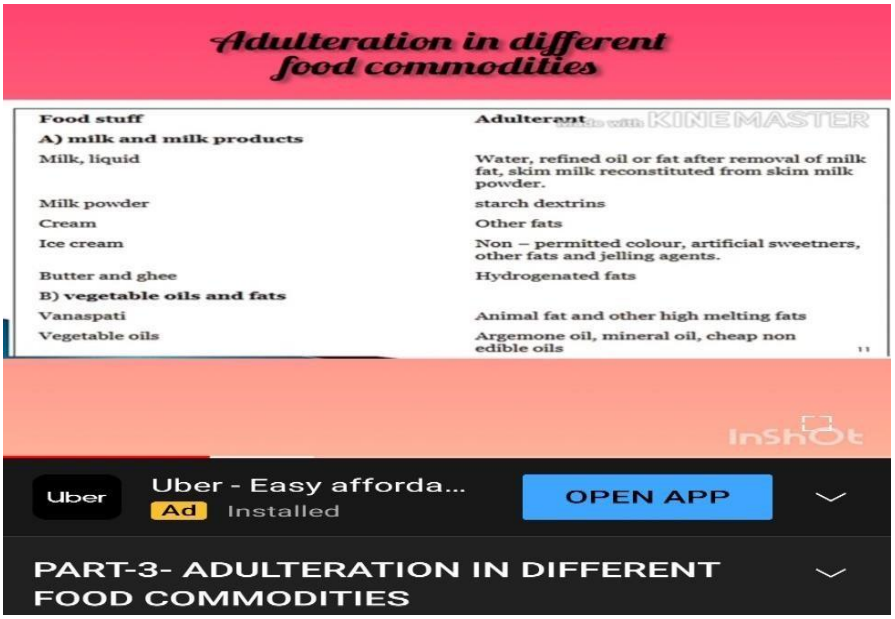


PLATE- 3

FOOD PRODUCTS PRONE TO ADULTERATION

Session: 4 - Health Effects of Food Adulteration

The session 4 video was about different food adulterants and their harmful effects to health. The topics that were included in the session 4 includes major and minor health problems caused by food adulteration like joint pain, diarrhea, liver damage and stomach pain, the video further includes name of different adulterants in food products and their harmful effects to our body. A total of twenty adulterants that are added to our food products which we use in our day to day life were briefly explained. The time length of the session 4 nutrition education video was about 2 minutes and 7 seconds.

Video link: **https://youtu.be/H8HQrseCy8A**

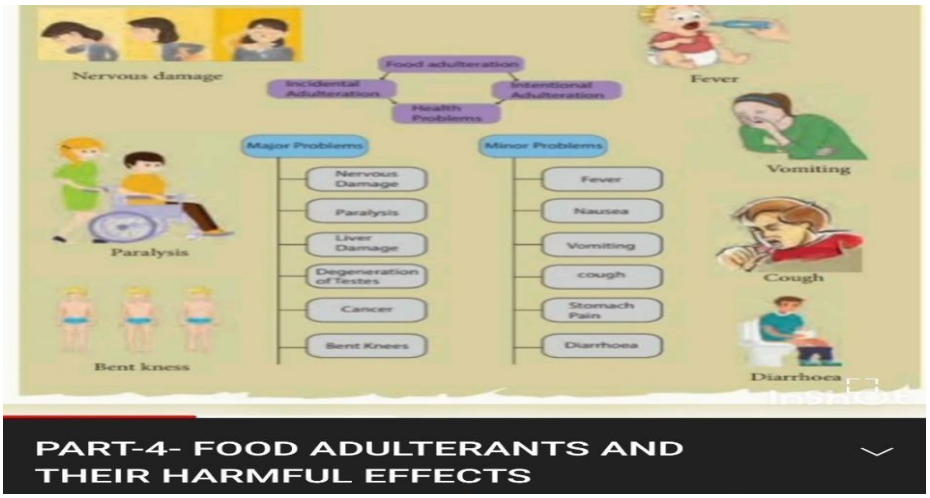


PLATE- 4

HEALTH EFFECTS OF FOOD ADULTERATION

Session: 5 - Testing Methods of Food Adulteration

The session 5 video includes different testing methods used to identify adulterants in a adulterated food product at home level. The testing methods explained in the video was simple and all the subjects can try at their home level. The food products for which the testing methods were explained in the video includes sweet potato, watermelon, green peas, honey, milk, food grains, black pepper, cinnamon, chilly powder and etc. These are the food products that are most often used by all the people at home level. Hence, the video was prepared to make sure the subjects get useful knowledge. The time length of the session 5 nutrition education video was about 6 minutes and 15 seconds.

Video link: **https://youtu.be/H8HQrseCy8A**

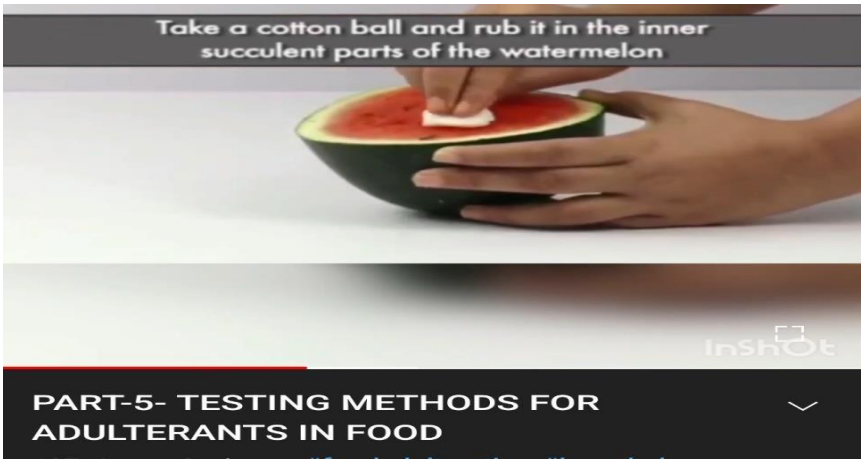


PLATE- 5

TESTING METHODS OF FOOD ADULTERATION

Session: 6 - Consumer Awareness Regarding Food Adulteration and Its Incidence in the Market

The session 6 video was regarding consumer awareness and its incidence in the market. Consumer awareness is one of the most important steps towards reducing the adulteration of foods. The topics included in the video was importance of consumer awareness, FSSAI rules and regulations for food industries to avoid food adulteration, penalties for food fraud and prevention of food adulteration. The time length of the session 6 video was about 6 minutes and 28 seconds.

Video link: **https://youtu.be/0u7EWHNyyV0**

PLATE- 6

CONSUMER AWARENESS REGARDING FOOD ADULTERATION AND ITS INCIDENCE IN THE MARKET

The videos were uploaded in you tube channel and the link was shared among the selected subjects through whatsapp, Mail and Instagram. In whatsapp, a group was created and added all the subjects in one whatsapp group account. The subjects who were not in whatsapp was monitored separately by sending them you tube video link in mail. The subjects were continuously followed and made sure they got educated properly. The six videos were uploaded separately in you tube channel leaving a gap of one week between each video and the link was shared to the selected subjects through whatsapp group and mail. Thus, there were totally six sessions of nutrition education regarding food adulteration and consumer awareness. After watching the video, the respondents gave their comments and doubts are clarified immediately.

The effectiveness of the nutrition education on food adulteration and consumer awareness was evaluated using online survey after nutrition education and the result obtained were consolidated. The consolidated data was used to evaluate the impact of the nutrition education program.

PHASE: IV

A. STASTICAL ANALYSIS AND INTERPRETATION OF DATA

Data are the basic input of any decision-making process. The processing of data gives statistical importance to the study and be classified into primary and secondary data (Reddy 2000). According to Paneerselvam (2005) data are the basic input in any decision- making process. The processing of data gives statistics of the study. The data was collected through primary data collection method.

The data collected were organized to obtain the desired results and interpreted scientifically (Gupta, 2007). The collection and integration of data from various sources into a single destination is referred to as data consolidation. The collected data wasconsolidated, tabulated and analyzed to see the knowledge and consumer awareness about food adulteration and its impact on health.

RESEARCH DESIGN

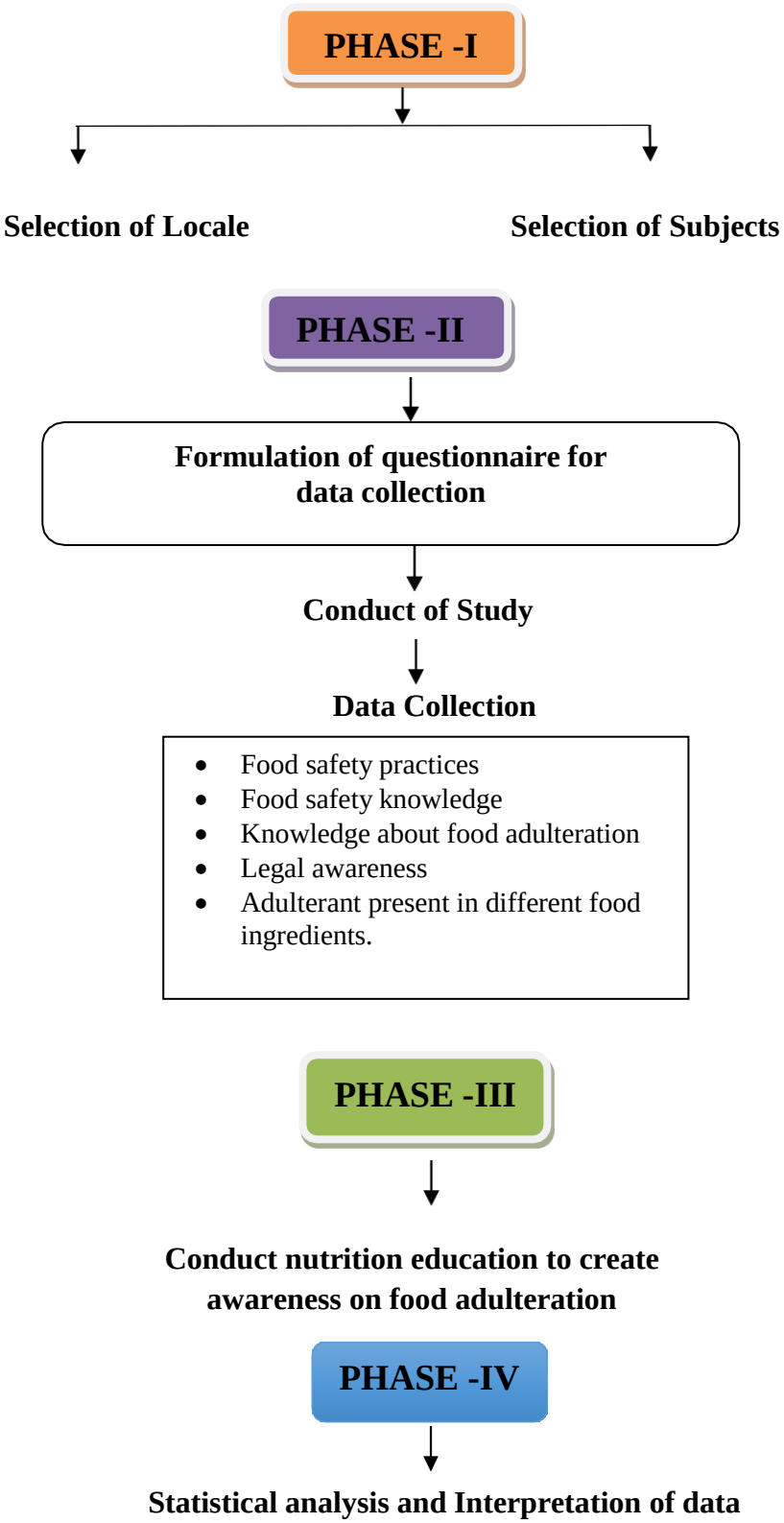


FIGURE- 4

RESULTS AND DISCUSSION

IV RESULTS AND DISCUSSION

The results of the present study titled, "Food Adulteration- Its Impact on Health and Consumer Awareness", are presented and discussed under the following headings

A. Socio-economic background of the subjects
B. Knowledge of subjects regarding Food Adulteration
C. Association between socio-economic conditions of subjects and their knowledge regarding Food Adulteration
D. Awareness about food adulteration before and after nutrition education

A. SOCIO-ECONOMIC BACKGROUND OF THE SUBJECTS

The details pertaining to the socio-economic background of the subjects are discussed as follows

1. Gender of the Subjects

Table II presents the gender of the subjects.

TABLE – II

GENDER OF THE SUBJECTS

(N=200)

Gender	Number	Percent
Female	109	54.5
Male	91	45.5
Total	200	100

Among the 200 subjects selected for the study, 54.5 percent of subjects were females and 45.5 percent of subjects were males.

2. Educational Qualification of the Subjects

Educational qualification of the selected subjects is presented in Table III and Figure 5.

TABLE- III

EDUCATIONAL QUALIFICATION OF THE SUBJECTS

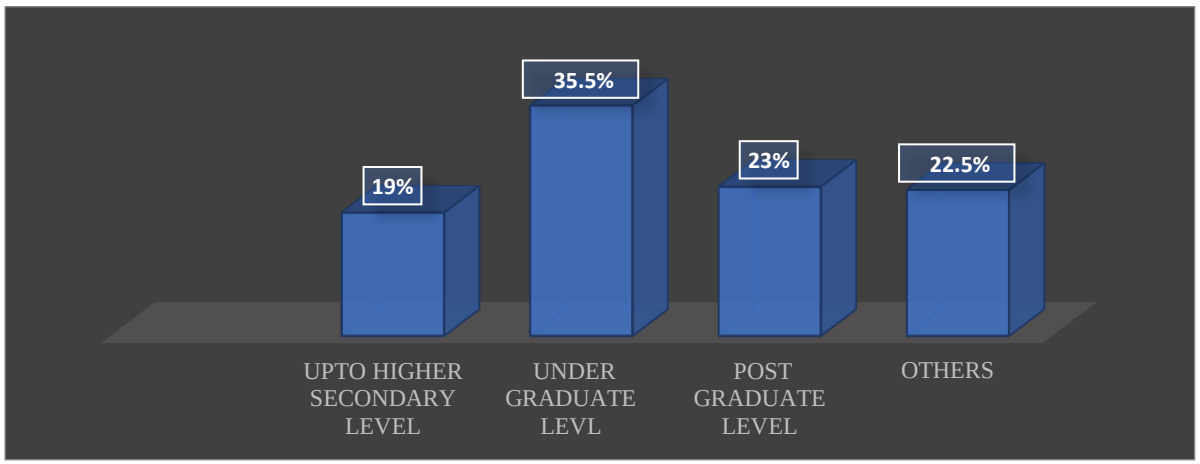
(N=200)

Educational qualification	Number	Percent
Up-to higher secondary school	38	19
Under graduate level	71	35.5
Post graduate level	46	23
Others	45	22.5
Total	200	100

Out of the selected subjects, 19 percent of them studied up to higher secondary school level, 35.5 percent were undergraduates, 23 percent of them were qualified up to postgraduate level and remaining 22.5 percent of them were qualified with diploma and other course studies.

FIGURE- 5

EDUCATIONAL QUALIFICATION OF THE SUBJECTS



3. Age Group of the Subjects

Table IV and Figure 6 presents the categorization of subjects according to their age.

TABLE – IV

AGE GROUP OF THE SUBJECTS

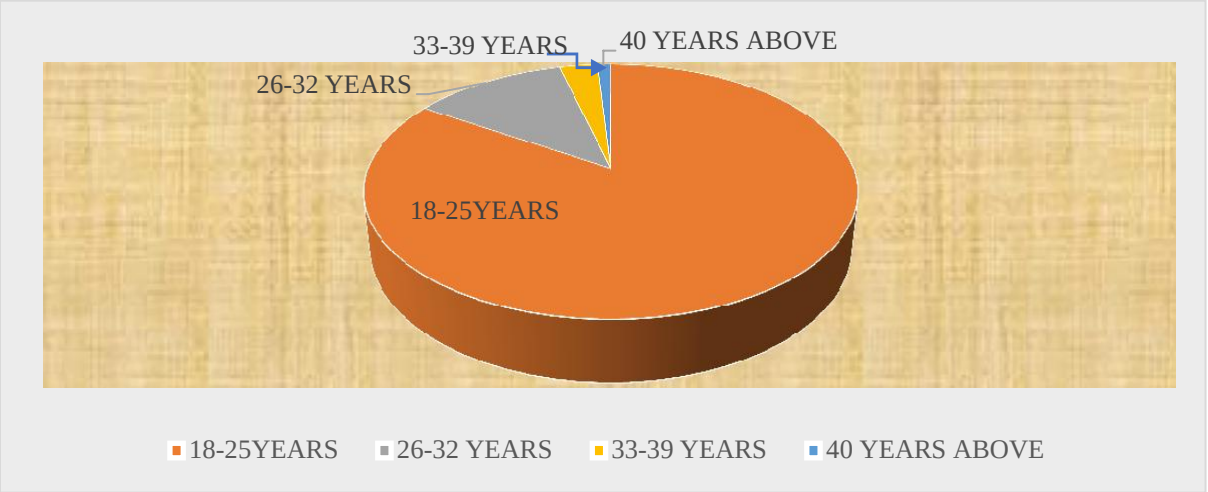
(N=200)

Age group (in years)	Number	Percent
18-25	168	84
26-32	24	12
33-39	6	3
> 40	2	1
Total	200	100

Among the 200 selected subjects for the study, 84 percent belonged to the age group of 18-25 years, 12 percent were in the age group of 26-32 years, three percent were in the age group of 33-39 years and one percent belonged to the age group of above 40 years.

FIGURE- 6

AGE GROUP OF THE SUBJECTS



4. Monthly Income of the Subjects

Monthly income of the selected subjects is presented in Table V.

TABLE – V

MONTHLY INCOME OF THE SUBJECTS

(N=200)

Monthly Income	Number	Percent
RS.5000-10,000	23	11.5
RS.10,000-20,000	55	27.5
RS.20,000-30,000	49	24.5
> RS.30000	73	36.5
Total	200	100

Out of the selected subjects, 11.5 percent of them had an income of Rs. 5000- 10,000 per month, while 27.5 percent of the subjects had an income of Rs. 10,000- 20,000, while 24.5 percent and 36.5 percent of them had a total income of Rs. 20,000- 30,000 and above Rs. 30,000 respectively.

5. Occupation of the Subjects

Table VI and Figure 7 depicts the occupation of the selected subjects.

TABLE – VI

OCCUPATION OF THE SUBJECTS

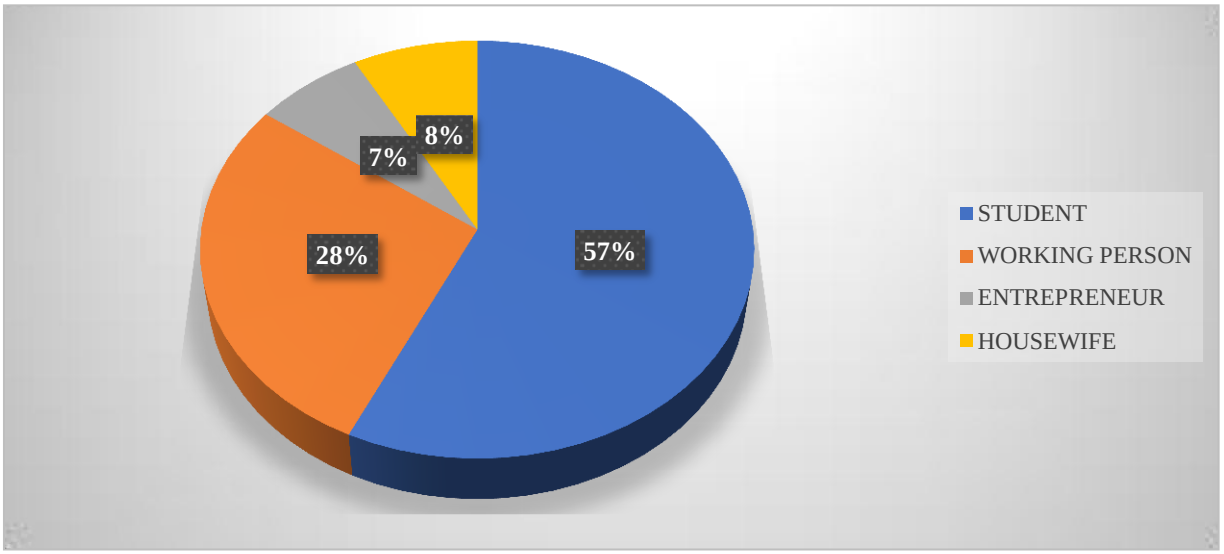
(N=200)

Occupation	Number	Percent
Student	114	57
Working Person	56	28
Entrepreneur	14	7
Housewife	16	8
Total	200	100

The data in the table VI reveals that 57 percent of selected subjects were students, while 28 percent of them were working in different sectors like IT, pharmaceutical industries, food industries and etc., while seven percent of them were entrepreneurs and remaining eight percent of the subjects were housewives, who take care of their family members.

FIGURE- 7

OCCUPATION OF THE SUBJECTS



B. KNOWLEDGE OF SUBJECTS REGARDING FOOD ADULTERATION

1. Source of Knowledge About Food Adulteration

Table VII presents the source of knowledge of subjects about food adulteration.

TABLE- VII

SOURCE OF KNOWLEDGE ABOUT FOOD ADULTERATION

(N=200)

	Number	**Percent**
T. V	36	18.0
Friends	59	29.5
Books	67	33.5
Neighbors	27	13.5
Newspaper	11	5.5
Total	200	100.0

From the data presented in table VII, it was found that 18 percent of subjects knew about food adulteration from television, 29.5 percent of them from friends, while 33.5 percent and 13.5 percent of them from books and neighbors, while 5.5 percent of them gained knowledge about food adulteration from daily newspapers.

2. Awareness of Subjects About Food Adulteration

The knowledge of subjects regarding food adulteration before and after nutrition education are discussed as follows

The awareness of subjects about food adulteration before and after nutrition education is presented in Table VIII and Figure 8.

TABLE – VIII

AWARENESS OF SUBJECTS ABOUT FOOD ADULTERATION

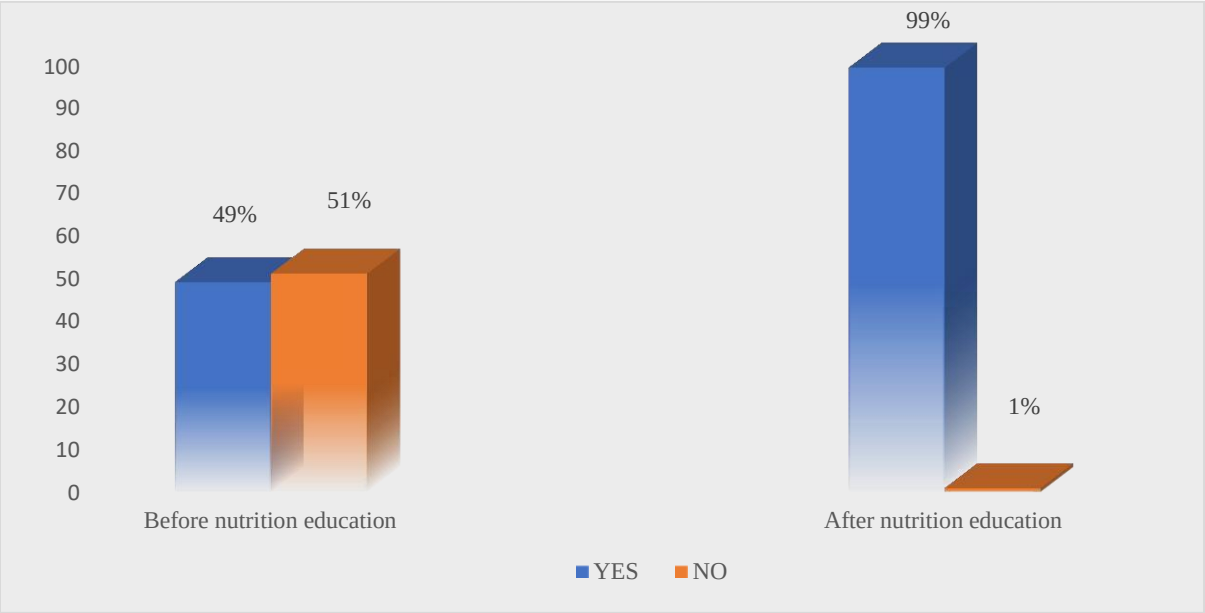
(N=200)

	Before nutrition education		After nutrition education	
	Number	**Percent**	**Number**	**Percent**
Yes	98	49	198	99
No	102	51	2	1
Total	200	100	200	100

Among 200 selected subjects, 51 percent of subjects had no awareness about food adulteration and only 49 percent of subjects had awareness about food adulteration before nutrition education but after effective nutrition education 99 percent of subjects were aware about food adulteration and only 1 percent of subjects was not aware of food adulteration.

FIGURE- 8

AWARENESS OF SUBJECTS ABOUT FOOD ADULTERATION



3. Knowledge About Checking Labels for the Weights of Food Products Procured

Table IX depicts the knowledge of subjects about checking labels for theweights of food products procured.

TABLE – IX

KNOWLEDGE ABOUT CHECKING LABELS FOR THE WEIGHTS OF FOOD PRODUCTS PROCURED

(N=200)

	Before nutrition education		**After nutrition education**	
	Number	**Percent**	**Number**	**Percent**
Yes	85	42.5	144	72
No	115	57.5	56	28
Total	200	100	200	100

The knowledge about details pertaining to adulteration of all the selected subjects were surveyed before education and also after education. Before imparting nutrition education, only 42.5 percent of them had knowledge about checking the labels for weights of food products procured and 57.5 percent did not have knowledge about checking labels for the weights of products procured, but after nutrition education, the percentage of subjects who had knowledge about checking labels for the weights of food products procured increased to 72 percent but the remaining 28 percent subjects knowledge about checking labels for the weights of products procured did not improve.

4. Awareness About the Functioning of Consumer Courts Regarding Grievances Redressal About Food Adulteration

Awareness about the functioning of consumer courts regarding grievances redressal about food adulteration is given in Table X.

TABLE- X

AWARENESS ABOUT THE FUNCTIONING OF CONSUMER COURTS REGARDING GRIEVANCES REDRESSAL ABOUT FOOD ADULTERATION

(N=200)

	Before nutrition education		After nutrition education	
	Number	**Percent**	**Number**	**Percent**
Yes	74	37	153	76.5
No	126	63	47	23.5
Total	200	100	200	100

Before creating awareness about adulteration to the subjects, 37 percent of them were aware of the functioning of consumer courts regarding grievances redressal about food adulteration and 63 percent of them were not aware of such courts functioning. After creating awareness about adulteration to the subjects, the percentage of subjects who were aware of the functioning of consumer courts regarding grievances redressal about food adulteration increased to 76.5 percent.

5. Level of Acceptance of Food Adulteration as an Illegal Act by the Subjects

The level of acceptance of food adulteration as an illegal act by the subjects is presented in Table XI and Figure 9.

TABLE- XI

LEVEL OF ACCEPTANCE OF FOOD ADULTERATION AS AN ILLEGAL ACT

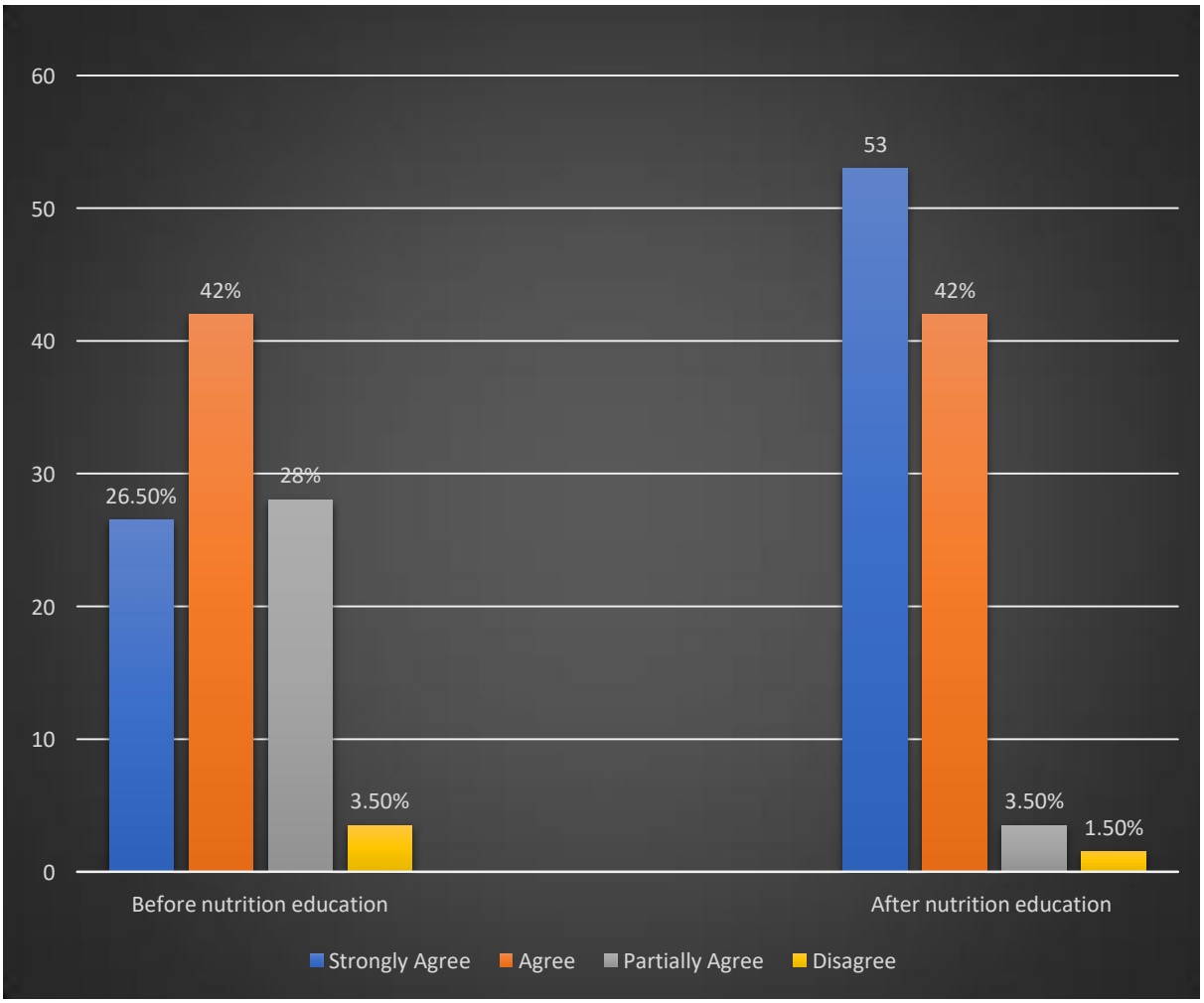
(N=200)

	Before nutrition education		**After nutrition education**	
	Number	**Percent**	**Number**	**Percent**
Strongly Agree	53	26.5	106	53
Agree	84	42	84	42
Partially Agree	56	28	7	3.5
Disagree	7	3.5	3	1.5
Total	200	100	200	100

From the data presented in the Table XI, it is clear that, before nutrition education, only 26.5 percent of subjects strongly agreed that food adulteration as an illegal act, while 42 percent just agreed food adulteration as an illegal act, while 28 percent and 3.5 percent of subjects partially agreed and disagreed that food adulteration as an illegal act. After nutrition education, maximum 53 percent and 42 percent of subjects strongly agreed and agreed that food adulteration as an illegal act while 3.5 percent and 1.5 percent of them partially agreed and disagreed that food adulteration as an illegal act.

FIGURE- 9

LEVEL OF ACCEPTANCE OF FOOD ADULTERATION AS AN ILLEGAL ACT



6. Purchasing Food Products After Checking the Label for Date of Manufacturing and Other Details

The knowledge of subjects about purchasing food products after checking the label for date of manufacturing and other details is depicted in Table XII.

TABLE- XII

PURCHASING FOOD PRODUCTS AFTER CHECKING THE LABEL FOR DATE OF MANUFACTURING AND OTHER DETAILS

(N=200)

	Before nutrition education		**After nutrition education**	
	Number	**Percent**	**Number**	**Percent**
Expiry date and date of manufacturing	50	25	17	8.5
Freshness and quality of the product	61	30.5	17	8.5
Approval of regulatory authority	29	14.5	19	9.5
All of the above	60	30	147	73.5
Total	200	100	200	100

As all the selected subjects were surveyed before and after nutrition education, it was found that before nutrition education, 25 percent of subjects purchased food products only by checking expiry date, date of manufacturing and 30.5 percent of them checked only freshness and quality of product, while 14.5 percent checked only approval of regulatory authority and only minimum of 30 percent of subjects checked all of the above.

After nutrition education, a total of 73.5 percent of subjects checked the label for expiry date, date of manufacturing, freshness and quality of food product and also approval of regulatory authority. Hence, after nutrition education, the knowledge of subjects improved to purchase food products after checking the label for date of manufacturing and other details.

7. Knowledge About Adulterants Present in Milk

The details regarding knowledge of subjects about adulterants present in milk is presented in Table XIII.

TABLE-XIII

KNOWLEDGE ABOUT ADULTERANTS PRESENT IN MILK

(N=200)

	Before nutrition education		**After nutrition education**	
	Number	**Percent**	**Number**	**Percent**
Honey	18	9	5	2.5
Water	81	40.5	36	18
Urea and starch	49	24.5	32	16
Water, urea and starch	52	26.0	127	63.5
Total	200	100	200	100

The selected 200 subjects were surveyed for their knowledge about adulterants present in milk before and after nutrition education. The adulterants present in milk includes water, urea, starch and etc. Before nutrition education, only 26 percent of the subjects had knowledge about adulterants present in milk, while after nutrition education, the percentage increased to 63.5 percent which indicated that creating awareness about different aspects of food adulteration helped subjects to improve their knowledge about food adulteration and thus in purchasing foods that are not adulterated.

8. Knowledge About Adulterants Present in Coffee Powder

The data regarding knowledge of subjects about adulterants present in coffee powder is given in Table XIV.

TABLE- XIV

KNOWLEDGE ABOUT ADULTERANTS PRESENT IN COFFEE POWDER

(N=200)

	Before nutrition education		**After nutrition education**	
	Number	**Percent**	**Number**	**Percent**
Chicory seeds	64	32	138	69
Artificial dye	70	35	24	12
Starch powder	38	19	23	11.5
Colored leaves	28	14	15	7.5
Total	200	100	200	100

Coffee is consumed by many people all over the world and it is also one of the common food products that is easily adulterated by adding substances like chicory seeds, coffee stem and etc. To prevent adulteration, knowledge about the adulterants should be high among people. From the data obtained from the table XIV, before nutrition education only 32 percent of subjects had knowledge about adulterants present in coffee powder. While, after nutrition education, 69 percent of the subjects improved their knowledge about adulterants present in coffee powder.

9. Knowledge About Harmful Effects of Food Adulteration

Table XV and Figure 10 represents the knowledge of subjects about harmful effects of food adulteration.

TABLE – XV

KNOWLEDGE ABOUT HARMFUL EFFECTS OF FOOD ADULTERATION

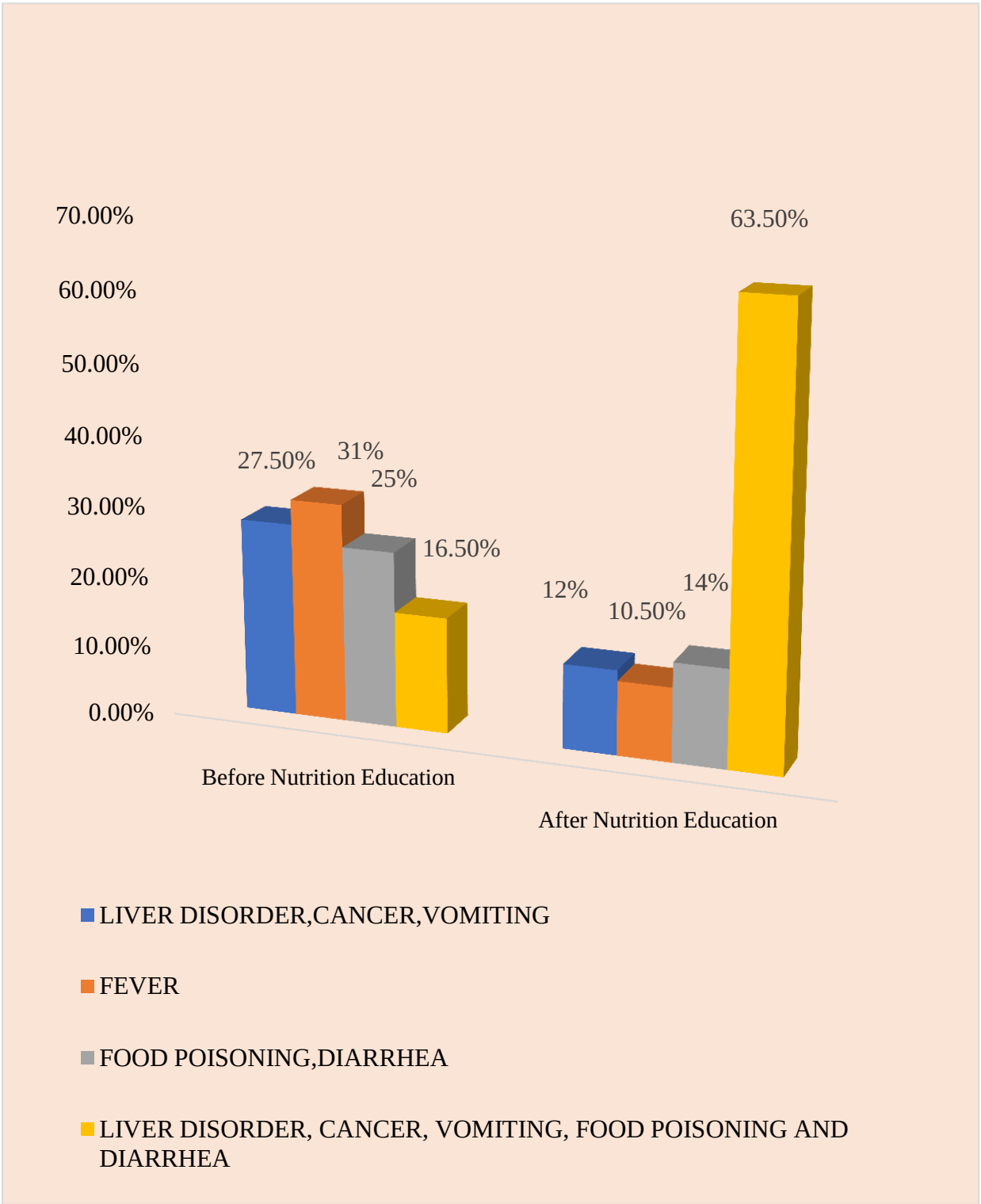
(N=200)

	Before nutrition education		**After nutrition education**	
	Number	**Percent**	**Number**	**Percent**
Liver disorder, Cancer, Vomiting	55	27.5	24	12
Fever	62	31	21	10.5
Food poisoning, diarrhea	50	25	28	14
Liver disorder, cancer, vomiting, food poisoning and diarrhea	33	16.5	127	63.5
Total	200	100	200	100

The most common harmful effects of food adulteration include liver disorder, cancer, vomiting, food poisoning and diarrhea. Out of 200 selected subjects, only 16.5% of them had complete knowledge about harmful effects of food adulteration before nutrition education, while 63.5% of the subjects improved their knowledge about harmful effects of food adulteration after nutrition education.

FIGURE- 10

KNOWLEDGE ABOUT HARMFUL EFFECTS OF FOOD ADULTERATION



10. Knowledge About Quality Mark That is Necessary on Labelled Food Product

Table XVI indicates the knowledge of subjects about quality mark that is necessary on labelled food product.

TABLE- XVI

KNOWLEDGE ABOUT QUALITY MARK THAT IS NECESSARY

ON LABELLED FOOD PRODUCT

(N=200)

	Before nutrition education		**After nutrition education**	
	Number	**Percent**	**Number**	**Percent**
Veg (green symbol) and Non-veg (red symbol)	83	41.5	37	18.5
FSSAI	56	28	111	55.5
ISO	45	22.5	36	18
Date of manufacturing	16	8	16	8
Total	200	100	200	100

The quality mark that is necessary on every packed food product is FSSAI (Food safety and standards authority of India). Among 200 selected subjects, only 28 percent of subjects had knowledge about quality mark that is necessary on every food product before nutrition education whereas, after effective nutrition education the percentage increased to 55.5 percent which indicates after education the knowledge of subjects about quality mark that is necessary on labeled food product has improved.

C. ASSOCIATION BETWEEN SOCIO-ECONOMIC CONDITIONS OF SUBJECTS AND THEIR KNOWLEDGE ABOUT FOOD ADULTERATION

The association between socio-economic conditions of subjects and their knowledge about food adulteration are discussed below using chi-square test.

1. Age Group of the Subjects and their Awareness About Food Adulteration

The distribution of subjects according to their age group and their awareness about food adulteration is shown in the table XVII.

TABLE – XVII

AGE GROUP AND AWARENESS ABOUT FOOD ADULTERATION

(N=200)

Age group (in years)	Awareness about food adulteration						X^2 value	P value
	YES		NO		TOTAL			
	N	%	N	%	N	%		
18-25	82	41	86	43	168	84	2.183	0.535*
26-32	11	5.5	13	6.5	24	12		
33-39	3	1.5	3	1.5	6	3		
> 40	2	1	0	0	2	1		
Total	98	49	102	51	200	100		

*Not Significant

The table XVII proves that the subjects between age group of 18-25, had more awareness about food adulteration than other age groups. A hypothesis was framed to investigate the association between the age group of the subjects and their knowledge about reasons for food adulteration and analyzed with the help of chi-square test. It was observed from the table XVII that there is no significant association between age group of subjects and their awareness about food adulteration as chi-square value was 2.183 with P value of 0.535.

Hence, it is concluded that there is no significant association between age group of subjects and their awareness about food adulteration.

2. Knowledge About Reason for Food Adulteration Based on Occupation

The distribution of subjects according to their occupation and their knowledge about reason for food adulteration is shown in the table XVIII.

TABLE- XVIII

OCCUPATION AND KNOWLEDGE ABOUT REASONS FOR FOOD ADULTERATION

(N=200)

Occupation	Knowledge about reasons for food adulteration						X^2 value	P value
	YES		NO		TOTAL			
	N	%	N	%	N	%		
Student	30	15	84	42	114	57	12.092	0.007*
Working person	28	14	28	14	56	28		
Entrepreneur	3	1.5	11	5.5	14	7		
Housewife	8	4	8	4	16	8		
Total	69	34.5	131	65.5	200	100		

*Significant

It is inferred from the table XVIII that among four categories of job activity, students have greater knowledge about reasons for food adulteration. A hypothesis was framed to investigate the association between the occupation of the subjects and their knowledge about reasons for food adulteration and analyzed with the help of chi-square test. It was observed from the table XVIII, that there is significant association between the occupation of the subjects and their knowledge about reasons for food adulteration as chi-square value was

12.092 with P value of 0.007. Hence, it is concluded that there is significant association between the occupation of the subjects and their knowledge about reasons for food adulteration.

3. Preference to Buy Food Products Based on Gender

The distribution of subjects according to their gender and their type of preference to buy food products have been shown in the table XIX.

TABLE- XIX

PREFERENCE TO BUY FOOD PRODUCTS BASED ON GENDER

(N=200)

Sex	Loose items		Packed items		Branded items		Others		Total		X^2 value	P value
	N	%	N	%	N	%	N	%	N	%		
Female	50	25	33	16.5	19	9.5	7	3.5	109	54.5	1.551	0.670*
Male	34	17	33	16.5	17	8.5	7	3.5	91	45.5		
Total	84	42	66	33	36	18	14	7	200	100		

*Not Significant

A hypothesis was framed to investigate the association between the gender of the subjects and their preference to buy food products and analyzed with the help of chi-square test. It was observed from the table XIX that there is no significant association between gender of the subjects and their preference to buy food products as chi-square value was 1.551 with P value of 0.670. Hence, it is concluded that there is no significant association between gender of the subjects and their preference to buy food products.

4. Occupation and Knowledge About Methods of Prevention of Food Adulteration

The distribution of subjects according to their occupation and their knowledge about methods of prevention of food adulteration is shown in the table XX

TABLE- XX

OCCUPATION AND KNOWLEDGE ABOUT METHODS OF PREVENTION OF FOOD ADULTERATION

(N=200)

Occupation	Knowledge about ways for prevention of food adulteration						X^2 value	P value
	YES		NO		TOTAL			
	N	%	N	%	N	%		
Student	25	12.5	89	44.5	114	64	1.037	0.792*
Working person	16	8	40	20	56	28		
Entrepreneur	4	2	10	5	14	7		
Housewife	4	2	12	6	16	8		
Total	49	24.5	151	75.5	200	100		

*Not Significant

A hypothesis was framed to investigate the association between the occupation of the subjects and their knowledge about methods of prevention of food adulteration and analyzed with the help of chi-square test. It is observed from the table XX, that there is no significant association between occupation of the subjects and their knowledge about methods of prevention of food adulteration as chi-square value was 1.037 with P value of 0.792. Hence, it is concluded that there is no significant association between occupation of the subjects and their knowledge about methods of prevention of food adulteration.

5. Age Group of the Subjects and Acceptance Level of Food Adulteration as an Illegal Act

The distribution of subjects according to age group and their acceptance level of food adulteration as an illegal act is shown in the table XXI.

TABLE- XXI

AGE GROUP AND ACCEPTANCE LEVEL OF FOOD ADULTERATION AS AN ILLEGAL ACT

(N=200)

Age group (in years)	Acceptance level of food adulteration as an illegal act										X^2 value	P value
	Strongly agree		Agree		Partially agree		Disagree		Total			
	N	%	N	%	N	%	N	%	N	%		
18- 25	48	24	68	34	47	23.5	5	2.5	168	84	17.120	0.047*
26-32	3	1.5	13	6.5	7	3.5	1	0.5	24	12		
33- 39	2	1	2	1	2	1	0	0	6	3		
> 40	0	0	1	0.5	0	0	1	0.5	2	1		
Total	53	26.5	84	42	56	28	7	3.5	200	100		

*Significant

A hypothesis was framed to investigate the association between the age group of the subjects and their acceptance level of food adulteration as an illegal act and it was analyzed with the help of chi-square test. It was observed from the table XXI, that there is significant association between age group of the subjects and their acceptance level of food adulteration as an illegal act as chi-square value was 17.120 with P value of 0.047. Hence, it is concluded that there is significant association between age group of the subjects and their acceptance level of food adulteration as an illegal act.

6. Educational Qualification and their Acceptance Level of Food Adulteration as an Illegal Act

The distribution of subjects according to educational qualification of subjects and theiracceptance level of food adulteration as an illegal act is shown in the table XXII.

TABLE- XXII

EDUCATIONAL QUALIFICATION AND ACCEPTANCE LEVEL OF FOOD ADULTERATION AS AN ILLEGAL ACT

(N=200)

Educational qualification	Acceptance level of food adulteration as an illegal act										X^2 value	P value
	Strongly agree		Agree		Partially agree		Disagree		Total			
	N	%	N	%	N	%	N	%	N	%		
Up to higher secondary level	11	5.5	17	8.5	10	5	0	0	38	19	6.494	0.690*
Under graduate level	18	9	31	15.5	18	9	4	2	71	35.5		
Post graduate level	13	6.5	16	8	14	7	3	1.5	46	23		
Others	11	5.5	20	10	14	7	0	0	45	22.5		
Total	53	26.5	84	42	56	28	7	3.5	200	100		

*Not Significant

A hypothesis was framed to investigate the association between the educational qualification of the subjects and their acceptance level of food adulteration as an illegal act and it was analyzed with the help of chi-square test. It was observed from the table XXII,

that there is no significant association between educational qualification of the subjects and their acceptance level of food adulteration as an illegal act as chi-square value was 6.494 with P value of 0.690. Hence, it is concluded that there is no significant association between educational qualification of the subjects and their acceptance level of food adulteration as an illegal act.

7. Awareness About the Functioning of Consumer Courts Regarding Grievances Redressal About Food Adulteration Based on Occupation

The distribution of subjects according to their awareness about the functioning of consumer courts regarding grievances redressal about food adulteration is shown in the table XXIII.

TABLE- XXIII

AWARENESS ABOUT CONSUMER COURTS THAT WORK FOR CONSUMER GRIEVANCES

(N=200)

Occupation	Awareness about consumer courts that work for consumer grievances						X^2 value	P value
	YES		NO		TOTAL			
	N	%	N	%	N	%		
Student	33	16.5	81	40.5	114	57	8.133	0.043*
Working person	25	12.5	31	15.5	56	28		
Entrepreneur	7	3.5	7	3.5	14	7		
Housewife	9	4.5	7	3.5	16	8		
Total	74	37	126	63	200	100		

*Significant

A hypothesis was framed to investigate the association between the occupation of the subjects and their awareness about the functioning of consumer courts regarding grievances redressal and it was analyzed with the help of chi-square test. It was observed from the table XXIV, that there is significant association between occupation of the subjects and their awareness about the functioning of consumer courts regarding grievances redressal as chi-square value was 8.133 with P value of 0.043. Hence, it is concluded that there is significant association between occupation of the subjects and their awareness about the functioning of consumer courts regarding grievances redressal.

D. AWARENESS ABOUT FOOD ADULTERATION BEFORE AND AFTER NUTRITION EDUCATION

The awareness of subjects about food adulteration before and after nutrition education are discussed below using T- test.

1. Acceptance Level of Food Adulteration as an Illegal Act Before and After Nutrition Education

The table XXIV shows the acceptance level of food adulteration as an illegal act beforeand after nutrition education.

TABLE – XXIV

ACCEPTANCE LEVEL OF FOOD ADULTERATION AS AN ILLEGAL ACT BEFORE AND AFTER NUTRITION EDUCATION

(N=200)

	Before nutrition education		**After nutrition education**		**t value**	**P value**
	N	%	N	%		
Strongly agree	53	26.5	106	53.0	7.620	0.00*
Agree	84	42.0	84	42.0		
Partially agree	56	28.0	7	3.5		
Disagree	7	3.5	3	1.5		
Total	200	100	200	100		

***** Significant

It was concluded from the table XXIV, that the P value is 0.00, which is lesser than 0.05 (P<0.05). Hence, it was observed that there is a significant difference between the acceptance level of food adulteration as an illegal act of subjects before and after nutrition education.

2. Awareness About Food Adulteration Before and After Nutrition Education

The table XXV presents the awareness of subjects about food adulteration before and after nutrition education.

TABLE – XXV

AWARENESS ABOUT FOOD ADULTERATION BEFORE AND AFTER NUTRITION EDUCATION

(N=200)

	Before nutrition education		**After nutrition education**		**t value**	**P value**
	N	%	N	%		
Yes	98	49	198	99	14.057	0.00*
No	102	51	2	1		
Total	200	100	200	100		

*Significant

It was proved from the table XXV, that the P value is 0.00, which is lesser than 0.05 (P<0.05). Hence, it was observed that there is a significant difference between the awareness of subjects about food adulteration before and after nutrition education.

3. Awareness About Prevention of Food Adulteration Act (PFA) Before and After Nutrition Education

The awareness about prevention of food adulteration act (PFA) before and after nutrition education have been presented in table XXVI.

TABLE- XXVI

AWARENESS ABOUT PREVENTION OF FOOD ADULTERATION ACT (PFA)

BEFORE AND AFTER NUTRITION EDUCATION

(N=200)

	Before nutrition education		**After nutrition education**		**t value**	**P value**
	N	%	N	%		
High	7	3.5	150	75.0	25.914	0.00*
Average	31	15.5	31	15.5		
Low	131	65.5	15	7.5		
Very low	31	15.5	4	2.0		
Total	200	100	200	100		

***Significant**

It was proved from the table XXVI, that the P value is 0.00, which is lesser than 0.05 (P<0.05). Hence, it was observed that there is a significant difference in the awareness level of subjects about prevention of food adulteration act (PFA) before and after nutrition education.

4. Knowledge About checking the Labels for Weights of Food Products Procured Before and After Nutrition Education

Table XXVII shows the knowledge about checking the labels for weights of food products procured before and after nutrition education.

TABLE- XXVII

KNOWLEDGE ABOUT CHECKING THE LABELS FOR WEIGHTS OF FOOD PRODUCTS PROCURED BEFORE AND AFTER NUTRITION EDUCATION

(N=200)

	Before nutrition education		**After nutrition education**		**t value**	**P value**
	N	%	N	%		
Yes	38	19	178	89	19.749	0.00*
No	162	81	22	11		
Total	200	100	200	100		

*Significant

It was observed from the table XXVII, that the P value is 0.00, which is lesser than 0.05 (P<0.05). Hence, it was proved that there is a significant difference in the knowledge of subjects about checking the labels for weights of food products procured before and after nutrition education.

5. Awareness About the Functioning of Consumer Courts Regarding Grievances Redressal Before and After Nutrition Education

The awareness about the functioning of consumer courts regarding grievances redressal before and after nutrition education is presented in table XXVIII.

TABLE – XXVIII

AWARENESS ABOUT THE FUNCTIONING OF CONSUMER COURTS REGARDING GRIEVANCES REDRESSAL BEFORE AND AFTER NUTRITION EDUCATION

(N=200)

	Before nutrition education		**After nutrition Education**		**t value**	**P value**
	N	%	N	%		
Yes	74	37	153	76.5	0.199	0.00*
NO	126	63	47	23.5		
Total	200	100	200	100		

*Significant

It was observed from the table XXVIII, that the P value is 0.00, which is lesser than 0.05 (P<0.05). Hence, it was proved that there is a significant difference between the awareness level of subjects about the functioning of consumer courts regarding grievances redressal before and after nutrition education.

SUMMARY AND CONCLUSION

V SUMMARY AND CONCLUSION

The title entitled “Food Adulteration - Its Impact on Health and Consumer Awareness” is summarized as follows,

Food adulteration is the intentional substitution, addition, tampering, or misrepresentation of food, food ingredients, or food packaging for financial advantage, as well as false or misleading assertions made about a product. According to several authors, all food categories are susceptible to adulteration, including milk, honey, butter, oil, grains, lentils, and so on. Adulterated meals are created in such a way as to entice customers in order to obtain a higher price. Food adulteration is a severe threat to public health. Some of the adulterants are naturally carcinogenic. It is critical to provide food producers and consumers with health education on the adverse effects of various adulterants in foods. Food adulteration has serious health consequences. Profit margins via increasing product volume and producer, retailer, and processor dishonesty are the causes of food adulteration. As a result, the consumer is either defrauded or becomes a frequent victim of ailments. Adulterated food can lead to significant illnesses such as cancer, diarrhoea, asthma, and ulcers.

A total of 200 subjects in the age group of 18- 40 years, were selected for the study by using purposive sampling method. A questionnaire was prepared and the data regarding socio economic background, awareness about food adulteration and knowledge of subjects regarding food adulteration was collected through online survey. Then, nutrition education was given to all the 200 subjects about food adulteration, types of food adulteration, food products prone to adulteration, health effects of food adulteration, testing methods of food adulteration and consumer awareness regarding food adulteration and its incidence in the market. The audio-visual aid used for educating the subjects was youtube videos. A total of six videos was prepared about food adulteration and uploaded in the youtube channel. The subjects were surveyed after continuous follow up. The subjects were assessed after nutrition education to assess their improvement in knowledge before and after nutrition education. Also, the data collected was analyzed and interpreted by using percentage, chi-square test and T test to obtain the results.

Nutrition education is an integral way to impart knowledge to the public. Nutrition education plays an important role in developing health and nutrition for a better living.

Nutrition education as one of the important practical aspects of nutrition knowledge, play an important role in raising public awareness and ultimately health of the society. The basic aim of nutrition education is to improve the awareness and knowledge of selected subjects about food adulteration and its impact on health.

Salient findings of the study

The salient findings of the study are given below;

- Among the 200 subjects selected for the study, 54.5 percent of subjects were females and 45.5 percent of subjects were males.
- Among the 200 subjects selected for the study, 84 percent belonged to the age group of 18-25 years, 12 percent were in the age group of 26-32 years, three percent were in the age group of 33-39 years and one percent belonged to the age group of above 40 years.
- Out of the selected subjects, 11.5 percent of them had an income of Rs. 5000- 10,000 per month, while 27.5 percent of the subjects had an income of Rs. 10,000- 20,000, while 24.5 percent and 36.5 percent of them had a total income of Rs. 20,000- 30,000 and above Rs. 30,000 respectively.
- Majority 57 percent of selected subjects were students, while 28 percent of them were working in different sectors like IT, pharmaceutical industries, food industries and etc., while seven percent of them were entrepreneurs and remaining eight percent of the subjects were housewife.
- With regard to educational qualification, 19 percent of them studied up to higher secondary school level, 35.5 percent were undergraduate, 23 percent of them were qualified up to postgraduate level and remaining 22.5 percent of them were qualified with diploma and other course studies.
- Among 200 selected subjects, only 49 percent of subjects had awareness about food adulteration before nutrition education but after nutrition education 99 percent of subjects had improved their awareness about food adulteration.
- The obtained result shows that 18 percent of subjects knew about food adulteration from television, 29.5 percent of them from friends, while 33.5 percent and 13.5 percent of them from books and neighbours, while 5.5 percent of them gained knowledge about food adulteration from newspapers.
- Before imparting nutrition education, only 42.5 percent of them had knowledge about checking the labels for weights of food products procured but after nutrition

education, the percentage of subjects who had knowledge about checking labels for the weights of food products procured increased to 72 percent.

- Before creating awareness about adulteration to the subjects, 37 percent of them were aware of the functioning of consumer courts regarding grievances redressal about food adulteration and 63 percent of them were not aware of such courts functioning. After creating awareness about adulteration to the subjects, the percentage of subjects who were aware of the functioning of consumer courts regarding grievances redressal about food adulteration increased to 76.5 percent.
- It is found that before nutrition education only 26.5 percent of subjects strongly agreed that food adulteration as an illegal act, while 42 percent just agreed food adulteration as an illegal act, while 28 percent and 3.5 percent of subjects, partially agreed and disagreed that food adulteration as an illegal act. After nutrition education, maximum 53 percent and 42 percent of subjects strongly agreed and agreed that food adulteration as an illegal act while 3.5 percent and 1.5 percent of them partially agreed and disagreed that food adulteration as an illegal act.
- As all the selected subjects were surveyed before and after nutrition education, it was found that before nutrition education, 25 percent of subjects purchased food products only by checking expiry date, date of manufacturing and 30.5 percent of them checked only freshness and quality of product, while 14.5 percent checked only approval of regulatory authority and only minimum of 30 percent of subjects checked all of the above. After nutrition education, a total of 73.5 percent of subjects checked the label for expiry date, date of manufacturing, freshness and quality of food product and also approval of regulatory authority. Hence, after nutrition education, the knowledge of subjects improved to purchase food products after checking the label for date of manufacturing and other details.
- Before nutrition education, only 26 percent of the subjects had knowledge about adulterants present in milk, while after nutrition education, the percentage increased to 63.5 percent which indicated that creating awareness about different aspects of food adulteration helped subjects to improve their knowledge about food adulteration and thus in purchasing foods that are not adulterated.
- Out of 200 subjects, before nutrition education only 32 percent of subjects had knowledge about adulterants present in coffee powder. While, after nutrition education, 69 percent of the subjects improved their knowledge about adulterants present in coffee powder.

- Out of 200 selected subjects, only 16.5 percent of them had complete knowledge about harmful effects of food adulteration before nutrition education, while 63.5 percent of the subjects improved their knowledge about harmful effects of food adulteration after nutrition education.
- Among 200 selected subjects, only 28 percent of subjects had knowledge about quality mark that is necessary on every food product before nutrition education whereas, after nutrition education the percentage increased to 55.5 percent which indicates after education the knowledge of subjects about quality mark that is necessary on every food product has improved.
- Using chi-square test, it is concluded that there is no significant association between age group of subjects and their awareness about food adulteration and acceptance level of food adulteration as an illegal act.
- The present study revealed that there is significant association between occupation of subjects and knowledge about reasons for food adulteration. The study also reveals that there is no significant association between occupation and knowledge of subjects about methods of prevention of food adulteration.
- The chi-square analysis shows that there is no significant association between gender of the subjects and their preference to buy food products.
- From the study, it is found that there is no significant association between educational qualification of the subjects and their acceptance level of food adulteration as an illegal act.
- Using T-test, it is concluded that there is significant difference in the awareness level of subjects about food adulteration before and after nutrition education.
- The study reveals that there is significant difference in the knowledge level of subjects regarding checking the labels for weights of products procured, functioning of consumer courts regarding grievances redressal and awareness about prevention of food adulteration act (PFA) after nutrition education.

CONCLUSION

The consequences of food adulteration will be a graveyard for future generations. Food adulteration and the use of chemicals on foodstuffs are destroying the future generation; food adulteration has the greatest impact on youngsters and the elderly. For filthy diets, children are sacrificing their disease-fighting ability. Their medical costs will rise day by day, having a significant influence on their socioeconomic situation. As a result, food adulteration puts the entire country at danger.

Adulterations can be completely avoided with careful planning and execution. Everyone's health is vital, and this adds to the family's responsibilities. 'Prevention is always better than cure.' Prevention is the greatest method to avoid these health issues. A number of steps can be taken to assure this. The place of buying food ingredients is important. The product's expiration date and origin should be checked. It is also important to check in with the local community on a frequent basis to see whether someone is becoming sick after eating at a particular restaurant or purchasing food items from a particular merchant. Educating the local people about the dangers of food adulteration can be done. As a result, it is critical that each person should take a keen interest in this issue and educate family, friends, and co-workers about the danger.

Nutrition education conducted during the study had a great impact on nutritional knowledge of the selected subjects. The salient findings of the study revealed that after nutrition education, the knowledge of the subjects about food adulteration, types of food adulterants, health impacts of food adulteration and testing methods used to find adulterants have improved. The current investigation discovered that 60% of the participants had average awareness about food adulteration. Food adulteration should be made more widely known, especially among the public. When purchasing things from stores and shopping malls, people must exercise utmost vigilance. They should check for standards such as ISI Standard mark, AGMARK for quality products, FSSAI standard mark, the date of packaging and the date of expiry, and so on. The general population should be encouraged to buy food directly from farmers, and seasonal foods should be preferred.

When food is processed and packed for long-term storage and export, it becomes adulterated. As a result, consumers should exercise greater vigilance while purchasing packaged foods. Hence, it is very important for the public to be aware of food adulteration and its health effects.

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APPENDIX I & II

APPENDIX I

INSTITUTIONAL HUMAN ETHICS COMMITTEE

Avinashilingam

Institute for Home Science and Higher Education for Women
(Deemed to be University under Category 'A' by MHRD, Estd. u/s 3 of UGC Act 1956) Re-accredited with 'A++' Grade by NAAC.
Recognised by UGC Under Section 12 B
Coimbatore-641 043, Tamil Nadu, India

Chairman
Dr. Sudha Ramalingam
Director-Research & Innovation,
Professor-Community Medicine,
PSG Institute of Medical Sciences & Research, Coimbatore

Member Secretary
Dr.S.Uma Mageshwari
Professor and Head,
Department of Food Service Management & Dietetics

Members
Mr. K.Arunmoli (Legal Expert)
Dr.Subhashini K. Sripathi
Dr.A.Saraswathy (Medical Officer)
Ms.D.Kavitha
Dr.A.R.Sudamani Ramasamy
Dr.G.Victoria Naomi
Dr. Judith Justin
Dr.Anitha Subash

26th February 2022

To
Ms.Surekha.P.M
Department of Food Science and Nutrition
Avinashilingam Institute for Home Science and
Higher Education for Women
Coimbatore – 641 043

Dear Surekha.P.M,

Ref: Your proposal No. IHEC/21-22/FSN-25 entitled "Food Adulteration –Its Impact on Health and Consumer Awareness" submitted for approval of IHEC on 23.11.2021.

The Institutional Human Ethics Committee of our University hereby grants approval to your research proposal No. IHEC/21-22/ FSN-25 entitled "Food Adulteration –Its Impact on Health and Consumer Awareness" submitted by you. The Approval number for the same is AUW/IHEC/ FSN-21-22/XPD-25.

We wish you all the best in your research endeavours.

Regards,

Dr.S.Uma Mageshwari
Member Secretary

Institutional Human Ethics Committee

APPENDIX II

Questionnaire to elicit knowledge about food adulteration- its impact on health and consumer awareness

1. Name:
2. Age :
3. Sex :
4. Occupation:
5. Educational qualification:
    a) Higher secondary
    b) Undergraduate
    c) Postgraduate
    d) Others
6. What is your family's monthly income?
    a) Rs.5000-10000
    b) Rs.10000-20000
    c) Rs.20000-30000
    d) More than Rs.30000
7. Which age group you belong to
    a) 18-25years
    b) 26-32years
    c) 33-39years
    d) 40 above
8. Are you a
    a) Student
    b) Working person
    c) Entrepreneur
    d) Housewife
9. Are you aware about food adulteration?
    a) Yes
    b) No
10. If yes, from-
    a) T.V
    b) Friends

c) Books
d) Social media Neighbour
e) Newspaper

11. Which of the following is correct about food adulteration?
    a) Mixing of poor quality, inferior, harmful, useless or unnecessary substances to food.
    b) Any article has been prepared packed or kept under sanitary conditions.
    c) Mixing, substituting, concealing the quality of food by mislabelling, addition of toxic substances.
12. How food can be adulterated?
    a) Intentionally
    b) Accidentally
    c) Both
13. Do you know the reason for food adulteration?
    a) Yes
    b) No
14. If yes, what are the reasons for food adulteration?
    a) To increase the quantity of food production and sales
    b) Lack of knowledge of proper food consumption
    c) Practised as part of business strategy
    d) To attract consumers
15. From where do you purchase food products?
    a) Market
    b) Street vendors
    c) Departmental stores
    d) Small shops near the house
16. What type of food you prefer to buy?
    a) Loose items
    b) Packet items
    c) Branded items
    d) Others
17. Do you purchase foods after checking
    a) Expiry date and date of manufacturing

b) Freshness and quality of the product

c) Approval of regulatory authority

d) All of the above

18. Have you experienced any health problems due to food adulteration?

a) Yes b) No

19. If adulterated milk is consumed, what is the harmful effect on human health?

a) Stomach disorder

b) Less nutritious

c) Fever

d) Others

20. What are the ways to avoid adulterated food products?

a) Avoid dark colored, junk and other processed foods.

b) Check if the seal is valid or not, before buying food products like milk, oil and other pouches.

c) Always make sure to check and buy products having an FSSAI-validated label, along with the license number, list of ingredients, manufactured date and its expiration.

d) All of the above.

21. When do we say that food is adulterated ?

a) If cheaper or inferior substances are substituted wholly or in part

b) Adding unwanted substances to food

c) If any ingredient is injurious to health

d) All of above

22. Methods for detection of common adulterants are_____

a) Visual tests

b) Chemical tests

c) Physical tests

d) All of the above

23. How do you detect milk adulterated with water?

a) Put a drop of milk on a polished slanting surface and check their flow

b) Shaking the milk contents thoroughly

c) Boiling the milk for 2-5minutes

d) Formation of blue color after adding iodine

24. How do you detect adulteration in honey?

a) Heat test: Dip a matchstick in honey and light it

b) Water test: Take a teaspoon of honey and put it in a glass full of water

c) Vinegar test: Mix a few drops of honey into vinegar water

d) All of the above

25. What are the harmful effects of food adulteration?

a) Liver disorder, cancer, vomiting

b) Fever

c) Food poisoning, diarrhoea

d) Both a and c

26. The crippling disease known as Lathyrism is caused due to consumption of

a) Argemone oil

b) Kesari dal

c) Metanil yellow

d) Rhodamine B

27. Symptoms like gastrointestinal disturbances, swelling of feet and legs, and respiratory distress are caused due to consumption of

a) Argemone seeds

b) Mustard seeds

c) Kesari dal

d) Chana dal

28. Health hazards due to food adulteration are caused due to

a) Addition of toxic substances and non- permitted food colours

b) Removal of vital components

c) Substituting substandard ingredients and reduce cost of goods to increase marketing

d) All of the above

29. Do you make aware your children about the health hazard in the edible items?

a) Yes

b) No

30. Do you know the ways for prevention of food adulteration?

a) Yes

b) No

31. If Yes, what are the ways of preventing food adulteration?

a) Building safety from the start

b) Risk-based inspections and testing

c) Rapid reaction, effective communication

d) Regular surveillance and monitoring

32. Who are responsible to control the practice of food adulteration?

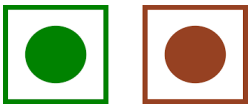
a) Government

b) NGOs

c) Civil society

d) Self

33. What is the quality mark that is necessary on every food product?

a) 

b)

c)

d)

34. Level of awareness about prevention of food adulteration act

a) High

b) Average

c) Low

d) Very low

35. Food adulteration is an offense that is punishable with

a) 5 years imprisonment and Rs 5 lakh fine

b) Life imprisonment and Rs 10 lakh fine

c) Fine of Rs 20 lakh

d) 2 years of imprisonment

36. Have you ever come across adulteration in any of the food stuff?

a) Yes

b) No

37. If yes, to whom do you complain:

a) Shopkeeper

b) FSSAI

c) Local health authority/Food safety authority

d) Food safety commissioner of the state

38. Was your complaint to the supplier/shopkeeper attended by him to your satisfaction?

a) Yes

b) No

39. Have you ever cross checked the weights of the products mentioned on the item?

a) Yes

b) No

40. How do you prefer buying food products?

a) Online

b) Offline

41. Are you aware of consumer courts that work for consumers grievances?

a) Yes

b) No

42. If yes, have you ever filed a case in the consumer court?

a) Yes

b) No

43. Do you agree that food adulteration is an illegal act?

a) Strongly agree

b) Agree

c) Partially agree

d) Disagree