IV Results and Discussion

The findings of the present study entitled **"Effect of Food Safety Intervention on Safe Handling Practices among Food Handlers and Microbial Assays of Processed Food Products of Fruits and Vegetables Industries"** were discussed under following headings.

4.1 Identification and collection of data from selected food handlers of vegetables and fruit Industries

4.2 Hygienic food handling practices of the selected food handlers.

4.3 Infrastructural facilities available in the selected food industries

4.4 Personal Hygiene of the selected food handlers

4.5 Microbial Assays of the selected food products.

4.6 Effect of food safety training intervention on safe handling practices using KAP survey.

4.1. Identification and collection of data from selected food handlers of vegetables and fruits Industries

Kerala has 82 fruits and vegetables processing units with Central FSSAI License and 1197 state FSSAI license fruits and vegetables processing units with the total of 1297 fruits and vegetables processing units with both State and Central FSSAI License.

4.1.1 Profile of Selected Vegetables and Fruits Industries

All the three mentioned food industries had FSSAI registration and followed strict statutory regulations complied by State and Central government. The Ice cream factory was a small scale industry situated in a rural area of Meenangadi so that the factory provides employment to the people staying in the vicinity of the industry. Olene is a small bakery and restaurant, situated in an urban areas of Manjeri. Panda Foods (India) Pvt Ltd is one of the key players in the food industry segment located in a rural area Krishnagiri in Waynad.

Table No. I depicts the company profile of the selected fruits and vegetables industries in the selected study area.

Table I

Profile of the selected Food Industries

Company Profile	Anna Foods	Olene	Panda
Inception Year	2004	2017	1989
FSSAI License No.	Registered No. 11319012000095	Registered No. 11317010000975	Registered No. 10015041000779
Type of Industry	Jackfruit Ice Cream	Bakery	Fruits and Vegetable Processing
Products Manufactured	Jackfruit Ice Creams, and Jackfruit Products	Fruit Cakes, buns and dehydrated fruits and fresh juices	Pickles, Jams, Ketchup, Fruit concentrates and squashes
Branches or Sub Units	Three	Three	Four
No. of Employees	180	120	200

Table I highlights the company profile of the selected three major fruits and vegetables food industries of Kerala. Panda has been rapidly growing since 1989 and today and has 30 years of rich experience in bringing innovative and technical expertise in to practice in the field of food industry. Panda Foods (India) Pvt Ltd. has a basket of products including spice powder, blended masala powder for both vegetarian and non -vegetarian recipes, jams, pickles, dried vegetables and fruits powder and fortified health mix.

Anna Food Product captured the market with its stellar brand “Fizzy” with an array of 70 different flavoursome ice cream varieties. With novel arena of innovation and creativity of jackfruit production units which turns out, more than 10 specialized jackfruit products, jam, squash, ice cream, jack chilly, jack pepper pickle, jack coffee, jack puttupodi, jack appetizer, jack chutney, jack sweets and savoury items . This company has many operational units in North –eastern part of Kerala State.

Olene Canto, an established brand in bakes and other fluffs based has always been investing to bring healthy fresh bakery products since its inception. With its extraordinary commitment for effective food products production. Olene Canto a revolutionary concept of ethical bakers in the production of fudge lip licking cakes, pastries and other bakery stuffs dehydrated fruits and vegetables powder and fresh fruit juices are the stronghold ethics in food making.

4.1.2. Profile of the food handlers in the selected vegetables and fruits industries

Three major fruits and vegetables based industries were selected from Meenangadi, Manjeri, and Waynad for this study. The total number of employees engaged in these three major industries were 509. Anna Foods has three sub units with 182 employees, Olene has three sub units with 121 employees and Panda has four sub units with 206 employees. Among 509 employees, 200 permanent employees were selected and their profile is highlighted in Table II.

Table II

Profile of employees engaged in selected industries

No. of employees	Male	Female	Total
Skilled	43(21.5%)	53(26.5%)	96(48%)
Unskilled	80(40%)	24(12%)	104(52%)
Total	123 (61.5%)	77(38.5%)	200(100%)

Table II denoted that out of 200 food handlers there were 48 percent skilled food handlers (21.5 percent males and 26.5 percent females) and 52 percent were unskilled food handlers (40 percent males and 12 percent females) and were engaged in the selected fruits and vegetables industries.

4.1.3. Demographic Profile of the selected Food Handlers

Demographic data gives data about research members and is needed to decide if the people in a specific report are an agent test of the objective populace for speculation purposes. Table III features the segment profile of the chose food controllers (N=200).

Table III

Demographic Profile of the selected food handlers (n=200)

Attributes	Ice Cream	Bakery	Fruits and Vegetable Industry	Total (N=200)
Age Group Young Adults (20-30 years)	18(9%)	30(15%)	21(10.5%)	69(34.5%)
Middle Adults (31-40 years)	39(19.5%)	30(15%)	37(18.5%)	106(53%)
Late Adults (40 -50 years)	8(4%)	7(3.5%)	10(5%)	25(12.5%)
Gender Male	40(20%)	36(18%)	47(23.5%)	123(61.5%)
Female	29(14.5%)	25(12.5%)	23(11.5%)	77(38.5%)
Educational Status Up to School Level	16(8%)	10 (5%)	12(6%)	38 (19%)
Up to High School	18(9%)	22(11%)	16(8%)	56(28%)
Up to College	30 (15%)	16(8%)	44 (22%)	90(45%)
illiterates	5(2.5%)	7(3.5%)	4(2%)	16(8%)
Job Responsibilities Processing	20(10%)	26(13%)	36(18%)	82(41%)

Cleaning and Washing	10(5%)	8(4%)	10(5%)	28 (14%)
Quality Control	2 (1%)	4 (2%)	6(3%)	12(6%)
Packaging	10(5%)	8 (4%)	18(9%)	36(18%)
Store Keeping	6(3%)	6(3%)	10(5%)	22(11%)
Dispatching	8(4%)	4(2%)	8(4%)	20(10%)
Marital Status				
Unmarried	10(5%)	12(6%)	6(3%)	28(14%)
Married	44(22%)	47(23.5%)	43(21.5%)	134 (67%)
Divorce	6(3%)	6(3%)	8(4%)	20(10%)
Widow/Widower	6(3%)	4 (2%)	8 (4%)	18 (9%)
Work Experience				
0-3 years	2(1%)	-	2(1%)	4(2%)
3-6 years	22(11%)	14(7%)	24(12%)	60(30%)
7-9 years	20(10%)	19(9.5%)	26(13%)	65(32.5%)
10-12 years	21(10.5%)	10(5%)	14(7%)	45(22.5%)
>12 years	4(2%)	6(3%)	16(8%)	26(13%)
Monthly Income				
< 5000	12(6%)	14(7%)	18(9%)	44(22%)
5001-10,000	32 (16%)	24 (12%)	28(14%)	84(42%)
10,000-15,000	14(7%)	10(5%)	18(9%)	42 (21%)
15,001-20,000	4(2%)	4(2%)	10(5%)	18(9%)
> 20,000	4(2%)	4(2%)	4(2%)	12(6%)

Table III depicts the demographic profile of the food handlers engaged in the selected three fruits and vegetables industries Food Handlers were selected from fruits and vegetables industries in the age group of 20-50 years for the research study. Out of 200 selected food handlers a total of 123 (nearly 62 percent) were males and 77(39 percent) were females employed in these ten sub units.This showed that more of male food handlers employed the food industry expressed that they had travelled from one place to another easily by their own or public transports for multitasks of the industries and rest of them were females. Female food handlers were mainly

employed for the purpose of cleaning and preliminary preparation of foods inside the industries. By observation, it was noted that the selected female food handlers had more culinary skills and adopted safe practices than male employees. Out of 200 food handlers 53 percent of the food handlers were in the middle adulthood (30-40 years).Among the selected food handlers 38.5 percent of the handlers were female employees. Findings of this study was coincided with the study of Prabhu (2012) and the ratio of male: female employed in food industries was 3.7:1

Kubde (2016) said that greatest investigation subjects were in the age gathering of 25 – 34 years (43%) and least were found in the age gathering of over 55 years for example just 6.9%.

Related to the marital status of the selected subjects, 67 percent of the food handlers were married. This indicated that there was an urge to work and earn money among the food handlers to meet their livelihood. It also showed that 10 percent of the selected food handlers were divorced while nine percent were widow and denoted that they were self -dependent to meet their daily expense and lived an economically stable life and rest of them were unmarried.

Table III also highlighted the educational status of the selected food handlers. Eight percent of the selected food handlers did not receive any formal education, and were illiterate and not able to read and write. Nineteen percent of the food handlers had primary level of education whereas 28 percent had education at secondary school level. Nearly forty five percent of the selected food handlers had an opportunity to receive higher education at colleges and universities level. Ifeadike.et .al (2014) inferred that upwards of 122 (72.7%) of the subjects had auxiliary schooling or more, while 46 (27.3%) had essential training and underneath. Bakry (2019) also expressed that the degree of instruction for most of the example was between secondary school and advanced higher education by 37.5 percent and 47.2percent, respectively.

Work experience of the food handlers in the field of food processing was expressed that 22.5 percent of the food handlers had of 10-12 years of experience in their field. As their advance in age, their experience also increases. As the education level was low they could not shift over to any other field of occupation. Most of the selected food handlers remained and continued the legacy of their work. Akabanda et.al

(2017) expressed that a more prominent number of members (76.2%) had >5 long stretches of involvement working in the foodservice business with a normal length of 11 ± 7.8 years. Mengist et.al (2018) proposed that greater part of food controllers (45.9%) had 1–2 years of work insight. Lee .et. al. (2012) also expressed that larger part of the respondents (40.5%) had short period of one to five years of working experience and the least was 3.6% with more than eleven to twenty years of involvement.

Table III denotes the job responsibilities and classification of the selected food handlers who were assigned in the fruits and vegetable industries. Forty one percent of the selected food handlers were assigned the processing responsibility which included selection of raw materials, grading, sorting, all preliminary preparations which included the washing, peeling, chopping and cooking the fruits and vegetables. Fourteen percent of the selected food handlers were involved in cleaning and sanitizing the processing unit. Six percent of the selected food handlers were selected as the quality controller or the quality assurance manager as they had experience in the field of food safety, quality and safe handling practices. Nearly 18 percent of the food handlers' especially female food handlers were in charge of the packaging as the food handlers were allocated the responsibility to measure the required quantity and pack appropriately according to the requirements. Eleven percent of the selected food handlers were allocated the responsibility of storekeeping or taking care of the commodities in the huge godown and also responsible for store keeping and to maintain accurate stock update of the raw materials procured, used and the balance leftover in the account. The storekeeper had a list of assured wholesale dealers and suppliers from where the raw materials procured. Ten percent of the selected food handlers were in the dispatch department where the prepared food products were packed and labelled properly and were transported to the market. Meagre percent of the males were drivers to deliver the processed products to various wholesale, retail and supermarkets. The same trend was noted in the study conducted by Nee and Sani (2011) and mentioned that the food handlers as indicated by their work dispersion, it has been tracked down that 36.9 percent were culinary specialists and partner cooks who were identified with food readiness and cooking, 20 percent were staff answerable for administration,

nine percent were dishwashers designated for different works aside from cooking and 24.6 percent were cafeteria' business visionaries and clerks.

Monthly income of the selected food handlers revealed that the income of the food handlers depends on the educational qualification and years of experience in food processing. It was found that around 42 percent of the food handlers earned a monthly income ranging between Rs.5000/- to 10,000/-. Only six percent of the food handlers working as quality controller in their food industries and had monthly income more than Rs.20,000/-. It might vary from place to place depending on the type of food industry, location, educational qualification and work experience. Nearly 22 percent of the food handlers earned less than Rs 5000/- and were engaged in the activities of cleaning and washing.

4.1.4. Training program attended by the selected food handlers

Data gathered from the present research study revealed that 52 percent of the food handlers were not trained professionally, but they gained knowledge regarding food processing through their practical work experience and possessed professional skills. Only 48 percent of the selected food handlers had participated in the training program and attained expertise in various aspects of food processing, distribution and marketing.

Lee .et. al. (2012) revealed that 84 percent of the members attended food instructional classes where 16 percent did not undergo any course to upgrade their knowledge and professional skills.

During their training period, the selected food handlers were categorized into two major groups by having less than 3 years and more than 3 years of the experience in the field. Nearly 40 percent of food handlers had attained training and advised to have refresher course as they needed to brush up and recollect the latest trend safe handling practices for effective implementation in the processing industry. Most of the food handlers were given continuous training and their work efficiency was improved by their updated the knowledge of the modern practices followed in the current situation and the opportunities existing for a better positioning in the processing unit. Whereas 58 percent of the trained food handlers attained their training, a couple of year before they were well aware of the food safety norms and the regulations which

are upgraded and required to be practiced and implemented in the processing industry.

Fig 12: Acquisition of Knowledge on Food Processing

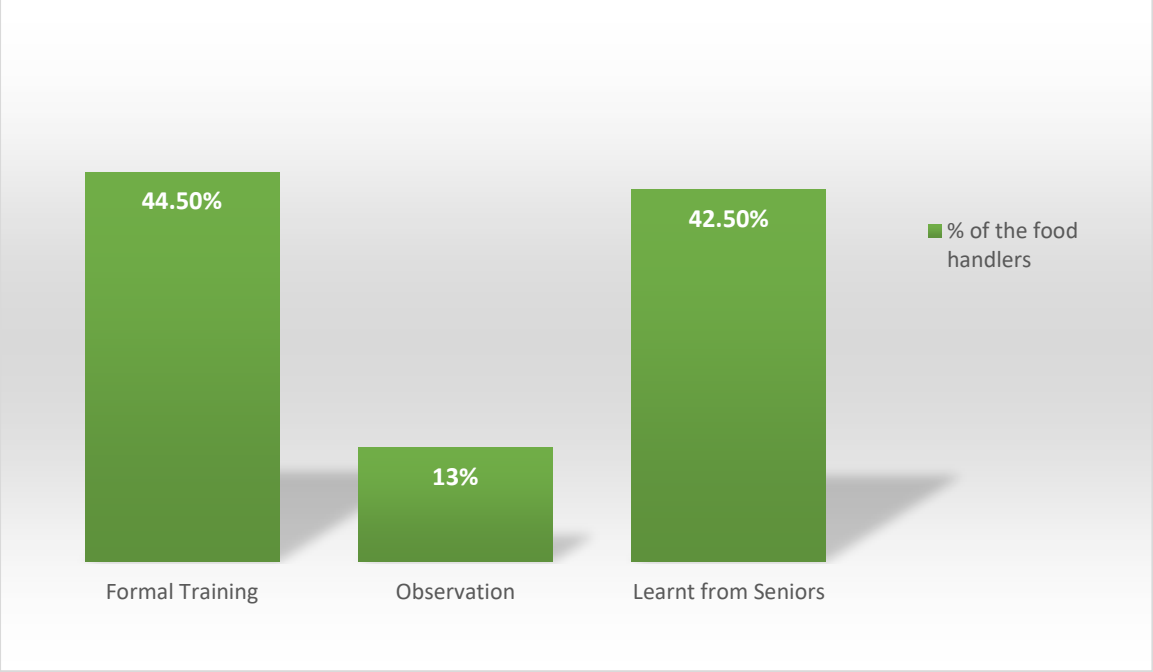


Figure 12 reveals that 44.5percent of the selected food handlers had acquired their knowledge on food processing by attainting a skill based formal training for the period of seven days which helped to improvise the working situation in the industry with their expertise and experience received during their internship as a trainee in previous food industries. Thirteen percent of the selected food handlers gained knowledge about food processing by self-observation, enthusiasm and eagerness to know more in the field of food processing. It is an inbuilt ability to learn and nurture from the environment and start imitating or performing in a particular manner and 42.5 percent of the selected food handlers learnt and gained practical experiences from their seniors in the processing industry by indulging in self-learning and trial and error methods. Majority of the selected food handlers were guided and supervised by their seniors and higher officials in the processing unit for the effective implementation of safe food handling practices.

4.1.5. Types of Vaccination

Fig 13: Types of Vaccination

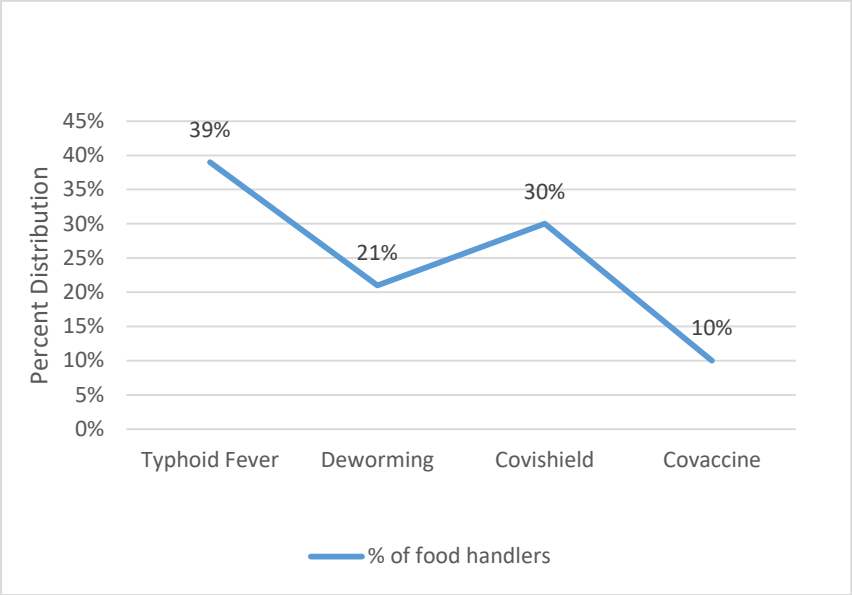


Figure 13 showed the awareness that the food handlers had regarding their optimum health and vaccination**.** It is believed that food handlers are the carriers of infection, contamination which leads to a lot of ill health and sickness. It is the greatest amount of liability of the food handlers to keep themselves healthy and practice good hygiene condition in order to eradicate harmful and contagious diseases. It was clear that the food handlers were health conscious and had regular vaccination at the prescribed time to protect themselves from deadly diseases and preventing it from been carried away by them along with food they process. Around 39 percent of the food handlers were vaccinated with typhoid vaccine. 21 percent were regularly dewormed, 30 percent with Covishield and 10 percent with Covaccine in the first wave and the lock down period which is the need to the hour. As Covid -19 and its variants are mutating every hour and the mode of transmission is through dirty hands, air droplets which spell in the air during sneezing and coughing. As per the Government rules each and every one followed the Covid norms to produce safe and sound good quality food products. Regular washing or sanitizing has become a part and parcel of one's life. Social distancing of about two meters along with usage of personal protection equipments like masks, gloves, headgears, face shields, protective clothing and shoe covers have been made mandatory for all the food handlers working in the industry. In India, absence of information and attention to forestalling foodborne sicknesses and practice of appropriate cleanliness among food controllers is a significant worry as it might prompt a huge illness trouble due to foodborne contaminations, for example, hepatitis A. Indian Medical Association (IMA) (2020) and the Association of

Physicians of India (API) (2009) suggested hepatitis. An inoculation in exceptional or high-hazard people like youths and grown-ups, and food handlers.

4.1.6. Basic Knowledge on the safety and safe handling practices

Pham (2010) revealed a shortage of sanitation information by food controllers and food premise administrators as a key food handling issue. A large portion of the food handlers felt that they needed information about legitimate food taking care of practices and why they need to deal with food appropriately. Some food controllers have an essential degree of sanitation information, however can't frame the connection of the best approach to apply their food handling information on an everyday premise. Azanaw, et .al (2019) also reviewed that educated food controllers were 2.92 occasions bound to rehearses great food handling than non-proficient.

A six-month food safety and hygiene training programme was implemented to improve the knowledge of food handlers in order to achieve effective and desirable transformations in individuals' personal and professional lives. The target population consisted of 200 food handlers working in the fruits and vegetables industries. The training programme aimed to raise awareness and enhance the knowledge about food safety hygiene and safe handling practices among selected food handlers.

Table IV depicts the basic knowledge on food safety and safe handling practices of the selected food handler

Table IV

Basic Knowledge of the selected food handlers

Aspects	Aware		Not Aware	
	(N=200)	%	(N=200)	%
Food Safety	62	31	138	69
HACCP	24	12	176	88
Food Contamination	31	15.5	169	84.50
Safe Handling Practices	53	26.5	147	73.50
Food borne Illness	89	44.5	111	55.50
Mean		**26%**		**74.1%**
SD		**±11.60**		**±11.60**

Table IV represents the initial knowledge of the food handlers regarding Food Safety, HACCP, Cross contamination, Good Handling Practices and Food Borne Illness. On an average only 26% of the food handlers had initial knowledge on various aspects covered in the training program and rest of them were ignorant of the selected aspects of safety and safe handling practices and were considered for training intervention.

4.2 Hygienic food handling practices of the selected food handlers

In hygienic food handling practices, foods purchased from the suppliers, storage facilities available in the food industries, food preparation and handling practices, dish washing and waste disposal are discussed and are statistically analysed for interpretation of data. Azanaw (2019) hypothesized that great individual cleanliness and food taking care of practices are significant for keeping the transmission of microbes from food overseers to the shoppers close 75 percent of food-borne sickness flare-ups are credited to absence of safe food dealing with rehearses by food controllers in food administration foundations. Food controllers assume a vital part in guaranteeing severe adherence to food handling standards all through the whole cycle.

4.2.1 Procurement and storage of foods

The food handlers should understand that the rules implemented for safe food handling especially in procurement and storage of foods is totally meant for prevention of contamination and spoilage of foods. By selecting, receiving and storing of foods help to ensure that the foods are safe for customer consumption. Fig. 15 highlights the procurement and storage of foods in the selected industries (N=10)

Fig 14: Procurement and storage of foods

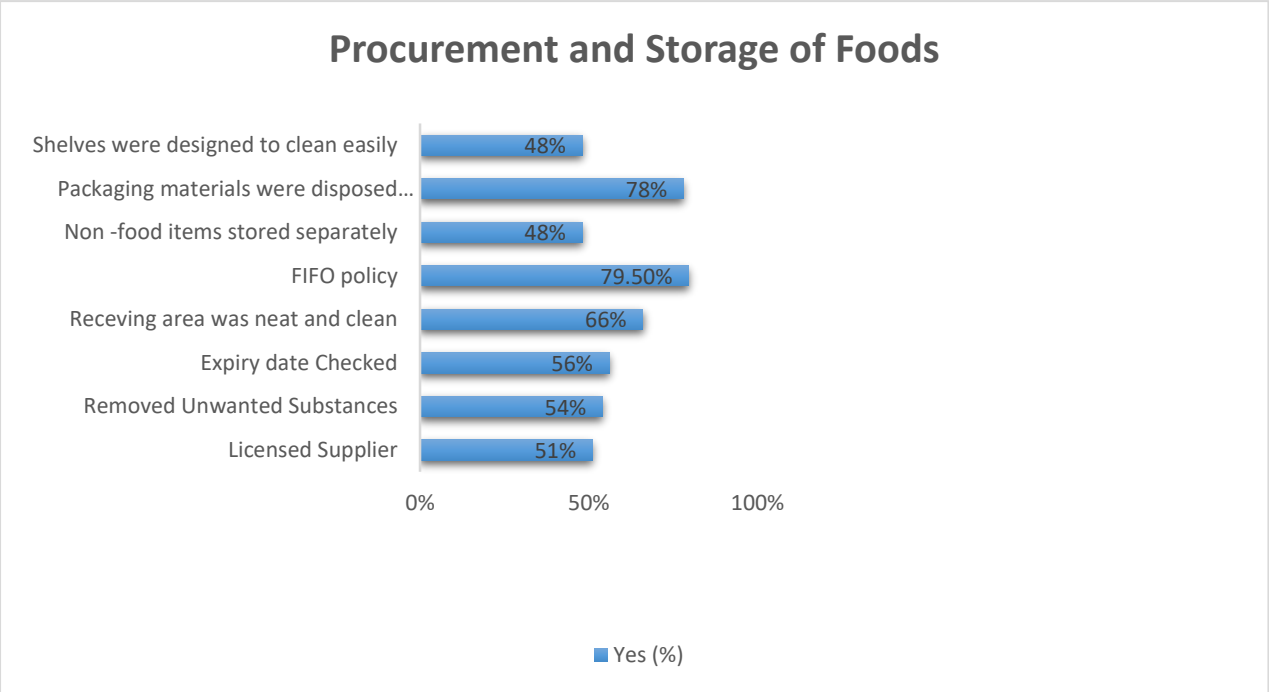


Fig 14 highlighted the practices which were followed while procurement receiving and storing foods and pointed out that 51 percent of the food industries procured raw materials from licensed suppliers. Fifty four percent of the food industries checked and cleaned the raw materials carefully to remove any foreign materials from the food stocks. It was also noted that 56 percent of the food handlers involved to check the date mentioned on the labels before incorporating them in the food products and 66 percent of the food handlers agreed that the receiving and storage areas were clean and dry. Fifty Seven percent of the food industries expressed that the raw materials were placed properly, whereas rest denied that there was not enough space to arrange the raw materially properly. Seventy nine percent of the food handlers observed the first in first out policy in the food industry. Fifty nine percent of the food handlers expressed that the non- food items were kept away from the food product to prevent hazards during processing and 48 percent of the food handlers found that the shelves were cleaned and maintained properly. Seventy eight percent food handlers pointed out that they disposed the packaging materials like plastics, paper and glassware to the municipality dust bins systematically from their food industries.

4.2.2 Availabilities of Food storage facilities in the selected food industries

All food industries, irrespective of all food industries had adequate storage facilities to protect food from spoilage, contamination and so on and make the foods to be remained wholesome till it is consumed. Table V depicts the food storage facilities with selected food industries.

Table V

Availability of Food Storage facilities in the selected food industries

Variables	Yes (N=200)	%	No (N=200)	%
Freezers were in good conditions	112	56	88	44
Correct temperatures were maintained	144	72	56	28
Defrosted the refrigerators periodically	138	69	62	31
Free from objectionable odour	179	89.5	21	10.5
First in First out policy followed	159	79.5	41	20.5
Processed foods were stored separately	167	83.5	33	16.5
Refrigerators were kept spill free	134	67	66	33
Foods were covered to avoid cross contamination	169	84.5	31	15.5
Refrigerator over stacked and opened frequently	53	26.5	147	73.5
Canned foods opened were stored in refrigerator	138	69	62	31

Table V shows the food storage facilities available in the selected food industries. Fifty six of the food handlers agreed that the refrigerators were in good working conditions. Seventy two percent of the food handlers knew the correct temperatures at which the fruits and vegetables were stored to attain a longer shelf life. Sixty nine percent of the food handlers responded that the deep freezers and refrigerators were periodically cleaned and defrosted so that the perishable food commodities can be kept and thus maintaining the sanitary conditions upgraded. Nearly 90 percent of the food handlers agreed that the foods which produced strong objectionable and unpleasant smell were kept away from other food items. No room refreshers were allowed inside the processing unit. Strong cleaning agents were kept away from the

food and labelled to prevent any hazards during processing. Nearly 80 percent of the food handlers followed the “first in first out policy”, which meant that the raw materials which came in the processing unit first were incorporated to develop any food product first and first items were the first to dispatch for marketing and for distribution. Nearly 84 percent of the food handlers strongly agreed on the fact that the processed food products were kept away from the raw or uncooked foods to prevent any sort of cross contamination which might take place among the raw foods and processed food products. Sixty seven products of the food handlers agreed that the deep freezers were kept clean and caution was taken while storing the food product from spilling. Majority (84.5 percent) of the food handlers always covered the food products after preparation to ensure its safety and quality of the product. Hence it also inhibited the mosquitoes and other insects falling in the food. Only 27 percent of the food handlers over stacked the refrigerator and frequently opened the doors and rest of them (74percent) did not over stock and open the refrigerator frequently. As it creates a fluctuation in the temperature and ultimately spoil the food products. Sixty nine percent of the food handlers responded and agreed that the “opened canned products” were immediately utilized and did not leave it longer in the refrigerator to prevent cross contamination. The same findings were coincided with the study of Nkhebenyane (2020) who tracked down that just 41 percent of the food handlers were ignorant of the legitimate working temperature of a refrigerator, while 59 percent were not aware of the right refrigeration temperature and used in their food industries.

4.2.3. Food Preparation and handling practices

Once careful selection and storage of foods and good personal hygiene on the part of the food handlers, outbreaks of the food borne illness can occur, if unsafe procedures are followed in food preparation and handling of food items (Moreb .et.al , 2017). Table VI points out the food preparation and handling practices of the selected food handlers.

Table VI

Food preparation and handling practices

Variables	Yes (N=200)	%	No (N=200)	%
Tongs /spoons were used to pick up food	139	69.5	61	30.5
Properly evaluated in the sensory laboratory	46	23	154	77
Cleaning was carried out before , during, and after preparation	136	68	64	32
Proper care was taken to preserve food items	137	68.5	63	31.5
Foods were thoroughly washed before use	122	61	78	39
Kitchen sink was used only for dishwashing	143	71.5	57	28.5
Sharp equipments were cleaned before and after usage	132	66	68	34
Equipments were cleaned and maintained properly	123	61.5	77	38.5
Separate processing / cutting boards used for vegetables and fruits	56	28	144	72

Table VI points out that the food preparation and handling practices of the selected food handlers. Majority (69.5 percent) of the food handlers used the tongs and spoons while picking up foods. In majority of the selected food industries, there was no in house laboratories and the foods were not proper sensory evaluated. The cleaning was done before and after the preparation of the food products. Sixty eight percent of the food handlers were cared to preserve the food carefully so that the shelf life could be sustained for a longer time. Sixty one percent of the food handlers were aware of the importance of washing fruits and vegetables before processing. Nearly 72 percent of the food handlers agreed that the kitchen sink was only meant for washing fruits, vegetables and kitchen vessels, and separate wash basins were installed at various places for the conveniences of the food handlers to wash their hand as and when required. Sixty Six percent of the food handlers responded that they used to carefully clean the sharp equipments like knives, chopping blades, and

various cutters before and after usage. Proper cleaning procedures and service maintenance was done for all the equipments regularly by 62 percent of the selected food handlers. Twenty eight percent of the food handlers expressed that they used the same chopping board for chopping fruits and vegetables. Chopping board and cutting boards were washed thoroughly before and after the usage and was kept in a dry place to prevent fungal growth on the chopping and cutting boards.

4.2.4 Cleaning and Waste Disposal

Proper procedures were adopted to clean and sanitize the equipments in the processing unit and service area to enable to prepare and pack foods in a clean and hygienic manner is highlighted in Table VII

Table VII

Cleaning and waste disposal

Variables	Yes (N=200)	%	No (N=200)	%
Washing / Cleaning area was well planned for easy usage	122	61	78	39
Adequate water supply was available for effective cleaning	180	90	20	10
Equipments /dishes with a dried residue was soaked before washing	137	68.5	63	31.5
Proper cleaning agents were used	128	64	72	36
Helpers were appointed for cleaning/ washing	98	49	102	51
Accessary equipments like dishwashing baskets etc. kept clean	129	64.5	71	35.5
Equipments / dishes were dried prior to storage	134	67	66	33
Food wastes/ refuse collected separately	103	51.5	97	48.5
Adequate garbage containers were available	103	51.5	97	48.5
Garbage ‘s were removed at frequent intervals and cleansed outside	136	68	64	32

Table No. VII discussed the practices related to the cleaning, washing and garbage disposal which were followed in their food industries The food industry had adequate space and the layout of the processing units was well planned and it had all the facilities which were required for the smooth conduct of the processing. Sixty one percent of the food handlers responded that the washing and cleaning were well

spaced. Sufficient water was available (24×7) for the cleaning and cooking purposes. Nearly 69 percent of the food handlers said that the equipments and dishes were first soaked in water as it was easy to clean the equipments. Sixty four percent of the food handlers mentioned that proper cleaning agents were available to sanitize and disinfect the surface areas. The food handlers were divided into groups according to the work and forty nine percent of the food handlers were assigned cleaning and washing responsibility. Adequate amount of cleaning agents, storage baskets and garbage dins were placed. Sixty eight percent expressed that of the food handlers informed that the garbage was disposed regularly. The fruits and vegetables were duged in the soil while the plastic and paper waste were taken away, on alternate days ,by the municipality workers, Routine cleaning of the garbage dins happened to evade the mosquitoes from lingering in and around the processing units and made the food handlers and food products ensured the quality and safety.

4.3 Infrastructural facilities available in the selected food industries

Proper selection of a location is imperative, otherwise manufacturing standard of sanitation is an improperly located and poorly equipped industries may prove to be an impossible task for the food handlers. Proper location and arrangements of the equipments should be cleared to avoid wastage of money and space. Well planned area accommodated with adequate equipments helped to facilitate the food handlers to work perfectly.

Table VIII furnishes the details related to construction, water supply and plumbing facilities and safety measures available in the selected food Industries.

Table VIII

Availabilities of Infrastructure

Variables	Yes (N=200)	%	No (N=200)	%
Wall and floor were properly titled and cleaned	144	72	56	28
Ceilings were properly maintained	155	77.5	45	22.5
Sinks had hot and cold running water	68	34	132	66
Overhead pipes free from leakages and well insulated	82	41	118	59
Water and ice were purchased / available in the same place	138	69	62	31
Ice and ice containers handled and stored properly	120	60	80	40
Water purification system was available and in working condition	158	79	42	21
Fire extinguisher were provided	132	66	68	34
Adequate lighting and ventilation were available	168	84	32	16
Electricity –Heavy power line	190	95	10	5
Fuel –LPG Gas line cylinders were used properly	192	96	8	4

Table VIII showcases the views of the selected food handlers in terms of construction, water supply, and plumbing facilities and safety measures available in the selected Industries. It was found that around 72 percent of the food handlers expressed that their industries had tiled walls and floors and the ceilings were intact and was white washed and cleaned perfectly in a periodic manner. The cobwebs were removed periodically. Thirty four of the food handlers responded that hot water was available to fulfil their needs. Forty one percent of the selected food handlers informed that the overhead pipes were well insulated and it was leak proof. As portable water was available for processing and commercial purpose ice cubes were made using the same water. Sixty six percent of the food handlers pointed out that emergency fire extinguisher installation in different places for safety purposes in the processing units. Adequate lighting and ventilation were also available for the smooth

functioning in the unit. LPG gas lines were placed securely so that no hazards happen. The gas pipe lines were also checked for leakages at regular intervals for safe functioning of the processing units.

Most of the processing units were well equipped with proper ventilation and storage facilities with locker facilities. The walls, ceilings and doors were made of non –toxic and impermeable materials. The floors of the processing unit were non-absorbent, non-slippery and sloped appropriately. The doors and windows had wire mess to prevent the entry of insects and pests inside the processing units and also used safe and portable water facilities during processing. All the processing unit was well ventilated and insulted exhaust fans. Stainless steel utensils and containers were used for preparing pickles and jam in the industries. The unit has well equipped machinery with proper maintenance of log books. Godown was in the unit for storing raw materials in jute bags and plastic sacks piled up one by one on pallets so as to keep away any moisture and rodents. The processing unit was cleaned regularly and kept free from dust, dirt and cobwebs. Rest rooms and hand washing facilities were also provided in the premises. An automatic hand drier was also installed in the restroom. The cleaning agents were kept in sealed and properly labelled containers. They disposed the garbage by putting all the organic materials and other inorganic things into a pit which is dug behind the processing units. The plastic wastes were disposed with the help of municipality workers. There was proper drainage system for the sewage water. Iron knives were used for chopping fruits and vegetables. Nearly 70-80 percent of the selected industries owned a van to transport the food products from manufacturing units to outlets. The processing unit had adequate power supply and a generator for back up. It also has a fire extinguisher to vade off fire in case of an emergency. There was a first aid box and hospital was located near to the processing unit to avail proper medical care and treatment at the time of an emergency. Inspection for pests by the pest control Board was carried out in every six months. Fumigation was systematically carried out around the unit to keep the work area clean and free from pests and other insects.

4.4 Personal Hygiene of the selected food handlers

Mukhopadhyay et.al (2012) clarified that individual cleanliness of food handlers and ecological sterilization are the two key components in the transmission of food borne

infections. A significant method to forestall food defilement is to keep an exclusive expectation of individual cleanliness and neatness. Misusing of food and excusal of clean measures regarding food controllers might engage microorganisms to come into contact with food and, every so often, to persevere through and expansion in satisfactory numbers to cause affliction in the purchaser. Information identified with individual cleanliness of the chose food overseers was assembled and were communicated in Table No. IX

Table IX

Personal Hygiene of the selected food handlers

Variables	Yes (N=200)	%	No (N=200)	%
Wounds like cuts, burns should be covered and gave immediate care	124	62	76	38
Kept their finger nails short , clean and well-shaped	122	61	78	39
Smoking was not permitted inside the industries	159	79.5	41	20.5
Hair should be covered with cap	108	54	92	46
Foods were tasted using spoon /spatula	120	60	80	40
Eye care was considered	144	72	56	28
Hands were washed periodically to avoid cross contamination of foods and food products	148	74	52	26
Jewellery / finger ring were not allowed inside the industries while working	132	66	68	34
Attention should be given to feet and foot wares to avoid stress and strain	132	66	68	34
Nose picking or fingering the nose were not allowed	154	77	46	23
Protective clothing must be kept clean and appropriate uniform worn	157	78.5	43	21.5
Regular medical health check -up was arranged	134	67	66	33
Adequate restrooms and locker facilities available for food handlers	129	64.5	71	35.5
Recreation and exercise were encouraged	101	50.5	99	49.5
Nutritious foods were provided	122	61	78	39

Table IX discussed about the personal cleanliness of the food handlers. Sixty two percent of the selected food handlers a personal cleanliness of the chose food handlers greed that wounds, cuts and burns should be kept covered properly during food processing and suitable medical care was given Nearly 61 percent of the food handlers were aware of the importance of keeping the nails trimmed, clean and tidy

as it carries a lot of germs which can lead to food borne illness. Eighty of the food handlers were aware that smoking was not allowed to smoke inside the food processing premises. Fifty four percent of the food handlers used hair caps while working inside the processing units. Tasting of foods was strictly practiced using a spoon and spatula. Seventy two percent of the food handlers took good care of their eyes, as it was essential to have good eyesight to prevent any sort of physical, chemical and biological hazards which could be inspected by visual inspection. At the same time 66 percent of the food handlers did not wear any jewellery, finger rings as there were chances of the jewellery falling into the processed food products. A shoe rack was provided at the entrance of the processing section. Outside foot wares were not allowed strictly. A pair of foot wares were made available for each food handlers and visitors so that dust and dirt from outside did not enter the processing unit. A shoe cover was also wore over the foot ware for double protection. Seventy seven percent of the food handlers practiced strict personal hygiene practices and did not scratch their hair or pricked their nose while working inside the processing units. Nearly 79 percent of the food handlers were properly dressed with full protection. Lock rooms were available and kept their valuables like watches, jewellery, money and their personal clothes during working period. In the selected processing units all the food handlers had two sets of uniform so that they could wore it interchangeably and there was no cross contamination occurred from the dress or uniform of the food handlers to the food products. Regular health check –up and received vaccinations to protect them from life threatening diseases, and 67 percent of the food handlers only availed this type of facilities rendered by the industries. Along with good and safe practices, food also played an important play in order to boost their immunity and perform exercises so that the food handlers have a healthy and active lifestyle pattern.

By conclusion, nearly 50 to 80 percent of the selected food handlers were knowledgeable and needed to have information with proper clarification and justification. In the present study, well framed training programme was executed to update the knowledge for effective implementation of safe handling practices.

4.5 Microbial Assays of the selected food products.

Microbiological examination of food varieties is valuable for observing defilement and evaluating patterns to distinguish arising hazards. The recognition of microorganisms in food varieties depends on quantitative or enumerative techniques, just as subjective strategies, otherwise called presence/nonattendance tests, in microbiological examines of foods.

To stay away from the danger of food borne illness, proper washing in chlorinated water using proper cleansing agents and sanitizers, and regular and active hand-washing practices needed to be followed before, during, and after processing steps involved in product life cycle management.

In this present study, thirty pre and post swab tests were carried from the hands of food hands (27 pairs) and surface areas. Best cleansing agents were selected randomly for washing and were seven different wash solutions. Shelf life study was executed for three processed food products of Jam, ketchup and pickle on 1^{st}, 7^{th}, 14^{th} and 30^{th} days of the study period of the products.

4.5.1 Pre and Post Swabs test

Pre swab test was done as a surprise check to find out that the selected food handlers had washed their hands properly before starting their work. Hands swabs were collected from food handlers (n=27) who had included in the present study and answered the questionnaire properly. Pre Swab Test was done only for 27 workers who were permitted by the administrator and three random surfaces of the processing unit. Post Swab test was done after pouring and rubbing their hands, surfaces with 70% alcohol based sanitizer. A total of 30 Pre and 30 Post Swab samples were collected from the food handlers, equipments and machineries and considered in the working area for the swab tests.

Table X depicts the total bacterial counts present on the hands of food controllers and surfaces of the foundation as swabs are a viable apparatus in the discovery of microbial contamination. .

Table X

Pre and Post Swab tests

Swabs	Pre TBC	Post TBC	Swabs	Pre TBC	Post TBC
Swab -1	25×10^1 cfu	6×10^1 cfu	Swab -16	71×10^1 cfu	15×10^1 cfu
Swab -2	60×10^1 cfu	15×10^1 cfu	Swab -17	53×10^1 cfu	11×10^1 cfu
Swab -3	31×10^1 cfu	8×10^1 cfu	Swab -18	66×10^1 cfu	10×10^1 cfu
Swab -4	70×10^1 cfu	18×10^1 cfu	Swab -19	61×10^1 cfu	12×10^1 cfu
Swab -5	46×10^1 cfu	10×10^1 cfu	Swab -20	40×10^1 cfu	6×10^1 cfu
Swab -6	53×10^1 cfu	11×10^1 cfu	Swab-21	51×10^1 cfu	10×10^1 cfu
Swab -7	37×10^1 cfu	9×10^1 cfu	Swab-22	47×10^1 cfu	8×10^1 cfu
Swab -8	42×10^1 cfu	8×10^1 cfu	Swab-23	35×10^1 cfu	6×10^1 cfu
Swab -9	67×10^1 cfu	12×10^1 cfu	Swab-24	46×10^1 cfu	9×10^1 cfu
Swab -10	50×10^1 cfu	10×10^1 cfu	Swab-25	32×10^1 cfu	7×10^1 cfu
Swab -11	41×10^1 cfu	7×10^1 cfu	Swab-26	51×10^1 cfu	10×10^1 cfu
Swab -12	46×10^1 cfu	6×10^1 cfu	Swab-27	43×10^1 cfu	9×10^1 cfu
Swab -13	68×10^1 cfu	13×10^1 cfu	Swab-28	58×10^1 cfu	12×10^1 cfu
Swab -14	59×10^1 cfu	15×10^1 cfu	Swab-29	52×10^1 cfu	11×10^1 cfu
Swab -15	51×10^1 cfu	12×10^1 cfu	Swab-30	55×10^1 cfu	10×10^1 cfu

Table XI

Change in Swab Test

Test	Pre Swab		Post Swab	
TBC	**Mean :** 502.33	**SD : ±**118.03	**Mean :** 102	**SD:** ±29.59

t=18.0198 df =58 p< 0.0001

Table XI discussed about the total bacterial rely on the hands of food handlers and surfaces of their food Industries. The mean total bacterial count in the pre swab test was 502.3. This indicated that the food handlers were working in the processing unit with dirty hands having 500 bacterial colonies in their hands. Food handlers come in direct contact with the food, the transmission of infections from the hands enter the food products leading to food borne illness easily.

The mean total bacterial count found in the post swab test was 102.This showed that the bacterial colonies present on the hands of the food handlers reduced to 100 colonies as compared to the pre swab test .Proper washing of hands with cleansing solution and using alcohol based sanitizers played the major role in reducing the bacterial count The results indicated that the food handlers became aware about the importance of practicing good personal hygiene during the processing so as to ensure the safety and quality of its food products**. "**t" test was used to know the mean difference between the swab tests. The t value for total bacterial count was t=18.0198 with a p< 0.0001 which depicted that a significant change was seen in the results of pre and post swab tests. Lee.et al (2017) in his review close by cleanliness evaluation of the food concentrate on uncovered that 65% (*n* = 55) of the objective gathering of populace had a high-impact bacterial count surpassing the limit of ≥20 CFU/cm2.

4.5.2. Cleansing agents used for washing fruits and vegetables

Washing fruits and vegetables was the most successful way of decreasing the danger of food-borne illness.The procedures for proper washing and handling with natural commercial fruit and vegetable cleaners were investigated in this study to determine the effectiveness of the cleansing agents commonly used in industries to

to decide the complete bacterial burden on the outer layer of the tomato and chose three food products by using seven different washing solutions such as tap water, chlorine, turmeric, saline, vinegar, nim wash and veggie clean.

In the pre microbiological analysis of tomato, the total bacterial count before wash of the tomato was 80cfu/g. After using various types of cleaning solutions post microbiological analysis was carried out. In the post microbiological analysis, soaking time (15 minutes) and known volume of solution (100ml) were kept constant and variety of cleansing agents were used and the results were discussed in Table XII

Table XII

Total bacterial count present on the outer layer of a tomato

S. No.	Sample	Soaking Time	Amt. of Solvent	Volume of Solution	TBC Result
1.	Before wash	-	-	100ml	80cfu/g
2	Tap Water	15min	-	100ml	55cfu/g
3	Chlorine	15min	0.1ml in 100ml water	100ml	22cfu/g
4	Saline	15min	2gm in 100ml water	100ml	21cfu/g
5	Vinegar	15min	1:3 (Vinegar: water)	100ml	18cfu/g
6	Turmeric	15min	1gm in 100ml water	100ml	14cfu/g
7	Nim Wash	15min	2ml in 100ml water	100ml	14cfu/g
8.	Veggie Clean	15min	0.5ml in 100ml water	100ml	9cfu/g

Table XIII

Change in Microbiological Analysis

Product	Before Wash		After Wash	
Tomato	Mean: 80	SD: ±2.79	Mean: 21.85	SD: ±14.15

t = 11.4040 df = 14 two-tailed P value < 0.0001

Table XIII represents the various solutions were used to clean the surface of the fruits and vegetables to destroy microorganisms. Total bacterial count after wash using faucet water was 55cfu/g, chlorine 22cfu/g, saline 21cfu/g, vinegar 18cfu/g, turmeric 14cfu/g, nim wash which is a business wash was 14cfu/g and veggie clean was 9 cfu/g. The composition of nim wash was citrus fruit extract and neem leaves extract which helped to remove the germs. On the other hand, veggie clean is a chemical wash and composed of Sodium Chloride, Sodium Cocoyl Glutamate, Lauryl Glucoside, Potassium sorbate, EDTA, Citric acid which helped to remove the pesticides and germs. Thereby reducing the total bacterial count from 80cfu/g before wash and to 9 cfu/g after wash with variety of cleaning agents. **"**t" test was used to evaluate the mean difference between the pre and post microbiological analysis of tomato "t" value for total bacterial count was t=11.4040 with a p< 0.0001 which depicted that a significant change was seen in the results of pre and post microbiological analysis. The results also encouraged the food handlers working in these processed fruits and vegetables to practice safe and good handling practices in regard to washing and cleaning the fruits and vegetables properly before processing to evade the contaminants present on the fruits and vegetables and preventing the entry of microorganisms in processed food products.

4.5.3 Shelf life of selected fruits and vegetables processed products

Buvé et.al (2018) declared that an item's time span of usability can be characterized as the limited measure of time that a food item stays safe, meets the particulars on the mark, and has a specific level of value when put away under predefined conditions as determined by food industries.

A shelf life study was conducted for jams, ketchup and pickles on 1st, 7th, 14th and 30th days which was collected from the selected 10 industries. These products were specially chosen because it had a stable shelf like as compared to perishable food products like ice creams and fruit cakes which gets spoiled within few hours if kept in ambient temperatures.

Shelf life study of Jam was discussed on the 1st, 7th, 14th and 30days in the following Table XIV

Table XIV

Shelf life study of Jam

S.no.	Parameters	1st	7th	14th	30th
1.	pH	3.5	3.2	2.8	2.5
2.	Acidity	0.36%	0.38%	0.42%	0.41%
3.	Moisture	21.4%	21.5%	22.0%	21.8%
4.	Total Bacterial Count	Nil	Nil	Nil	25cfu/g
5.	Total Fungal Count	5cfu/g	11cfu/g	13cfu/g	15cfu/g

Jam refers to an item made of entire organic product cut into pieces or squashed, then, at that point, warmed with water and sugar until it comes to "jellying" or "setting" point, which is accomplished through the activity of normal or added pectin.t is then fixed in holders and dispersed to the entire deal and retail markets. Table XV clearly showed that the appearance of jam remained good throughout the study of shelf life and was accepted for human consumption and slight fluctuations were noted in the pH (3.5-2.5), acidity (0.36-0.41percent) and moisture content (21.4 to 21.8 percent) after the product was kept in ambient temperature for one month. During the study period, it was noted that the jam turned to slightly acidic in taste, due course of time. Nearly twenty two percent of moisture content was found after one month study. Moisture is one of the factors which makes the food spoil quickly and its serves a platform for bacterial multiplication. The growth of fungal moulds were also noted on

the first day itself and it reached its optimum growth of 15cfu/g after one month of study period. Thereby it was concluded that the jam produced by these industries got spoiled within one month period. The bacterial and fungal growth is schematically represented in the Plate No.1 and 2.

Plate No.1

Jam's Total Fungal Count

1st Day **7th Day** **14th Day** **30th Day**

Plate No.2

Jam's Total Bacterial Count

1st Day **7th Day** **14th Day** **30th Day**

Tomato ketchup is a sweet and tart topping made with tomatoes, sugar, vinegar, flavours. Onions, all zest, coriander, cloves, cumin, garlic, and mustard are normal flavours and celery, cinnamon, or ginger are at times added. Ketchup is usually utilized as a fixing on food varieties that are normally served hot and might be seared or oily, for example, French fries and different potatoes, cheeseburgers, franks, chicken fingers, potato children, hot sandwiches, meat pies, cooked eggs, and barbecued or singed meat. Ketchup is once in a while utilized as the establishment for, or as one of the fixings in, different sauces and dressings, and the character can be duplicated as an added substance seasoning for snacks. Time span of usability

investigation of ketchup was talked about on the first, seventh, fourteenth and 30days in the accompanying Table XV

Table XV

Shelf life study of Ketchup

S.no.	Parameter	1st	7th	14th	30th
1.	pH	5.0	5.0	3.8	3.3
2.	Acidity	1.05%	1.10%	1.12%	1.12%
3.	Moisture	64.3%	64.3%	64.5%	64.6%
4.	Total Bacterial Count	Nil	Nil	Nil	18cfu/g
5.	Total Fungal Count	4cfu/g	9cfu/g	8cfu/g	12cfu/g

According to Thakur et.al 2018, the natural and regular ketchups were tried for microbiological decay and wellbeing boundaries like clockwork. To include the microorganisms present in each example, 10-overlap sequential weakening were utilized, and provinces were depended on supplement agar media following 24 hours of brooding at 37℃ at 20-day stretches. The time span of usability of the natural sauce was found to be more noteworthy than 20 days when contrasted with the control sample.

Table XV clearly showed that the appearance of ketchup remained good throughout the shelf life study and was accepted for human consumption. It was noted that pH of ketchup came down from 5 to 3. As the days prolonged the ketchup became more acidic (1.12 percent). Nearly sixty five percent of moisture content was observed after the product was kept in ambient temperature for one month. During the study period, it was noted that the fungal growth was also multiplying from 4 colonies to 12 colonies by the end of four weeks. Moisture is one of the factors which makes the food spoil quickly and its serves a platform for bacterial multiplication. Thereby it was concluded that the ketchup produced by these industries got spoiled within one

month period and was not fit for human consumption. The bacterial and fungal growth is schematically represented in Plate No.3 and 4

Plate No.3

Ketchup's Total Fungal Count

1st Day **7th Day** **14th Day** **30th Day**

Plate No.4

Ketchup's Total Bacterial Count

1st Day **7th Day** **14th Day** **30th Day**

Pickles are items produced using perfect, solid fixings that could conceivably have been matured and relieved in a salt saline solution. The item is ready and saved through normal or controlled maturation, or by adding vinegar and flavours to broaden their rack life.

Shelf life study of Pickle was executed on the 1st, 7th, 14th and 30 days and presents in the following Table XVI

Table XVI

Shelf life study of Pickle

S.no.	Parameters	1st	7th	14th	30th
1.	pH	3.0	3.0	2.5	2.2
2.	Acidity	1.68%	1.70%	1.75%	1.74%
3.	Moisture	75.01%	75%	76.2%	76.3%
4.	Total Bacterial Count	85×10^1 cfu/g	92×10^1 cfu/g	10×10^2 cfu/g	11×10^2 cfu/g
5.	Total Fungal Count	9cfu/g	20cfu/g	38cfu/g	50cfu/g

A perception made by Anandh and Sobana, (2021) was that decrease of pH 4.6 in cured item is expected to forestall the development of microorganisms and make the cured item rack stable at room temperature. As it is verifiable truth that corrosive and hotness treatment are the central point for expanding the wellbeing against miniature creatures of salted items .This might be because of the hotness treatment and acidic corrosive utilized for pickling which hinders the microbial development. Acidic nature, low pH, low dampness, salt and flavours in the pickle had the option to keep the microbial level very low.

Table XVI highlighted the major parameters which were responsible for the deterioration of the processed product. Pickle showed good appearance of all four different points of days like the other two products namely jam and ketchup. It was noted that there was a reduction in the pH level from 3 to 2.2 and the pickle became acidic in table XVII Nearly seventy six percent of moisture content was noted as the product was kept in ambient temperature for one month. During the study period, it was noted that the fungal growth and bacterial growth was multiplying rapidly within a span of one month. Around 1100 bacterial counts were formed as compared to 12 colonies and 15 colonies found in ketchup and jam respectively. Moisture is one of the factors which makes the food spoil quickly and its serves a platform for bacterial multiplication. Thereby it was concluded that the pickles produced by these industries

got spoiled since day one with a least count of 850 colonies which rapidly increased to 1100 colonies within one month period and was not fit for human consumption as it may lead to food borne illness. The bacterial and fungal growth is schematically represented in Plate No.5 and 6

Plate No.5

Pickles' s Total Fungal Count

1st Day **7th Day** **14th Day** **30th Day**

Plate No.6

Pickles' s Total Bacterial Count

1st Day **7th Day** **14th Day** **30th Day**

Table XVII

Change in Total Bacterial Count

Product	1st Day	7th Day	14th Day	30th Day
Jam	Nil	Nil	Nil	25cfu/g
Pickle	85×10^1 cfu/g	92×10^1 cfu/g	10×10^2 cfu/g	11×10^2 cfu/g
Sauce	Nil	Nil	Nil	18cfu/g
Mean	**283.33**	**306.66**	**333.33**	**381**
SD	**±400.69**	**±433.69**	**±471.40**	**±508.41**

The above table depicted the increment in the total bacterial count over the time span of usability time of 30 days.Initially it was found to be “nil” for jam and sauce whereas it was around 85×10^1 cfu/g for pickle. After 30 days, total bacterial count was 25cfu/g and 18cfu/g for jam and sauce respectively whereas the total bacterial count doubled within one month. This showed that the label of the products which denoted that the products will last long for six months whereas it actually got spoiled within 30days in ambient temperature. Even though the appearance was good for all the three products even after one month.

Table XXVIII

Change in Total Fungal Count

Product	1st Day	7th Day	14th Day	30th Day
Jam	5cfu/g	11cfu/g	13cfu/g	15cfu/g
Pickle	9cfu/g	20cfu/g	38cfu/g	50cfu/g
Sauce	4cfu/g	9cfu/g	8cfu/g	12cfu/g
Mean	**6**	**13.33**	**19.66**	**25.6**
SD	**±2.16**	**±4.78**	**±13.12**	**±17.24**

The above table depicted the gradual increase in the total fungal count over the period of one month. Initially, it was 5cfu/g for jam, 4cfu/g for ketchup and 9 cfu/g for pickle. After one month the total fungal count was of jam and ketchup 15cfu/g and12cfu/g respectively whereas the total fungal count was increased and it was 50cfu/g over a shelf life period of 30 days. This showed that the label of the products which denoted that the products will last long for six months. Actually these products got spoiled within one month in ambient temperature, whereas the appearance was good for all the products even after one month of shelf life study period.

4.6 Effect of food safety training intervention on safe handling practices using KAP survey.

According to World Wellbeing Get together Goal passed in 2000, food handling has turned into a worldwide concern. Food overseers' information and practices on food handling and safe taking care of practices assume a significant part in devouring quality food in clean conditions in the proper amount and are viewed as the most ideal way of keeping up with wellbeing. One of the significant reasons for food cross defilement is ill-advised dealing with rehearses brought about by an absence of information and helpless execution of FSSAI rules and guidelines. However the food business is developing, preparing for appropriate food dealing with rehearses is inadequate with regards to, which adds to the public's view of food-borne illnesses. In light of this, the specialists zeroed in their exploration on fostering a sanitation and safe taking care of works on preparing program for chosen food overseers in chose food businesses, fully intent on giving the fundamental functional data to follow great food handling and conservation rehearses for the creation of safe food sources in the area. Notwithstanding these progressions, information, as usual, is the way to creating protected and healthy food sources, and it is through the use of information that the food ventures should fulfil clients while likewise agreeing with food handling and standard law.

4.6.1 Forms of fruits and vegetables used in the selected food

In the preparation of fruits and vegetables based food products, different forms were handled by the selected food handlers in the selected industries are given in Table XIX

Table XIX

Forms of fruits and vegetables products handled by food handlers.

Forms used	No. of Industries(N=200)	%
Canned Fruits	40	20.0
Brine	60	30.0
Fresh Form	21	10.5
Preserved the pulp	79	39.5

In the selected fruits and vegetables based industries, 20 percent of the food handlers handled the fruits in canned forms, 30 percent handled the products which were preserved using brine solution, nearly 10 percent handled fresh forms of fruits and vegetables for their products preparation and rest of them (40percent) extracted pulp from the fruits and preserved for further product development. Variety of ice creams were formulated by incorporating various types of fruits pulps. Fruit pulp incorporated ice cream are very popular in Kerala State and adored to have variety of ice creams by irrespective of all age groups.

Food handlers involved in food industries are target subjects for the present study. It focuses on knowledge identified with sanitation, cleanliness and safe taking care of practices among the selected subjects in vegetables and fruits industries in the study area of Kerala state. A total of 200 food handlers were formally selected for the 180 days training programme at their convenient time and within their premises. Initially their knowledge related to these aspects was recorded using the speciality designed questionnaires based on the objectives of the study.

4.6.2 Responses of food handlers related to Knowledge, attitude and practices related to Food Safety

Adoption and evaluation of good practises by food handlers in the fruit and vegetable industries are critical to reduce food borne diseases, cross contamination, and producing high-quality and high-quantity food products. KAP surveys are useful for identifying knowledge gaps, beliefs, and behavioural patterns that aid in understanding for effective execution and problem solving. The Pearson correlation test (r) was used to evaluate the correlation between KAP scores, taking into account the strength of the correlations and the respective probability of error ($p<5$ percent). Table XXI revealed the responses on information identified with sanitation of the chose food handlers.

Table XX

Response of food handlers on knowledge related to food safety

Knowledge Attributes	Before Training (N=200)				After Training (N=200)			
	Yes	%	No	%	Yes	%	No	%
Food poisoning is due to pathogenic microbes	72	36	128	64	114	57	86	43
Consumption of raw or improper cooking / processing food products is not good for health	94	47	106	53	134	67	66	33
Poor washing or unwashing of vegetables and fruits are high risk for food for food poisoning	78	39	122	61	98	49	102	51
Unhygienic practices of food handlers is the main cause for food contamination and food poisoning	84	42	116	58	134	67	66	33
Uncovered / poor quality food items / poor or incorrect temperature for long time leads to have food contamination , spoilage and poisoning	76	38	124	62	96	48	104	52
Essential to have proper refrigerator temperature	128	64	72	36	164	82	36	18
Contact of ready to eat perishable vegetables and fruits with unhygienic / bare hands is not good for health	74	37	126	63	128	64	72	36

Correct method of thawing frozen products help to maintain the quality of products	92	46	108	54	134	67	66	33
Food poisoning is the main cause for severe diseases	124	62	76	38	166	83	34	17
Healthy food handlers play an important role in maintaining food quality	118	59	82	41	168	84	32	16

Table No. XX discussed about the reactions of the food overseers in regards as far as anyone is concerned identified with food safety. It was noted that prior to the training, 36 percent food handlers had knew that food poisoning was cause due to the presence of microorganisms present in the foods. After the training intervention, there was an increase in the knowledge level of fifty seven percent regarding the microbes which were responsible for the spoilage of food. Around 47 percent of the food handlers strongly believed that consumption of uncooked, raw foods and improper techniques employed during processing was harmful for the human health and after undergoing the training it rose till 67 percent. An awareness was created among fifty percent of the food handlers after the intervention programme that poor washing of fruits and vegetables are major risk factors for food poisoning. It was clearly seen in forty eight percent food handlers that they had become more cautious regarding the quality of food as well as the temperatures at which they are stored. Eighty Two percent of the food handlers responded that the perishable food items should be mandatory kept at low temperatures in the refrigerators so as to ensure the shelf life of these perishable food products. The training brought about a change in their safe handling practices and it was observed that around 64 percent of the food handlers strongly agreed that unhygienic and dirty hands can lead to food borne illness thus active hand washing for 20 seconds was implemented before touching fruits and vegetables with bare hands. A significant change was observed among the food handlers who underwent the training as 84 percent strongly responded that healthy food handlers play an important role in maintaining food quality. Table XXI

points out the statistical analysis of knowledge of the food overseers identified with food safety.

Table XXI

Statistical Analysis of knowledge related to Food Safety

Knowledge	Mean	SD	"t" value	df	P value
Before	47.0	±10.24	t = 3.874	18	P=0.0011
After	66.8	±12.50			

The data obtained was statistically analysis and the initial mean was found to be 47.0 with a SD of ±10.24.whereas after the training the final mean score was 66.8 with a SD of ±12.50. The "t" value was t = 3.874 with a p value equals 0.0011.which depicted that the a statistically significant difference was seen before and after training as the food handlers had enhanced their knowledge levels regarding food safety.

Table XXII

Response of food handlers to attitude related to food safety

Attitude Attribute	Before Training				After Training			
	Yes	%	No	%	Yes	%	No	%
Safe food handling practices are important responsibility of food handlers in the industry	78	39	122	61	148	74	52	26
Learning about food safety through training course updated my knowledge	88	44	112	56	132	66	68	34
Proper checking and maintaining the temperature of storage structure (fridge / freezer) prevent food spoilage /	112	56	88	44	166	83	34	17

poisoning / contamination								
Advised to store raw and processed food products separately	94	47	106	53	138	69	62	31
Food handlers are also source of food borne diseases and need to wash their hands before handling	78	39	122	61	148	74	52	26
Thorough washing and cleaning of fruits and vegetables are safe for human consumption	84	42	116	58	132	66	68	34
Thorough washing and cleaning of fruits in clean water with good cleaning agent help to maintain the quality and quantity of products	88	44	112	56	146	73	54	27
Beards, long finger nails, ornaments could spoil and contaminate food products with food borne microbes	150	75	50	25	164	82	36	18
Raw vegetables and natural products ought not be cut by a similar cutting ,sheets , choppers and knifes	56	28	144	72	84	42	16	8
Periodic medical check-up is essential for food handlers	124	62	76	38	178	89	22	11

Table XXII discusses about the responses of the food handlers regarding their attitude towards food safety. It was noted that the training enormously affected the food handlers as 74 percent of them felt that safe food handling was their sole responsibility and priority to safeguard the health of the consumers. Sixty six person responded that this training was a refresher course as they had an opportunity to enhance as well as upgrade and polish their knowledge as learning relearning and unlearning a continuous process. After gaining knowledge on the proper storage conditions eighty three percent of the food handlers practiced and followed strict storage condition principles in the deep freezers and refrigerators. As the concept of cross contamination was discussed with the food handlers sixty nine percent of the food handlers practised keeping the raw and uncooked food away from the processed food products. The training also improved their hand hygiene practices as seventy four percent of the handlers regularly washed their hands as working with unclean hands can be a source of food borne diseases. It was interesting to know that seventy three percent of the food handlers emphasized in washing and cleaning of fruits and vegetables with good cleaning agents which would eradicate all the harmful microorganisms and thus it will help in maintaining the quality and quantity of the food products. As the knowledge of the food handlers had increased it also played an important role in maintaining good personal regimen in eighty two percent of food handlers. The knowledge of cross contamination from surface to surface brought a significant change as 42 percent of the food handlers used separate chopping and cutting boards for fruits and vegetables. As food safety became the first priority for every food handler it was seen that around eight nine percent of them had periodic medical check -up in order to their promote goodness and wellbeing and become healthy and diseases free.

Table XXIII

Statistical Analysis of attitude related to Food Safety

Attitude	Mean	SD	"t" value	df	P value
Before	45.4	±11.91			
After	72.4	±13.18	t = 4.806	18	P =0.0001

The data obtained was statistically analysed (Table XXIII) and the initial mean score of attitude was found to be 45.4 with a SD of ±11.91.whereas after the training the final mean score was 72.4 with a SD of ±13.18 The “t” value was 4.804 with “p” equals 0.0001.which depicted that the a statistically significant difference was seen after the selected food handlers underwent the training which brought a change in their work attitude towards food safety.

Response of food handlers to practice related to food safety

Many advancements have been made lately with the improvement of new food fabricating processes and new kinds of food items. Shoppers would now be able to choose from an assortment of plant handled food sources and ingredients.

Table XXIV

Response of food handlers to practice related to food safety

Practices Adopted	Before Training				After Training			
	Yes	%	No	%	Yes	%	No	%
Wear gloves while handling food products	124	62	76	38	158	79	42	21
Wash hands with clean water and good quality cleaning agents	134	67	66	33	168	84	32	16
Wash hands after using rest room	118	59	82	41	134	67	66	33
Not advisable to work when you have diarrhoea , lesions, boils , burn etc.	126	63	74	37	148	74	52	26
Not allowed to work with long nails , untied hair	144	72	56	28	168	84	32	16
Processed fruits and vegetables using correct temperature	132	66	68	34	162	81	38	19
Wash the vegetables and	144	72	56	28	192	96	8	4

fruits thoroughly before processing								
Proper containers and package materials are used for distribution	138	69	62	31	156	78	44	22
Suitable soaps solutions were used to wash fruits and vegetables.	76	38	124	62	128	64	72	36
Periodic medical check-up is essential for food handlers	124	62	76	38	178	89	22	11

Table XXIV discusses about the responses of the food handlers regarding their practices in regard to food safety. It was noted that the training incredibly affected the food overseers as it was seen that around 79 percent of the food handlers used gloves while handling food products. Around 84 percent of the food handlers practiced to use good quality cleaning agents while washing their hands every time they come in contact with dirty surfaces. Seventy four percent of the food handlers were not allowed to work near the processing area if the food handler was suffering from any skin infection and gastro intestinal problems as the infection may get transmitted and it may contaminate the food. Personal hygiene became a part and parcel of their lives. Eighty four percent of the food handlers responded that they were not allowed inside the processing units if their hands were untied. They had to wear a head gear or a cap to prevent the hair from falling into the food while processing. The nails were supposed to be always cleaned and trimmed to eradicate the germs. 96 percent of the food handlers adopted good and safe handling practices in regard to washing the fruits and vegetables before processing. Nearly 78 percent of the selected food handlers used appropriate containers and packaging materials to store the food contents. The selection packaging materials depend up to the food product, quantity, shelf life, transportation and distribution in order to prevent spillage and wastage of food commodities.

Table XXV

Statistical Analysis of practices related to Food Safety

Practices	Mean	SD	"t" value	df	P value
Before	63.0	±9.30	t = 4.027		
After	79.6	±9.13		18	p=0.0008

The data obtained was statistically analysed (Table XXV) and the initial mean score of practices was found to be 63.0 with a SD of ±9.30 whereas after the training the final mean score was 79.6 with a SD of ±9.13. The "t" value 4.027 with "p" value equals 0.0008.which depicted that the a statistically significant difference was seen after the selected food handlers had adopted safe handling practices which should be totally continued in all the handling unit to guarantee the security, quality and amount of handled food sources and forestall wastage because of tainting and deterioration because of unfortunate acts of the food handlers.

4.6.3 Hazard Analysis Critical Control Point

According to data obtained from the studies of Beyza and Nurdan (2018), HACCP is a food safety approach, helps to prevent the hazards occur before usage. Specially designed questionnaire was developed to assess the responses of knowledge, attitude and practices of food handlers in all aspects of products processing in the selected fruits and vegetables industries. Training has been found to be important for effective quality and quantity food productions Table XXVI shows the responses of food handler's knowledge on HACCP.

Table XXVI

Response of food handlers to knowledge related on HACCP

Knowledge Attributes	Before Training				After Training			
	Yes	%	No	%	Yes	%	No	%
HACCP is a powerful framework for all food industries.	56	28	144	72	78	39	122	61
HACCP is a food handling								

law explicit to our county	64	32	136	68	96	48	104	52
HACCP is needed qualified staff for training in food safety and hygiene	68	34	132	66	112	56	88	44
Physical, chemical and microbiological hazards are included in HACCP.	62	31	138	69	98	49	102	51
It is vital for monitor and to record each progression of food creation in HACCP System.	64	32	136	68	108	54	92	46
HACCP Plans are prepared each process or products	72	36	128	64	124	62	76	38
HACCP identify possible hazards and control / eliminate the hazards	66	33	134	67	104	52	96	48
Proper training programmes ensures hygienic environment	84	42	116	58	124	62	76	38
Good manufacturing processes minimize the risk of food contamination	74	37	126	63	114	57	86	43
Food safety management system certification programs are on the basis of HACCP.	54	27	146	73	102	51	98	49

Table XXVI discusses about the responses of the food handlers regarding their knowledge on HACCP. It was noted that prior to the training only 28 percent of the selected food handlers knew the importance of HACCP in food industries. 56 percent of the food handlers agreed that qualified staff who are trained in HACCP is required in the food industry in order to identity any hazards which may occur at any stage of

processing. Forty nine percent of the food handlers learnt about the various types of hazards which could hamper the safety and quality of the products, like physical hazards such as wood, glass, stones, hair, chemical hazards like pesticides, cleaning agents, metal contaminants and microbiological hazards like bacteria, algae and fungi which lead to spoilage and harmful health effects if consumed. Fifty two percent of the food handlers responded that all the steps involved should be recorded and monitored carefully to identity and control the hazards from occurring again. It was noted by 62 percent of food handlers that regular training is very necessary to upgrade and it helps to maintain safety and ensuring cleanliness in and around the processing unit. The training created an awareness regarding the good manufacturing practices which decrease the risk of contamination and enhancing the quality of food products. Fifty one percent of the food handlers responded that their industries received the HACCP certification as they were following the correct principles as well as evaluating and monitoring the possible hazards which might take place in the food industry while processing.

Table XXVII

Statistical Analysis of knowledge related to HACCP

Knowledge	Mean	SD	"t" value	df	P value
Before	33.2	±4.16	t = 8.069	18	P <0.0001
After	53.0	±6.55			

The data obtained was statistically analysed (Table XXVII) and the initial mean was found to be 33.2 with a SD of ±4.16.whereas after the training the final mean score was 53.0 with a SD of ±6.55 The "t" value was 8.069 with a p value less than 0.0001.which depicted that the a statistically significant difference was seen in the food handlers after attending the HACCP training programme as the food handlers had enhanced their knowledge levels and implemented their expertise while processing. Responses of food handlers to attitude on HACCP is discussed in the Table XXVIII

Table XXVIII

Responses of food handlers to attitude related on HACCP

Attitude Attributes	Before Training				After Training			
	Yes	%	No	%	Yes	%	No	%
Physical , chemical and biological hazards contaminate the food products	98	49	102	51	164	82	36	18
It is essential to have expertise in evaluation of the hazards	82	41	118	59	132	66	68	34
Hazards identification is assessed and evaluation of the hazards help to find out the critical control point	44	22	156	78	86	43	114	57
Uses of specific temperature , pH, time and major procedure identify the preventive measures	78	39	122	61	132	66	68	34
Regulatory measures / limits meet this control point	58	29	142	71	98	49	102	51
Continuous monitoring of the control point is essential to maintain this standard of the products	72	36	128	64	124	62	76	38
The evaluation process determines the cause of the problems and eliminates the causes	68	34	132	66	124	62	76	38
Records are expected to show as far as possible	72	36	128	64	114	57	86	43

and the framework is in control								
HACCP Plan must be validated properly	86	43	114	57	126	63	64	37
Maintenance of records are needed to measure and monitor the equipments in control	76	38	124	62	134	67	66	33

Table XXVIII discusses about the responses of the food handlers regarding their attitude on HACCP. It was seen that around 82 percent agreed that physical, chemical and biological hazards contaminate the food and it can cause deleterious effects on the health of the consumers. Sixty six percent of the food handlers responded that to identify any hazards skills and expertise is required so every food handler should undergone at least the basic level HACCP training so that the hazards can be identified and be eliminated before it can spoil the end product. The food handlers if they strictly follow the correct time, pH and temperature they can prevent the growth of microbiological hazards in food. Sixty two percent of the selected food handlers expressed that observation and monitoring of possible hazards can be properly identified through continuous inspection and adopting preventive strategies. Nearly 57 percent of the food handlers responded that acceptable limits should be set in for pH, time and temperature to identity the causative agents which become hazardous in due course of time. Sixty seven percent of the food handlers strongly believed that proper documentation and record keeping should be maintained for the smooth conduct of the processing. Record of time, temperature, equipments, hazards identity, preventive measures taken to control and eliminate the causative agents leading to contamination of physical, chemical and biological hazards which can be eradicate by properly monitoring and identification by food handlers who are trained in this field thus giving as assurance that the food products are manufactured and processed in a safe and good sanitary conditions

Table XXIX

Statistical Analysis of attitude related on HACCP

Attitude	Mean	SD	"t" value	df	P value
Before	36.7	±7.07	t = 6.429	18	P <0.0001
After	61.7	±10.06			

The data obtained was statistically analysed (Table XXIX) and the initial mean score of attitude was found to be 36.7 with a SD of ±7.07.whereas after the training the final mean score was 61.7 with a SD of ±10.06 The "t" value was 6.429 with p value less than 0.0001.which depicted that the a statistically significant difference was seen after the selected food handlers underwent the training which brought a change in their work attitude towards HACCP. Table XXX highlights the response of the selected food handlers to practice related to HACCP.

Table XXX

Response of food handlers to practice related on HACCP

Practices Adopted	Before Training				After Training			
	Yes	%	No	%	Yes	%	No	%
HACCP team members are involved conduct a hazard analysis for each step to identity threats to human health	64	32	136	68	124	62	76	38
Analysis for each step to identify the threats to human health may be introduced into the produced products	64	32	136	68	124	62	76	38
Biological hazards are living organisms that can make food unsafe for	58	29	142	71	98	49	102	51

human consumption								
Harmful chemicals are associated with chronic and acute health issues	72	36	128	64	102	51	98	49
Physical hazards are physical components of a food that cause illness to the human consumption of foods	84	42	116	58	124	62	76	38
Enable to present HACCP assessment in a clean and professional manner	92	46	108	54	126	63	74	37
Fully understand the purposes and importance of HACCP for effective execution of laws & regulatory activities	84	42	116	58	124	62	76	38
HACCP is the system used to identity ,present and control food safety hazards	92	46	108	54	114	57	86	43
Focusses attention of management on HACCP issues	86	43	114	57	148	71	58	29
HACCP helped to determine the problems and suggest the solution for prevention	76	38	124	62	124	62	76	38

Table XXX discusses about the responses of the food handlers regarding their practices on HACCP. Nearly sixty two percent of the food handlers responded that to identify any hazards the food handlers need to work as a team it is the responsibility and priority of each food handler to report any incidence of hazards at each step of processing in request to protect the quality and security of the handled foods. As the

food handlers attended the training their knowledge was enhanced any they became aware that microorganisms are the basic causative agents in contamination of food as responded by 49 percent of the selected food handlers. It was found that 51 percent of the food handlers knew that chemical hazards or metal toxicants present in food, if ingested in the body can leading to chronic food borne illness whereas 62 percent of food handlers responded that physical hazards are physical components of a food that cause illness to the human consumption of foods and the food handlers understood the importance of hazard analysis critical control point in the food industry.

Table XXXI

Statistical Analysis of practices related on HACCP

Practices	Mean	SD	"t" value	df	P value
Before	38.6	± 5.81	t = 8.140	18	P <0.0001
After	60.1	±6.00			

The data obtained was statistically analysed (Table XXXI) and the initial mean score of practices was found to be 38.6 with a SD of ±5.81whereas after the training the final mean score was 60.1 with a SD of ±6.00 The "t" value was 8.140 with p value less than 0.0001.which depicted that the a statistically significant difference was seen after the selected food handlers strictly followed the principles of HACCP in all the processing unit to ensure the safety, quality and quantity of processed foods and prevent wastage due to contamination and spoilage due to hazards present which may lead to deleterious health issues.

4.6.4 Responses of food handlers related to cross contamination of foods

Cross contamination of food is a common cause of food borne illness. During the food preparation and storage process, microorganisms (bacteria and viruses) from a variety of sources can contaminate foods. One important step toward eliminating food-borne illness is to prevent cross-contamination.

Table XXXII

Response of food handlers to knowledge related to cross contamination of foods

Knowledge Attributes	Before Training				After Training			
	Yes	%	No	%	Yes	%	No	%
Washing hands before handling fruits and vegetables will help to prevent food contamination	112	56	88	44	144	72	56	28
Germs and bacteria easily spread from ready to eat foods	124	62	76	38	164	82	36	18
Proper storage temperature and time help to prevent food contamination	96	48	104	52	136	68	64	32
Advised to use different cutting / chopping boards for different food items	112	56	88	44	144	72	56	28
Wash hands and work area regularly	116	58	84	42	124	67	66	33
Use different containers for different foods while handling foods	132	66	68	34	164	82	36	18
Clean water and cleaning agents are helpful to prevent food spoilage, contamination etc.	128	64	72	36	162	81	39	19
People , animals , raw foods with processed foods are main source of contamination	142	71	158	79	164	82	36	18

Hands , cloths , equipments food and hand contact surfaces are all vehicles and routes of contamination	78	39	122	61	144	72	56	28
Keep raw and cooked foods separate to prevent cross contamination	94	47	106	53	142	71	58	29

Table XXXII discusses about the responses of the food handlers regarding their knowledge about cross contamination of foods .Nearly seventy two percent of the food handlers had attained knowledge on proper hand washing before handling fruits and vegetables in order to eradicate the germs from getting in the food. Eight two percent of the selected food handled responded that germs and bacteria easily spread from raw to ready to eat foods because raw are very perishable in nature. Microorganisms can multiply rapidly and may spoil the food. According to 68 percent of food handlers. Storage conditions like proper time and temperature should be maintained to prevent cross contamination. Eight two percent of the food handlers gained knowledge regarding usage of different containers for different foods while handling various food commodities. It was pointed out by 81 percent of the food handlers used clean water and cleansing agents which are useful in preventing food borne illness and the major sources of transmission are raw foods, people, animals, hands cloths , equipment and all contact surfaces.

Table XXXIII

Statistical Analysis of knowledge related to cross contamination of foods

Knowledge	Mean	SD	"t" value	df	P value
Before	56.7	±9.26	t = 5.262	18	P <0.0001
After	74.9	±5.82			

The data obtained was statistically analysed (Table XXXIII) and the initial mean was found to be 56.7 with a SD of ±9.26whereas after the training the final mean score

was 74.9 with a SD of ±5.82. The “t” value was 5.262 with p value less than 0.0001.which depicted that the a statistically significant difference was seen before and after training as the food handlers had enhanced their knowledge levels regarding cross contamination.

Table XXXIV

Response of food handlers to attitude related to cross contamination of foods

Attitude Attributes	Before Training				After Training			
	Yes	%	No	%	Yes	%	No	%
Well cooked foods are free of contamination	84	42	116	58	142	71	58	29
Proper hand cleanliness can forestall food borne diseases.	124	62	76	38	148	74	52	26
After cleaning, products are closed or covered properly.	114	57	86	43	148	74	52	26
Cans , jars and containers of foods are also closed or covered	114	57	86	43	148	74	52	26
Raw and cooked food varieties ought to be put away independently to diminish the danger of food contamination	68	34	132	66	124	62	76	38
It is important to check the temperature of fridges and coolers occasionally to lessen the danger of contamination	74	37	126	63	138	69	62	31
Keep the fridge temperature below 5℃ and used a fridge thermometer to check the	68	34	132	66	118	59	82	41

temperature								
Avoid opening of fridge door frequently	96	48	104	52	162	81	38	19
Don't reheat the food products frequently	106	53	94	47	148	74	52	26
Food controllers have scraped spots or cuts on their hands ought not to touch food sources without gloves.	114	57	86	43	164	82	36	18

Table XXXIV discusses about the responses of the food handlers regarding their attitude towards preventing cross contamination of foods. Nearly seventy one percent of the food handlers pointed out well cooked foods are free of contamination only they are store properly away from raw, cooked foods at suitable time and temperature. Seventy four percent of the food handlers also understood the importance of maintaining proper hand hygiene in order to eradicate and prevent illness caused by cross contamination. Around 62 percent of the food handlers had responded that the raw foods should be kept separate and covered in different containers so that transmission of cross contamination could be hampered. Around 69 percent of the food handlers also pointed out that the storage conditions as well as deep freezers and refrigerators should be cleaned periodically to stop or eliminate cross contamination from its surfaces to food. Around 82 percent of the selected food handlers also said that they avoided opening the doors of the refrigerators as it will cause fluctuations in the temperatures and ultimately spoil the products and food handlers who had any kind of skin infections were also not allowed to touch any food items without wearing gloves.

Table XXXV

Statistical Analysis of attitude related to cross contamination of foods

Attitude	Mean	SD	"t" value	df	P value
Before	48.1	±10.06			
After	72.0	±6.89	t = 6.198	18	P <0.0001

The data obtained was statistically analysed (Table XXXV) and the initial mean score of attitude was found to be 48.1with a SD of ±10.06.whereas after the training the final mean score was 72.0 with a SD of ±6.89 The "t" value was 6.198 with p value less than 0.0001.which depicted that the a statistically significant difference was seen after the selected food handlers underwent the training which brought a change in their work attitude towards prevention of cross contamination in foods.

Table XXXVI points out the response of food handlers to practices related to cross contamination of foods.

Table XXXVI

Response of food handlers to practice related to cross contamination of foods

Practices Adopted	Before Training				After Training			
	Yes	%	No	%	Yes	%	No	%
Defrosted foods should not be refrozen	68	34	132	66	144	72	56	28
Wash worktops, knives, utensils properly	142	71	58	29	164	82	36	18
Used dish cloths should be washed periodically	144	72	56	28	168	84	32	16
Used separate chopping and cutting boards and properly sanitized to prevent cross contamination	104	52	96	48	142	71	58	27
Keep raw foods separately	98	49	102	51	146	73	54	27
Store raw food commodities on the bottom	124	62	76	28	156	78	44	22

shelf of refrigerators or freezer								
The wellbeing status of the labourers ought to be surveyed before employment	68	34	132	66	118	59	82	41
The most ideal ways of lessening the danger of pollution are not wearing finger rings and watch	96	48	104	52	162	81	38	19
Safe food handlings is a significant practice and part of my responsibility	106	53	94	47	148	74	52	26
Beards could defile food with food borne pathogens.	114	57	86	43	164	82	36	18

Table. XXXVI discusses about the responses of the food handlers regarding their practices in regard to cross contamination. Nearly 72 percent of the food handlers did not store the defrosted foods as the change in temperature and texture of the food from solid state to semi solid and then into liquid stages and vice versa change create favourable conditions for the growth of microorganisms. It was seen that 82 percent of the food handlers washed and sanitized work areas, knives, utensils , used dish cloth and the chopping boards properly to prevent all possibilities of cross contamination from these surfaces to the foods which are been processed. As the knowledge level of the food handlers had increased it was also reflected into their working style 78 percent of the food handlers used to sort and store raw and fresh food commodities in the bottom shelves away from cooked foods to ensure the safety of food products. Around 68 percent of the food handlers were medically examined for their employment to assess their health status and to know if they were physically and mentally fit for the job. Nearly 74 percent of the food handlers responded that the use of masks, gloves, caps as well as not wearing finger rings and watches can forestall the event of cross tainting in the food products. The knowledge and awareness create among the food handlers created a sense of responsibility among

84 percent of food handlers so good and safe handling practice along with personal hygiene became a crucial part in the prevention of cross contamination in foods.

Table XXXVII

Statistical Analysis of practices related to Cross Contamination

Practices	Mean	SD	"t" value	df	P value
Before	63.0	±9.30	t = 4.027	18	
After	79.6	±9.13			P =0.0008

The data obtained was statistically analysed (Table XXXVII) and the initial mean score of practices was found to be 63.0 with a SD of ±9.30whereas after the training the final mean score was 79.6 with a SD of ±9.13 The "t" value was 4.027 with p value equals 0.0008.which depicted that the a statistically significant difference was seen after the selected food handlers had adopted safe handling practices which should be completely continued in all the handling unit to guarantee the security, and keep cross tainting from food controllers and surface regions to the food which are been processed.

4.6.5 Responses of food handlers related to good handling practices.

Good handling practises (GHP) reduce contamination while maintaining food quality and quantity. Water quality, sanitation and hygiene of the work area, pest control, and cleaning and sterilising containers used for processing, packaging, and distribution are all examples of good handling practises. Producers and handlers of fruits and vegetables use (GAP) (Good agricultural practises) and GHP to reduce the risk of microbial food safety hazards. Table XXXVIII depicts the response of the selected food handlers to the knowledge related to Good handling practices.

Table XXXVIII

Response of food handlers to knowledge related to Good Handling Practices

Knowledge Attributes	Before Training				After Training			
	Yes	%	No	%	Yes	%	No	%
Poor quality of water is the potential source of contamination and vehicle of spreading contamination	126	63	74	37	156	78	44	22
Contact of water with fresh produce indicates the potential for pathogen contamination	104	52	96	48	128	64	72	36
Good handling practices control or minimise microbial contamination from processing water (good quality water)	88	44	112	56	116	58	84	42
Workers health and hygiene ensure to reduce contamination of fresh produce	76	38	124	62	112	56	88	44
Contaminated hands also transmit infectious diseases	104	52	96	48	148	74	52	26
Hand washing with warm water is more effective than cold water	68	34	132	66	108	54	92	46
Thorough scrubbing , rinsing and drying of the hands are the important aspects considered for GHP	96	48	104	52	136	68	64	32
Common or shared towels to be avoided for hand washing etc.	108	54	92	46	144	72	56	28

Hand washing stations need to be well equipped with basin, clean water, soap solution , hand drying devices , waste containers etc.	56	28	144	72	112	56	88	44
Proper toilet facilities and rest room need to be properly maintained	144	72	56	28	180	90	20	10

Table XXXVIII discusses about the responses of the food handlers regarding their knowledge about good handling practice .Seventy eight percent of the food handlers knew that poor quality of water or non- portable water had the potential source of transmitting microorganisms into the food. Regular waster testing are been checked for quality of water by BIS labs to detect the presence of microorganism and metal contaminants which can lead to food poisoning. Around fifty eight percent of the food handlers strictly followed good handling practices which helped to minimize or control of microbial contamination from water. The portal and non- portable water were marked with green colour and red colour so that good quality water could only be used for processing. It was also interesting to know that food handlers paid more attention their health and personal hygiene regime to ensure the safety of the consumable fresh produces. Fifty four percent of the food handlers used warm water to wash their as it was more effective as microorganisms are destroyed at high temperatures when water is boiled. Around 68 percent of food handlers thoroughly scrubbing, rinsing and drying of the hands were considered very important in good handling practices while working in the food industry, hence hand washing stations were installed at various places along with hand driers so that the food handlers avoid using the same towel. Ninety percent of the food industries maintained the toilets and rest room in an excellent manner equipped with proper facilities like soap, water, hand driers napkins, exhaust fans, proper ventilation and lighting and dustbins.

Table XXXIX

Statistical Analysis of knowledge related to good handling practices

Knowledge	Mean	SD	"t" value	df	P value
Before	48.5	±12.56	t = 3.494	18	P=0.0026
After	67.0	±11.07			

The data obtained was statistically analysed (Table XXXIX) and the initial mean was found to be 48.5 with a SD of ±12.56 whereas after the training the final mean score was 67.0 with a SD of ±11.07 The "t" value was 3.494 with p value equals 0.0026.which depicted that the a statistically significant difference was seen before and after training as the food handlers had enhanced their knowledge levels regarding safe and good handling practices.

Table XXXX

Response of food handlers to attitude related to good handling practices

Attitude Attributes	Before Training				After Training			
	Yes	%	No	%	Yes	%	No	%
All Shoppers reserve the option to anticipate safe , cleanly ready and great quality food	78	39	122	61	156	78	44	22
Handling of food produce expect care to forestall the hazards	86	43	114	57	138	69	62	31
Good cleanliness rehearses are the arrangement of prerequisites to forestall pollution of food	108	54	92	46	158	79	42	21
To give quality and safe food to the purchasers , great dealing with	106	53	94	47	164	82	36	18

rehearses are significant component								
Contamination of foods is the main cause for the occurrence of food borne illness	98	49	102	51	138	69	62	31
Good environmental hygiene and good hygiene practices to be followed in food industries	92	46	108	54	152	76	48	24
Proper and suitable transport are essential for proper distribution of food in good condition	104	52	96	48	164	82	36	18
Proper personal hygiene also consider for good handling practices	96	48	104	52	152	76	48	24
Safe food sources are also due to GHP	106	53	94	47	144	72	56	28
Cleansing , upkeep and individual cleanliness are the main components consider for GHP	126	63	74	37	162	81	38	19

Table XXXX discusses about the responses of the food handlers regarding their attitude towards good handling practices. Around 78 percent of food controllers reacted that all buyers reserve the privilege to expect safe, cleanly ready and great quality food. Nearly 69 of the food handlers responded that it requires good care while handling food in order to prevent hazards. Nearly 79 percent of the food handlers believed that good handling practices were a set of guidelines to prevent contamination in foods. Seventy six percent of the food handlers followed good handling practices which included keeping the work areas and its premises neat and clean. Transportation also had an important role in transporting safe, good quality

food products in good sanitary conditions. Eighty one percent of the selected food handlers focussed on cleaning, sanitation and maintenance along with personal hygiene of the food handlers played an important role in implementing good handling practices.

Table XXXXI

Statistical Analysis of attitude related to good handling practices

Attitude	Mean	SD	"t" value	df	P value
Before	50.0	±6.30	t = 10.61	18	P <0.0001
After	76.4	± 4.71			

The data obtained was statistically analysed (Table XXXXI) and the initial mean score of attitude was found to be 50.0 with a SD of ±6.30.whereas after the training the final mean score was 76.4 with a SD of ±4.71 The "t" value was 10.61 with p value less than 0.0001.which depicted that the a statistically significant difference was seen after the selected food handlers underwent the training which brought a change in their work attitude towards good handling practices. Table XXXXII depicts the response of food handlers to practice related to good handling practices.

Table XXXXII

Response of food handlers to practice related to good handling practices

Practices Adopted	Before Training				After Training			
	Yes	%	No	%	Yes	%	No	%
Training is one of the main part of GHP and methodically attended	104	52	96	48	152	76	48	24
Good training of food handlers is also promoted and motivated to involve in hygienic manner	92	46	108	54	144	72	56	28
Cleaning the machinery and equipments, utensils etc are also considered for GHP	76	38	124	62	142	72	56	28

Food products must be packed ,stored and transported on the basis of food safety regulation and standards	86	43	114	57	144	72	56	28
Processed foods and raw foods should be stored separately using suitable storage equipments	112	56	88	44	156	78	44	22
Hand Washing prior entry in the production unit	98	49	102	51	158	79	42	21
Safe water is used in preparation and also cleaning process	126	63	74	37	178	89	22	11
Maintenance of standards of food hygiene have a positive impact upon food handlers	106	53	94	47	144	72	56	28
Good dealing with rehearses are fundamental to guarantee the security and appropriateness of food at all phases of food chain	86	43	114	57	138	69	62	31
Good taking care of training for sanitation and cleanliness is critical to defend buyers wellbeing and notoriety of food business	98	49	102	51	158	79	42	21

Table XXXXII highlights about the responses of the food handlers regarding their practices in regard to good handling practices. Seventy six percent of food handlers

considered training as one of the most important aspect of good handling practices. Seventy two percent of the food handlers responded that they were motivated and also promoted and given incentives if they practice good handling practices while preparation, packaging, storage and transportation as it ensures the wellbeing and appropriateness of food at all phases of evolved way of life. 79% of the food controllers additionally referenced that great dealing with rehearses are critical to shield customer's wellbeing and notoriety of food business.

Table XXXXIII

Statistical Analysis of practices related to good handling practices

Practices	Mean	SD	"t" value	df	P value
Before	49.2	±6.86	t = 9.56	18	
After	75.8	±5.50			P <0.0001

The data obtained was statistically analysed (Table XXXXIII) and the initial mean score of practices was found to be 49.2 with a SD of ±6.86 whereas after the training the final mean score was 75.8 with a SD of ±5.50.The "t" value was 9.56 with p value less than 0.0001.which depicted that the a statistically significant difference was seen after the selected food handlers had adopted safe and good handling practices which protects thereby giving an assurance that the food products were prepare in a very safe and must be completely continued in all the handling unit to guarantee the security and nature of the food a hygienic environment making it palatable and fit for human consumption.

4.6.6 Responses of food handlers related to personal hygiene

Good personal hygiene aids in the prevention of food contamination, poisoning, and spoilage, as well as the preservation of food quality and quantity. Personal cleanliness additionally adds to great controllers who are sterile and practice safe food handling. Personal cleanliness is critical for by and large wellbeing support. Numerous microorganisms are normally conveyed by people, and sources incorporate hair, skin, mucous films, gastrointestinal system, wounds, contaminations, and attire. Individual cleanliness is fundamentally worried about the anticipation of infection and distress. Hand washing, dental consideration, abstaining from spitting, every day showering, and different practices, just as spotless living, all

assume a significant part. Garbage removal is additionally critical. All of these measures are preventative in nature and are easily implemented. Table XXXXIV reveals the response of food handlers to knowledge related to personal hygiene.

Table XXXXIV

Response of food handlers to knowledge related to personal hygiene

Knowledge Attributes	Before Training				After Training			
	Yes	%	No	%	Yes	%	No	%
Wash and dry your hands thoroughly and frequently during handling of foods	104	52	96	48	152	76	48	24
Smoking, chewing gums, spitting eating while food handling	72	36	128	64	108	54	92	46
Never coughing or sneezing over food or where the food preparation and storage is being carried out	92	46	108	54	136	68	64	32
Wear clean protective clothing like apron, gloves , masks etc.	136	68	64	32	176	88	24	12
Keep personal belongings like mobile phone, rings, watch etc. away from food preparation and storage units.	132	66	68	34	136	78	44	22
Tie hair, keep short nail without nail polish because it will chip into the food	76	38	124	62	116	58	84	42

Cover cuts, wounds, boils, burns etc. with proper waterproof bandages	124	62	76	38	164	82	36	18
Wear disposable hand gloves and dispose perfectly	104	52	96	48	156	78	44	28
Not advisable to handle foods while sick or feel ill health	92	46	108	54	144	72	56	28
Wash hands after going to toilet blowing nose , handling waste / garbage , smoking etc.	108	54	92	46	148	74	52	26

Table XXXXIV discusses about the responses of the food handlers regarding their knowledge about personal hygiene. It was observed that 76 percent of the food handlers washed and dried their hands thoroughly and frequently during handling foods as dirty hands becomes the cause factor in transmitting germs into the food. Fifty four percent of the food handlers responded that the selected food handlers were not allowed smoke, chew gums, spitting and eating while working in the food industry. Eighty eight percent of the food handlers were supposed to be in their aprons, masks and gloves in order to prevent cross contamination of foods. Seventy eight percent of food handlers get their valuables such as watches, rings, mobile phones, purses in the locker room as they were not allowed to carry these accessories in the processing area. Around 58 percent of the female food handlers had to tie their hands and were asked to trim their nail and keep it neat without nail paint as it may chip off while working in the processing unit. Eighty two percent of the food handlers were so cautious that they used water proof bandages to evade the infection caused by burns, boils and cuts. Nearly 74 percent of the food handlers frequently washed their hands after using the washrooms, blowing nose, disposing garbage etc. and if the person was sick he was not allowed near the processing area

because there was a risk if the transmitting the germs and infection if they sneeze and cough. Hence if was advisable to stay at home and re-join after recovery.

Table XXXXV

Statistical Analysis of knowledge related to personal hygiene

Knowledge	Mean	SD	"t" value	df	P value
Before	52.0	± 10.39	t=4.58	18	P =0.0002
After	72.8	± 9.88			

The data obtained was statistically analysed (Table XXXXV) and the initial mean was found to be 52.0 with a SD of ±10.39whereas after the training the final mean score was 72.8 with a SD of ±9.88 The "t" value was 4.58 with a p value equals 0.0002.which depicted that the a statistically significant difference was seen before and after training as the food handlers had enhanced their knowledge levels regarding maintaining good personal hygiene as food handlers come in direct contact with food.

Table XXXXVI

Response of food handlers to attitude related to personal hygiene

Attitude Attributes	Before Training				After Training			
	Yes	%	No	%	Yes	%	No	%
Food handlers can contaminate foods	112	56	88	44	156	78	44	22
Employers and employees must be ensured that they are healthy	76	38	124	62	136	68	64	32
Ill health and sick may be transmitted through foods	56	28	144	72	92	46	108	54

Provision of food protective measures like gloves, masks are good in work areas	108	54	92	46	156	78	44	22
Safe germ free and clean water is good for food processing	106	53	94	47	138	69	62	31
Closing the food substances when not in process	116	58	84	42	156	78	44	22
Aware of food borne infections like typhoid , diarrhoea	76	38	124	62	136	68	64	32
Pathogenic germs are also present in nail gaps	88	44	112	56	150	75	50	25
Individual vaccinations also helpful to maintain health	76	38	124	62	152	76	48	24
Periodic training for food handlers helped to update their knowledge	72	36	128	64	148	74	52	26

Table XXXXVI discusses about the responses of the food handlers regarding their attitude towards personal hygiene as 78 percent of the food handlers agreed that food handlers could contaminate food they did not maintain and follow good personal hygiene as they come in direct contact with food while processing. Sixty eight percent of the food handlers understood the importance of good health without any ailments in order to ensure safety and good shelf life of food handlers. Seventy eight percent of the food controllers utilized every one of the defensive frill like gloves, covers, head covers, shoe covers and covers so that cross contamination does not occur due to

sweat and germs on the body. An awareness was created among sixty eight percent of food handlers regarding food borne illness and use of safe portable water while processing. Regular health checks with vaccinations play a very important role in preventing various life threatening. Periodic training should be conducted for food handlers as it would help to update their knowledge regarding the importance of practicing personal hygiene.

Table XXXXVII

Statistical Analysis of attitude related to personal hygiene

Attitude	**Mean**	**SD**	**"t" value**	**df**	**P value**
Before	44.3	±9.73	t =6.31	18	P <0.0001
After	71.0	± 9.18			

The data obtained was statistically analysed (Table XXXXVII) and the initial mean score of attitude was found to be 44.3 with a SD of ±9.73 .whereas after the training the final mean score was 71.0 with a SD of ± 9.18. The "t" value was 6.31 with p value less than 0.0001.which depicted that the a statistically significant difference was seen after the selected food handlers underwent the training which brought a change in their work attitude towards following good personal hygiene practices as a healthy body creates a feeling of wellbeing of an individual.

Table XXXXVIII

Response of food handlers to practice related to personal hygiene

Practices Adopted	Before Training				After Training			
	Yes	%	No	%	Yes	%	No	%
Taking bath before entering into the processing units	56	28	144	72	102	51	98	49
Short nail, fingers and hands without any ornaments control food contamination spoilage etc.	66	33	134	67	128	64	72	36
Frequent cleaning of work spots , floors, work unit with disinfects	88	44	112	56	146	73	54	27
Systematic Arrangements of health check -ups is needed	68	34	132	66	114	57	86	43
Standard concentration of antiseptics, disinfectants and cleaning agents are not harmful	56	28	144	72	92	46	108	54
Visit of health inspectors and food safety officials to the processing unit facilities environmental , food and personal hygiene	86	43	114	57	124	62	76	38
Provision of risk management first aid are helpful to the food handlers	76	38	124	62	96	48	104	52
Proper training (for storage								

time and temperature and quality of foods to be stored) is needed to update their knowledge	134	67	66	33	124	62	76	38

Table XXXXVIII discusses about the responses of the food handlers regarding their practices in regard to personal hygiene. It was an integral part to have a bath every day before entering the processing unit as 51 percent of the food handlers practiced personal hygiene regime strictly in order to evade skin allergy and infections. Sixty four percent of the food handlers pointed that they had to remove finger rings and were required to trim the nails in order to prevent contamination and preventing physical hazards which may hamper the safety and quality of the foods processed. Seventy three percent of the food handlers laid importance on sanitation and maintenance in the food industries. According to 62 percent of the selected food handlers each processing unit should be inspected by well -trained health and food safety officers for the smooth functioning of the food industry. As a part of personal hygiene practices forty eight percent of food handlers were provided first aid treatment in order to protect and safeguard any emergencies occurring in the food industries. Proper training should be conducted for the food handlers to keep them upgraded with the latest information about food safety and personal hygiene practices.

Table XXXXIX

Statistical Analysis of practices related to personal hygiene

Practices	**Mean**	**SD**	**"t" value**	**df**	**P value**
Before	31.5	±11.87	t = 2.860	14	
After	46.3	±8.56			P=0.0126

The data obtained was statistically analysed (Table XXXXIX) and the initial mean score of practices was found to be 31.5 with a SD of ±11.87whereas after the training the final mean score was 46.3 with a SD of ±8.56.The "t" value t = 2.860 with p value

equals 0.0126.which depicted that the a statistically significant difference was seen after the selected food handlers had adopted good and healthy personal hygiene practices which had become a part and parcel of their lives. Personal cleanliness was totally continued in all the handling unit to guarantee the wellbeing and nature of the food ensures along these lines giving an affirmation that the food items were plan in an exceptionally protected and a decent sterile conditions.

4.6.7 Utilization of infrastructure facilities and safety at work place, practices of disposal of waste products

Bridging large gaps in food system infrastructure for good food industries requires a focus on creating a more conducive business environment. Table XXXXX points out the response of food handlers to knowledge related to infrastructural facilities

Table XXXXX

Response of food handlers to knowledge related on infrastructural facilities

Knowledge Attributes	Before Training				After Training			
	Yes	%	No	%	Yes	%	No	%
All handling and capacity regions should be kept clean and tidy	98	49	102	51	156	78	44	22
Floors are kept clear to permit access by food overseers and vehicles	86	43	114	57	142	71	58	29
Waste products and food products must be cleared from floor or work top quickly	94	47	106	53	126	63	74	37
Processed units , floors , walls and roofing need to								

have periodic washing and cleaning	76	38	124	62	98	49	102	51
In windows , doors , shelves , dirt accumulation needs to clean for preventing microbial growth and contamination	44	22	156	78	86	43	114	57
Proper drainage facilities are needed for avoiding accumulation needs to clean for preventing microbial growth and contamination of waste materials and food deposits	74	37	126	63	96	48	104	52
Food processing area /units and equipments should be covered when it is not use	78	39	122	61	114	57	86	43
Waste materials and by products ought to be set in squander canisters for simple disposal	86	43	114	57	126	63	74	37
Waste bins are emptied frequently	94	47	106	53	128	64	72	36
Work area , service area, wash area and rest room should be properly equipped with proper water facilities	102	51	98	49	152	76	68	34

Table XXXXX discusses about the responses of the food handlers regarding their knowledge about utilization of infrastructure facilities and safety at work place, practices of disposal of waste products. Around 78 percent of the food handlers responded that all the processing and storage areas to be kept clean and tidy as the dust and dirt will contaminate the food commodities leading to spoilage and wastage of food. The floors of the handling region ought to likewise be kept spotless and dry to forestall falls and mishaps. Water ought not to be permitted to stale in and around the handling making accordingly making it messy and sloppy while coming in and going out. 63% of the food overseers reacted that the side-effects ought to be arranged off rapidly and as often as possible to dodge the rearing of mosquitoes which might wait around the handling regions and defile the food commodities Regular sweeping, dusting and mopping, is required to keep away the dust and cobwebs in the processing unit. Nearly 48 percent of the food handlers cleaned the cleared the drainage in order to prevent any blockages caused by washing and cleaning fruits and vegetables. Around 63 percent of food handlers insisted on the use of dustbins with a lid in order to prevent flies, mosquitoes while processing of food and is easy to dispose the waste frequently. As the food handlers are expected to maintain personal hygiene and practice cleanliness in and around the processing unit soap, napkins, hand driers, drinking water should be made available for the food handlers in an adequate amount for a hassle free functioning of the processing unit.

Table XXXXXI

Statistical Analysis of knowledge related to infrastructural facilities

Knowledge	**Mean**	**SD**	**"t" value**	**df**	**P value**
Before	41.6	± 7.93	t=4.48	18	P =0.0003
After	61.2	± 11.32			

The data obtained was statistically analysis and the initial mean was found to be 41.6 with a SD of ±7.93 whereas after the training the final mean score was 61.2 with a SD of ±11.32 The "t" value was 4.48 with p value equals 0.0003.which depicted that the a statistically significant difference was seen before and after training as the food handlers had enhanced their knowledge levels regarding the proper utilization of the

infrastructural facilities which were available for the food handlers so that the food products are processed in a safe manner and the waste is disposed off efficiently without polluting the environment. Table XXXXXII reviews the response of food handlers to the attitude related to infrastructural facilities.

Table XXXXXII

Response of food handlers to attitude related to infrastructural facilities

Attitude Attributes	Before Training				After Training			
	Yes	%	No	%	Yes	%	No	%
Food handlers needed to have healthy and safe environment in work spot to produce the good products	76	38	124	62	142	71	58	29
A safe and clean environment increases productivity and profits	94	47	106	53	154	77	46	23
Food handlers should be trained in good safety habits like keep all areas clean and dry	72	36	128	64	112	56	88	44
Use of proper protective clothing , gloves, slippers helped to prevent accidents in the work spots	56	28	144	72	108	54	92	46
Following operational instructions on equipments help to maintain the good conditions	106	53	94	47	156	78	44	22
Water quality and standard								

need to be marked for prevention of contamination	98	49	102	51	164	82	36	18
It is advisable to have pest control for safety and personal hygiene	78	39	122	61	72	36	56	28
Proper ventilation and lighting are needed for effective production and profits	86	43	114	57	136	68	64	32
Cleaning of surrounding and drainage requires special attention to prevent food contamination , spoilage etc.	94	47	106	53	144	72	56	28
All furniture, chairs and tables should be clean and swept or dusted systematically	118	59	82	41	158	79	42	21

Table XXXXXII discusses about the responses of the food handlers regarding their attitude towards utilization of infrastructure facilities and safety at work place, practices of disposal of waste products. Nearly 71 percent of the food handlers responded that food handlers need to practice healthy habits for a safe environment in order to produce good quality food products. Seventy seven of the food handlers also agreed that if the work area are clean and tidy it fosters production as well profits for the food industries. Fifty six percent of the food handlers are well trained and skilled in handling food commodities in a safe and hygienic manner with proper uniform and protective clothing in form of masks, head caps, gloves and shoe covers. Nearly 78 percent of the food handlers followed the standard operational procedures for the efficient functioning and maintenance of the equipments. Nearly 68 percent of

the food handlers responded that proper lighting and ventilation is important for effective production of food products so the pests can be inspected and identified and eliminated from the premises.

Table XXXXXIII

Statistical Analysis of attitude related to infrastructural facilities

Attitude	Mean	SD	"t" value	df	P value
Before	43.9	±8.54	t =4.58	18	P =0.0002
After	67.3	± 13.71			

The data obtained was statistically analysed (Table XXXXXIII) and the initial mean score of attitude was found to be 43.9 with a SD of ±8.54 .whereas after the training the final mean score was 67.3 with a SD of ± 13.71 The "t" value was 4.58 with p value equals 0.0002.which depicted that the a statistically significant difference was seen after the selected food handlers underwent the training which brought a change in their work attitude towards proper utilization of infrastructure facilities and safety at work place, practices of disposal of waste products**.** The food handlers were encouraged to utilize the resources which are provided by the industries in order to bring out efficient output and making it sustainable for the long run. Table XXXXXIV highlights the response of food handlers to practices related to infrastructural facilities.

Table XXXXXIV

Response of food handlers to practice related to infrastructural facilities

Practices Adopted	Before Training				After Training			
	Yes	%	No	%	Yes	%	No	%
Infrastructural facilities have direct impact on food safety	78	39	122	61	144	72	56	28

Production unit should be away from the area which are prone to pest infestation animal, waste products, chemicals etc.	84	42	116	58	98	49	102	51
Internal design , structure , plan of the food preemies and equipments should be plan in clear convenience and perfect manner	78	39	128	64	118	59	82	41
Premises, equipments doors, furnitures etc. Should be easily cleaned , maintained disinfected and monitored properly	72	39	122	61	104	52	96	48
Water quality , pipes , storage and distribution should be perfect without having any contamination	98	49	102	51	158	79	42	21
Ventilation system , air filters , exhaust fans must be properly constructed and maintained for easy cleaning	76	38	124	62	98	49	102	51
Disposal of waste products , sewage and drainage system should be constructed perfectly and not to affect the quality of produce	58	29	142	71	96	48	104	52
Cold storage and deep freezing facilities are essentially used to	86	43	114	57	130	65	70	35

maintain the quality of products produced								
Separate areas for raw and processed products ,packed products, cleaning agents are essential and maintained carefully	78	39	122	61	136	68	64	32
Transporting and storing food products under suitable temperature control are the important aspect to maintain the quality and quantity of food products	90	45	110	55	126	63	74	37

Table XXXXXIV discusses about the responses of the food handlers regarding their practices in regard to the infrastructural facilities which were available for the food handlers nearly 72 percent of the selected food handlers responded that infrastructural offices straightforwardly affect the security of food as spotless and clean sterile guarantees the nature of food. Forty nine percent of the food handlers responded that pest infestation and cleaning agents should be kept closed and away from the processing areas as it may contaminate the good if incidence of pest infestation and chemical toxicants are found. Fifty two percent of the food handlers responded that the internal design, structure, plan and equipments should be well planned so that it is easy for the food handlers to work without any hurdles and the output is productive. Around 49 percent of the food handlers emphasised on the cleaning of air filters and exhaust fans so that the circulation of air and ventilation is well maintained. The drainage system should be well constructed and cleaned regularly to remove the contaminants and the drainage water is flows freely which would help in removing off smell and odours. Sixty five percent of the selected food handlers responded that it was important to keep the cold storage and deep freezers clean and away from dirt in order to prevent cross contamination, separate areas should be allocated to store raw and processed food products. Pallets should be

placed in order to store huge amount raw materials and it keeps them protects from rodents and moisture providing stability to the commodities. Sixty three percent of the food handlers laid stress on improving the sanitary conditions of vans. The refrigerated vans should monitor the temperature as it transports the perishable food products from the industries for distribution and marketing to the whole sale and retail market. The vans should be well painted in order to remove rusting of the doors and footrest. Mechanical damage is also prevented if the processed foods are packed and transported properly.

Table XXXXV

Statistical Analysis of practices related to infrastructural facilities

Practices	**Mean**	**SD**	**"t" value**	**df**	**P value**
Before	40.2	±4.97	t = 5.60	18	P <0.0001
After	60.4	±10.25			

The data obtained was statistically analysed (Table XXXXXV) and the initial mean score of practices was found to be 40.2 with a SD of ±4.97whereas after the training the final mean score was 60.4 with a SD of ±10.25 The "t" value was 5.60 with p value less than 0.0001.which depicted that the a statistically significant difference was seen after the selected food handlers had started utilizing the available resources and infrastructural facilities available to reach the optimum level of productivity and efficiency. The safe handling practices adopted by the food handlers led to increase in profits and less cases of food contamination was also reduced by diffusing the waste and recycling the food waste into organic manure thereby enhancing the nutrients in the soil for production of more good quality fruits and vegetables.

4.6.8 Packaging, labelling and transportation of processed food products

Food bundling is utilized to make merchandise simpler to move, to secure the uprightness of food items, and to keep destructive synthetic substances, particles, microscopic organisms, and nuisances under control. It additionally considers food

naming and other shopper data like fixings, permitting you to follow any laws and guidelines overseeing the naming of for-utilization merchandise. This angle accentuates the significance of the production network in food handling, just as methods for safe bundling, marking, and transportation. Table XXXXXVI points out the response of food handlers to knowledge related to packaging, labelling and transportation of processed food products.

Table XXXXXVI

Response of food handlers to knowledge related to packaging, labelling and transportation

Knowledge Attributes	Before Training				After Training			
	Yes	%	No	%	Yes	%	No	%
Packaging of food is the covering to protect food from quality and quantity spoilage damage, contaminating, pest attacks etc.	58	29	142	71	128	64	72	36
Packaging is labelled with nutrition information	52	26	148	74	92	46	108	54
Different types of package materials are available to pack the food products	64	32	136	68	98	49	102	51
Packaged foods are identified with label text and content	58	29	142	71	88	44	112	56
Advisable to use reuse or recycle packaging materials	148	74	52	26	162	84	32	16
Cling films are useful to								

stop drying of foods and protecting from contamination	112	56	88	44	144	72	56	28
Food labelling is a communication between the producer and consumers	56	28	144	72	92	46	108	54
Expired products to be discarded and used for dispatching process	106	53	94	47	142	72	56	28
Vehicles used to move food varieties should be kept up with in great conditions and kept clean	86	43	114	57	132	66	68	34
Food should be perfectly protected during transport	102	51	98	49	158	49	42	21

Table XXXXXVI discusses about the responses of the food handlers regarding their knowledge about packaging, labelling and transportation. According to 64 percent of the food handlers emphasized on the importance of appropriate packaging as it protects the food contents from getting spoiled, damaged and contaminated with the presence of pest infestations. Nearly 46 percent of the food handlers stated that packaging labels should contain all the important nutrition information about processed product. There are several packaging materials available market such as paper, glass, wood, plastic, thermo coal and so. Selection of packaging materials depend upon type and quantity of food commodities. These packaging materials can also be recycle in order to prevent environmental pollution. Seventy two percent of the selected food handlers used cling films to keep the food fresh and evading the mosquitoes from entering the food. Food handlers pointed out that all the relevant information pertaining to the processed food should be clearly mentioned such as date of manufacture, expiry, lot and batch number and first in and first policy should

be followed so that first processed products could be dispatched first and expired products can be discarded. Sixty six percent of the food handlers used appropriate packaging materials so that the processed food products are transported safely without cause any damage to the food product.

Table XXXXXVII

Statistical Analysis of knowledge related to packaging, labelling and transportation

Knowledge	Mean	SD	"t" value	df	P value
Before	42.1	± 15.20	t= 2.66	18	P=0.0157
After	59.2	± 13.41			

The data obtained was statistically analysed (Table XXXXXVII) and the initial mean was found to be 42.1 with a SD of ±15. 20 whereas after the training the final mean score was 59.2 with a SD of ±13.41 The "t" value was 2.66 with p value equals 0.0157.which depicted that the a statistically significant difference was seen before and after training as the food handlers had enhanced their knowledge levels regarding the proper packaging, labelling and transportation of food products**.** Table XXXXXVII highlights the response of food handlers related to packaging, labelling and transportation.

Table XXXXXVIII

Response of food handlers to attitude related to packaging, labelling and transportation

Attitude Attributes	Before Training				After Training			
	Yes	%	No	%	Yes	%	No	%
Food packaging is the most important part of food processing for distribution	94	47	106	53	144	72	56	28

Food packaging helps to protect and extend the shelf life.	70	35	130	65	142	71	58	29
Food packaging is helpful to know about the nutritional content and shelf life of the products	86	43	114	57	164	82	36	18
Food products expired are discarded and not good for human consumption	104	52	96	48	134	67	66	33
Packaged foods are required to have a label with nutrition information	106	53	94	47	164	82	36	18
Food labelling helps the consumers to prevent unnecessary food borne diseases and other allergic conditions	98	49	102	51	148	74	52	26
Vehicles utilized for moving food varieties should be maintained	76	38	124	62	144	72	56	28
Vehicles and capacity compartments for moving food ought to be in the condition of spotless and great condition	56	28	144	72	112	56	88	44
Foods should be adequately protected from any other external contamination during	74	37	126	63	144	72	56	28

transportation								
In food business , unsafe and contaminated products should be removed as per the legal standards	58	29	142	71	110	55	90	45

Table XXXXXVIII discusses about the responses of the food handlers regarding their attitude towards packaging, labelling and transportation. Forty seven percent of selected food handlers stated that food packaging is the most important part of food processing as it acts as a barrier against spillage, mechanical injuries caused during the transportation, thereby extending the shelf life of the processed foods products. Around 82 percent of the food handlers pointed out the food packaging should also possess nutritional information about the processed food so that the consumers know about the health benefits of that product and if the consumer is allergic to any ingredient he /she can omit it. Around 72 percent of the selected food handler emphasized on the cleanliness and maintenance of the vans and vehicles used to transport the processed food products from the manufacturer to the market for distribution. The vehicles should be inspected carefully for any cracks or holes in order to prevent the entry of any reptiles and insects. The vehicles should also be painted washed and dried regularly to remove dirt and grease and maintain good cleaning and sanitation practices.

Table XXXXXIX

Statistical Analysis of attitude related to packaging, labelling and transportation

Attitude	Mean	SD	"t" value	df	P value
Before	41.1	±8.61	t = 7.57	18	P <0.0001
After	70.3	± 8.63			

The data obtained was statistically analysed (Table XXXXXIX) and the initial mean score of attitude was found to be 41.1 with a SD of ±8.61 .whereas after the training

the final mean score was 70.3 with a SD of ± 8.63 The “t” value was 7.57 with p value less than 0.0001.which depicted that the a statistically significant difference was seen after the selected food handlers underwent the training which brought a change in their work attitude towards proper packaging, labelling and transportation as it is important for the sustaining and prolonging the shell life the processed products during transportation along with complete nutritional profile of the product on the product label.

Table XXXXXX

Response of food handlers to practice related to packaging, labelling and transportation

Practices Adopted	Before Training				After Training			
	Yes	%	No	%	Yes	%	No	%
Proper packaging preserves the quality of foods and attracts the customers	78	39	122	61	144	72	56	28
Basically customers are like to judge the food quality from the packaging	94	47	106	53	144	72	56	28
Packaging is uniquely designed to pack and protect foods from external hazards	76	38	124	62	114	57	86	43
Packed foods are free from contamination and enhance the shelf life of the food products	78	39	122	61	156	78	44	22
Proper labelling of food products is a great market tool	58	29	142	71	108	54	92	46
Labelling builds brand								

recognition in the market	66	33	134	67	142	71	58	29
Proper packaging and labelling help the customers to remember and purchase the products	70	35	130	65	96	48	104	52
Proper transportation of perishable food products fulfil the customer demands	98	49	102	51	152	76	48	24
Transportation ties farms, retailers, restaurants, packers , processers and distributors	72	36	128	64	116	58	84	42
Transportation ensures to retain the quality and reduce the chance of getting external hazards until it reaches the destination	78	39	122	61	130	65	70	35

Table XXXXXX discusses about the responses of the food handlers regarding their practices in regard to packaging, labelling and transportation of processed food Around seventy two percent of the selected food handlers knew the importance of packaging as it helps in preserving the quality in terms of nutritional composition and draws the attention of the customers as anything which is presented and promoted in an attractive packaging tends to capture demand in the market. The colour, unique design, font and pictorial representation also plays an important factors in seeking attention becomes the highlight in the market. Nearly seventy eight percent of the selected food handlers stated that packed foods are free from contamination and enhance the shelf life of the food products. Nearly seventy one percent of the food handlers pointed out the proper labelling guarantee assurance to the consumers about the safety and purity of the product and it seeks a recognition in the market and becomes popular among its competitors and customers will have a deep and good

impression about the industry as well as its processed products. It was noted by seventy six percent of the food handlers that proper packaging retails its shelf life and meets the expected quality of the customers until it reaches the destination and it creates a bridge between the manufactures and the middle men involved in the manufacturing of the processed product from the farm to costumers.

Table XXXXXXI

Statistical Analysis of practices related to packaging, labelling and transportation

Practices	Mean	SD	"t" value	df	P value
Before	38.4	±5.67	t = 7.49	18	P <0.0001
After	65.1	±9.73			

The data obtained was statistically analysed (Table XXXXXXI) and the initial mean score of practices was found to be 38.4 with a SD of ±5.67 whereas after the training the final mean score was 65.1 with a SD of ±9.73 The "t" value was 7.49 with p value less than 0.0001.which depicted that the a statistically significant difference was seen after the selected food handlers had adopted safe handling practices in regard to packaging, labelling and transportation. Packaging is a very important step in the processing as it is the medium through which the contents of the food products and transferred from manufacturer to the consumers. The packaging also carries the brand name, price , weight, nutritional composition, store conditions, batch number, lot number , date of manufacture, best before date, instructions to consume and name and address of the manufacture with contact details so that the consumers can directly approached the manufactures if they had some complains or some valuable suggestions and feedback. Transportation also a crucial and the final stage in which the processed foods are send to the market for distribution. Hence packaging, labelling and transportation are linked together as safety is the first priority and responsibility of every food handlers who comes in contact with the whole process from farm to fork.

4.6.9 Statistical Analysis and interpretation of the collected data

Mean percent score for knowledge attitude and practice and KAP of the food handlers on food safety and safe handling practices.

Table No. XXXXXXII

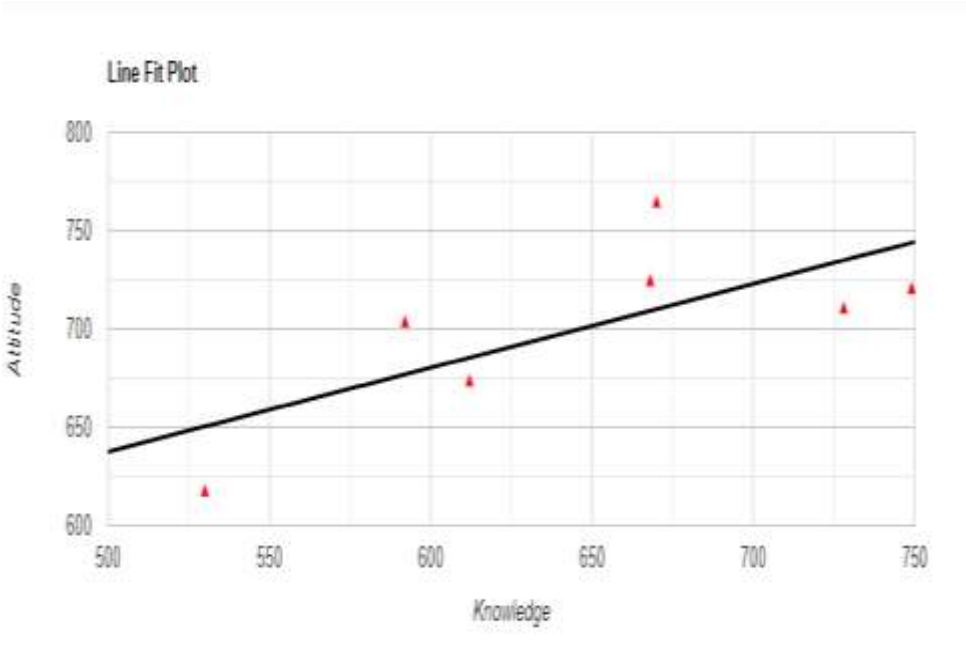
Overall mean percent score of the food handlers

	Attributes	Mean percent	SD
Food Safety and Safe handling practices	Knowledge	64.98	±7.15
	Attitude	70.15	±4.27
	Practice	66.70	±11.4
	KAP	**67.27**	**±2.92**

Correlation between overall knowledge and attitude of food handlers

Fig: 15

Overall knowledge and attitude of food handlers

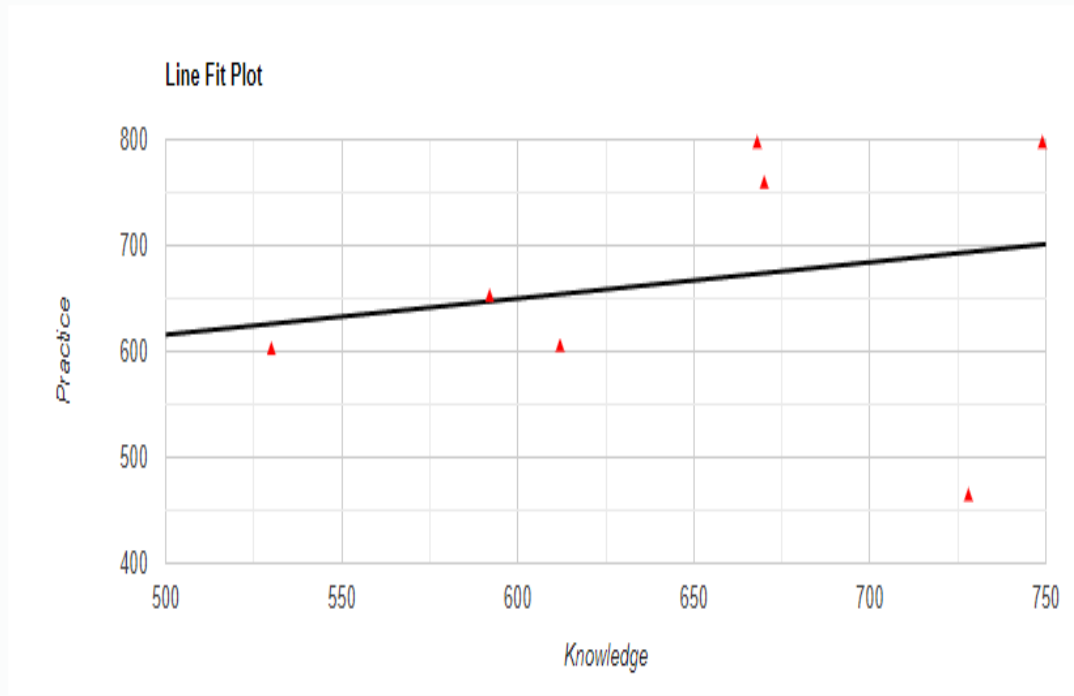


Pearson's coefficient correlation indicated a positive connection between the information and demeanour of the food controllers. The (r) value was observed to be 0.7144. This portrayed that the preparation emphatically affected the information levels of the food overseers and it welcomed a critical change on the demeanour of the food controllers. The food controllers took in the protected taking care of practices which ought to be drilled to defend the wellbeing of the purchaser and upgrade the nature of food.

Correlation between overall knowledge and attitude of food handlers

Fig: 16

Overall knowledge and attitude of food handlers

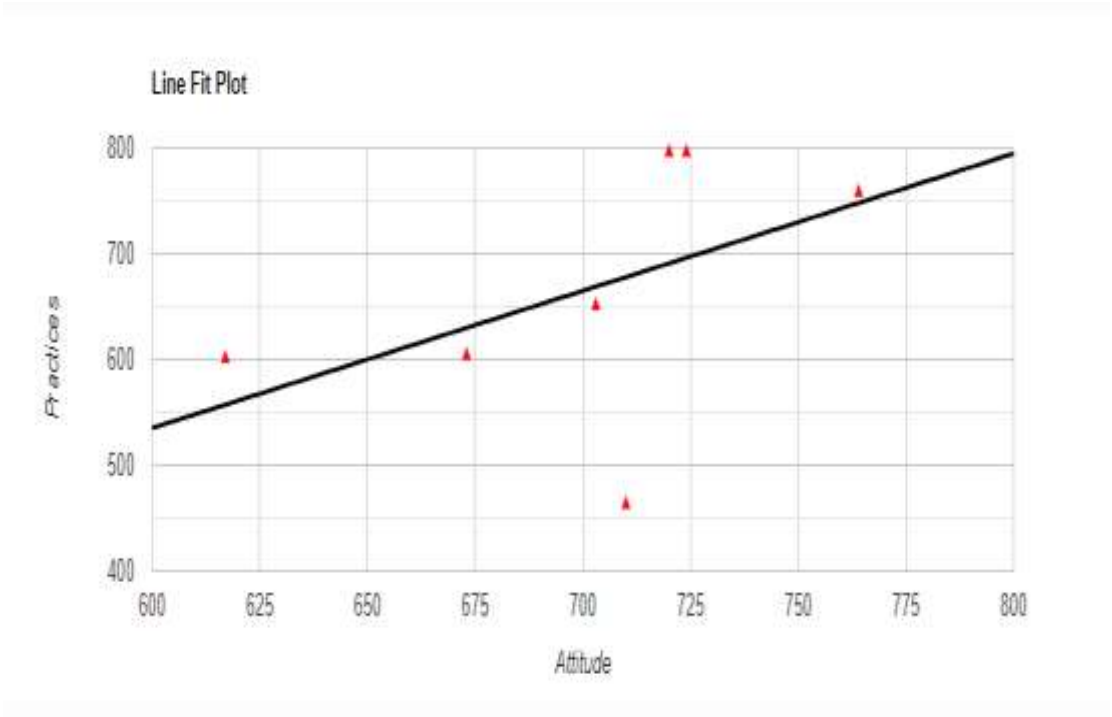


Pearson's coefficient correlation indicated a positive connection between the information and practices of the food controllers. The r esteem was observed to be 0.2136.This portrayed that the preparation decidedly affected the information levels of the food controllers and it welcomed a huge change on the acts of the food overseers. The food controllers took on the protected taking care of practices which ought to be carried out in food enterprises to guarantee there are no potential risks happening because of physical, substance and organic impurities present in the surrounding.

Correlation between overall attitude and practice of food handlers

Fig: 17

Overall attitude and practice of food handlers



Pearson's coefficient correlation indicated a positive connection between the demeanour or and practices of the food controllers. The r esteem was observed to be 0.4845 .This portrayed that the preparation decidedly affected the disposition of the food controllers as it welcomed a critical change on the work practices of the food overseers concerning safe dealing with practices of handled products of the soil. Disinfection, individual cleanliness, avoidance of cross tainting, legitimate bundling, marking and transportation are the impression of the protected taking care of practices took on by the food handlers as an assurance to the customers about the wellbeing, healthiness as far as quality and amount and in this manner been perceived finished for keeping up with the ideal principles set somewhere near the administrative organizations. Consequently a positive relationship was seen among the information, mentality and practices of the chose food overseers of products of the soil industries.

To conclude overall knowledge and practices (0.2136) of food handlers were highly correlated followed by overall attitude and practice (0.4845) of food controllers and by overall knowledge and attitude (0.7144).