INFORMED CONSENT FORMAT FOR RESEARCH PROJECTS

(strike off items that are not applicable)

I **Anit James** am carrying out a study on the topic**Effect of Food Safety Intervention on Safe Handling Practices among Food Handlers and Microbial Assays of Processed Food Products of Fruits and Vegetables** Industries as part of my research project being carried out under the aegis of the Department of Food Science and Nutrition

My research guide is:Dr.A.Thirumani Devi
(Applicable to students only)

The justification for this study is: This study is a precious and valuable contribution to the society as it will give an assurance to the consumer that the food product which they are consuming was prepared under good sanitary conditions and it will not harm them and their children in any form. The perishable food products will retain its quality and texture and its shelf life will be prolonged if it is packaged and store at proper storage conditions. It will help the manufactures to transport their products from one place to another without any deterioration.

The objectives of this study are:
Primary Objective(s):

- Identification of food handlers and collection of data related to the knowledge of food safety, personal hygiene, infrastructure facilities available, sanitation and record keeping from the selected fruits and vegetables processing industries.
- Assess the safety of food handling practices among food handlers using specially designed questionnaire.
- Development and evaluation of safe food handling education modules for training intervention.
- Implementation and Evaluation of effect of training intervention among the selected food handlers on knowledge, attitude and practices (KAP) of food handlers from fruits and vegetable processing unit.
- Assessment of Microbial assay of processed foods from fruits and vegetables processing industries.

Secondary Objective(s):

- To enhance the knowledge, attitude and practices of food handlers regarding Food Safety, Personal hygiene and good handling practices
- To prevent hazards during processing of food products.
- To reduce the growth of microorganisms thereby retaining the shelf life of the product.
- Prevention of food borne illness by providing safe, nutritious, healthy food products to the consumers.

Sample size: 200
Study volunteers / participants are (specify population group & age group): **Processed Fruits and Vegetables Industries**

Location of the study: Meenangadi ,Manjeri, and Wayanad
We request you to kindly cooperate with us in this study. We propose collect background information and other relevant details related to this study. We will be carrying out:

Initial interview (specify approximate duration):**30** minutes.

Data collected will be stored for a period of fifteen years. We will / will not use the data as part of another study.

Health education sessions: Number of sessions: **Four**

Approximate duration of each session: **60**minutes.

Clinical examination (Specify details and purpose): **Not Applicable**

Blood sample collection: Specify quantity of blood being drawn: ____**N/A**_____ml.

No. of times it will be collected: _____**N/A**_____.

Whether blood sample collection is part of routine procedure or for research (study purpose):

☐Routine Procedure ☐ Research Purpose**N/A**

Specify purpose, discomfort likely to be felt and side effects, if any:

Will the blood sample collected be stored after study period: ☐Yes **N/A**

No, it will be destroyed

Will the blood sample collected be sold: ☐Yes No✓

Will the sample collected be shared with persons from another institution: ☐Yes ✓No

Medication / supplementation given, if any, with duration, side effects, purpose, benefits:

Is the medication / supplementation given part of routine procedure: ☐Yes ☐No
(If no, state reasons for giving this medication/supplementation)

Not Applicable

Are alternatives available for medication / supplementation given: ☐Yes ☐No
(If no, state reasons for giving this particular medication/supplementation)

Not Applicable

Final interview (specify approximate duration):**30** minutes.

If photograph is taken, purpose: **To the witness to the genuineness of the study**

Benefits from this study, if any :-Food safety assures the consumers that the food product is safe and fit for human consumption and it will not cause any harm to the consumer and prevent him from life style diseases.

Risks involved by participating in this study, if any : **Not applicable**

How will the results be used:

1. The result of my study shall be submitted at the processed fruits and vegetables industries.
2. The result will published as an article in many journals and books.
3. The results will be presented in seminars and conferences.

If you are uncomfortable in answering any of our questions during the course of the interview you have the right to withdraw from the interview / study at anytime. You have the freedom to withdraw from the study at any point of time. You will NOT be paid any remuneration for the time you spend with us for this interview / study. The information provided by you will be kept in strict confidence. Under no circumstances shall we reveal the identity of the respondent or their families to anyone. The information that we collect shall be used for approved research purposes only. You will be informed about any significant new findings – including adverse events, if any- whether directly or indirectly related to you or to other participants of this study, developed during the course of this research which may relate to your willingness to continue participation

Consent: The above information regarding the study, has been read by me/ read to me, and has been explained to me by the investigator(s). Having understood the same, I hereby give my consent to them to interview me. I am affixing my signature / left thumb impression to indicate my consent and willingness to participate in this study (i.e., willingly abide by the project requirements)

Signature / Left thumb impression of the Study Volunteer / Legal Representative:

Signature of the Interviewer with date

Signature of the Witness with name:

ANNA FOOD PRODUCTS
Near Community Hall, MEENANGADI
Wayanad Dt. Kerala - 673591
Ph: 04936 248352
e-mail: fizzyannafood@gmail.com
GSTIN No: 32AGOPJ0630K1ZK

Date:

TO WHOM SO EVER IT MAY CONCERN

This is to bring in to your kind concern that **Ms. Anit james Ph.D** Research scholar of Avinashilingam Institute of Home Science and Higher Education for Women Coimbatore can conduct the survey as a part of her research study in our organization.We have no objection . We wish her all the success for her research study.

For
ANNA FOOD PRODUCTS

Proprietor

Managing Director

Anna Food Products

Near Community Hall, Meenangadi, Wayanad

Panda Foods (India) Pvt. Ltd.
318/6, Krishnagiri, Wayanad, Kerala, India-673 591
Ph: +91 4936 246213/14, Fax: +91 4936 246248
e-mail: info@pandafoods.co.in | www.pandafoods.co.in

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Managing Director

Panda Foods India Pvt. Ltd.

Krishnagiri,Meenangadi, Wayanad

For PANDA FOODS (INDIA) PVT.LTD.
Managing Director

TO WHOM SO EVER IT MAY CONCERN

This is to bring in to your kind concern that **Ms. Anit James Ph.D** Research Scholar of Avinashilingam Institute of Home Science and Higher Education for Women Coimbatore can conduct the survey as a part of her research study in our organization. We have no objection. We wish her all the success for her research study.

Nibin Thomas
Admin Head
Olene Foods Pvt. Ltd.

OLENE FOODS PVT. LTD. * TADAPPARAMBU, PAYYANAD P.O. * MANJERI 676 122

Olene Foods Pvt. Ltd.
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INSTITUTIONAL HUMAN ETHICS COMMITTEE

Avinashilingam

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

20th January 2020

To
Ms Anit James
Department of Food Science and Nutrition
Avinashilingam Institute for Home Science and
Higher Education for Women
Coimbatore – 641 043

Dear Anit James,

Ref: Your proposal No. IHEC /19-20/FSN /32 entitled "Food Safety Management of Processed Fruits and Vegetables Industries of Palakkad" submitted for approval to the IHEC on 30.10.2019.

The Institutional Human Ethics Committee of our University hereby grants approval to your research proposal No. IHEC /19-20/FSN /32 entitled "Food Safety Management of Processed Fruit and Vegetables Industries of Palakkad" submitted by you. The Approval number for the same is AUW/ IHEC/FSN-19-20/XPD/32.

We wish you all the best in your research endeavours.

Regards,

V. Uma Mageshwari
Dr.S.Uma Mageshwari
Member Secretary

Institutional Human Ethics Committee

INSTITUTIONAL HUMAN ETHICS COMMITTEE

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Coimbatore - 641 043, Tamil Nadu, India

Appendix L2

(Item No 5 of Check List)
Details of Research Publications

S.No	Article	Journal	Other Details Vol/No/Page No/ Year	Published in UGC-CARE / Scopus Indexed/ Web of Science (*List of Journals in that category including the particular Journal to be attached)
1	KAP study of an Ice Cream Factory at Palakkad	Indian Journal of Nutrition and Dietetics	Supplement -2 January –March 2021. ISSN -0022-3174, Online ISSN-2348-621X. Pages 8-12.	**UGC-CARE**
2	Assessment of sanitation and hygiene of hands , equipment of food handlers by swab test and finding a suitable wash solution to reduce bacterial load and pesticide present in fruits and vegetables	Annals of Romanian Society for Cell Biology	ISSN:1583-6258,Vol .25 Issue 6 , 2021, Pages 2544-2550.	**Scopus**

Scholar : **Anit James**

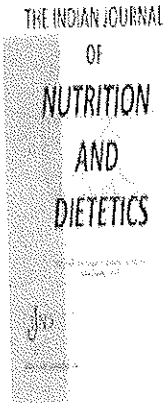
Supervisor : **Dr. A Thirumani Devi**

Checked By:

HoD/Dean

The Indian Journal of Nutrition and Dietetics

About the Journal



The Indian Journal of Nutrition and Dietetics

Editor-in-Chief: Prof. S. P. Thyagarajan

Online ISSN: 2348-621X

Print ISSN: 0022-3174

Frequency: Quarterly

Published since: 1964

Publisher(s): Avinashilingam Institute for Home Science and Higher Education for Women

Recommend this Journal!

Volume 58, Issue S2, January-March 2021

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Original Articles

The Indian Journal of Nutrition and Dietetics
ISSN 0022-3174 eISSN 2348-621X
www.anfonline.org

DOI:10.21048/IJND.2021.58.S2.28001

KAP Study of an Ice Cream Factory at Palakkad

Anit James and Thirumani Devi, A.

(Department of Food Science and Nutrition, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore)

e-mail: angeljames.james@gmail.com

Abstract

Chikoos ice cream is a leading brand of Kerala State's food industry situated at Alathur in Palakkad district. The industry is highly recognized and has claimed various prestigious awards from the Kerala State Government. The company manufactures a variety of ice creams made out of seasonal fruits and vegetables. The company took an initiative to promote the goodness of Jackfruit and its products like pudding, payasam, ice cream, jam, squash, chips, pakodas, pickles, curries, cutlets and cookies. The main attraction was the green chilly ice cream, ginger ice cream and pan or betal leaf ice cream. The survey was conducted using a questionnaire and interview schedule among 50 food handlers working in this factory. The food handlers were assessed on their knowledge, attitude and practices regarding food hygiene, good handling practices and sanitation which they practiced during processing. Regular inspection, internal audit and observation were done to identity the hazards which might spoil or cause harm to the product and consumers who would consume them. Food Safety Training was given to the food handlers regarding active hand washing, proper personal hygiene, pest infestation, sanitation and waste management along with storage of ice creams in insulated boxes and deep freezers. Training was done using power-point presentation, practical demonstration, flashcards and audio visuals. Post evaluation was done using the same questionnaire along with brainstorming interactive group discussions. The training brought about a positive impact on the knowledge, attitude and practices of the food handlers which contributed to the wholesomeness and quality of the food products.

Keywords: *Food hygiene, sanitation, good handling practices, waste management, insulated boxes*

Introduction

Chikoos ice cream is a leading brand of Kerala State's food industry situated at Alathur in Palakkad district. The industry is highly recognized and has claimed various prestigious awards from the Kerala State Government. The company manufactures a variety of ice creams made out of seasonal fruits and vegetables. The company took an initiative to promote the goodness of Jackfruit and its products like pudding, payasam, ice cream, jam, squash, chips, pakodas, pickles, curries, cutlets and cookies. The main attraction was the green chilly ice cream, ginger ice cream and pan or betal leaf ice cream. Food poisoning happens as a result of food being contaminated with microorganisms, contamination arising from inadequate preservation strategies, unsanitary handling practices, cross-contamination from food contact surfaces or from humans[1]. Poor personal hygiene, particularly dirty hands, has established as a major risk factor for contamination[2]. The main objective of the study was to conduct an existing KAP survey among the food handlers, to create awareness on personal hygiene, sanitation, good handling practices and proper storage of ice creams in insulating boxes and to evaluate the outcome of training among the food handlers.

Materials and Methods

Selection of area and required materials

The present study was conducted at Chikoos ice cream factory which is a leading brand of K. K. Foods situated at Alathur in Palakkad District. Questionnaire, interview schedule, power-point presentation, demonstration and flash cards were used for the study.

Collection of data

The KAP survey was conducted on 50 food handlers working in that factory. The food handlers were asked to fill in the questionnaire and interview was also conducted on one-on-one basis. Observation and inspection were done to know the working practices which the food handlers followed in the factory. The processing unit was well equipped with machineries, lighting and ventilation. Most of the food handlers were women. The seasonal fruits and vegetables were sorted according to their ripening stage. Only the ripen fruits were processed and made into a pulp. The off season fruits like jackfruit and watermelon were pulped and kept in cold storage. Milk powder was used to prepare the ice creams. A time chart and menu was prepared on daily basis. A variety of new flavours like green chilly, ginger and betal leaf ice cream were prepared if they had an order. Training was given to these food handlers to improve the handling practices, prevent pest infestation, to maintain proper sanitation in and around the processing unit and steps were taken to decompose the vegetable and fruit peelings. Hand washing techniques were taught to the selected food handlers. Power-point and pictorial

presentation were done using flashcards for better understanding of the concept of food safety. Awareness was created among the food handlers regarding the use of thermal insulating boxes and deep freezers. Post evaluation was done using the same questionnaire with some brainstorming interactive group discussions. The learning outcomes brought about a positive impact on their knowledge, attitude and practices.

Results and Discussion

Socio-economic Profile

The socio economic profile of the 50 food handlers is highlighted in Table I.

About 84% were female members and rest of them were male members and 62% of them had school level education. About 44% of the food handlers earned ₹ 10,000/- to 15,000/- as their monthly income.

Knowledge level

An awareness was created among the food handlers regarding food hygiene, sanitation and good handling practices which were to be followed in the processing unit.

Table II depicts that the initial mean score of the food handlers was 48 but after undergoing training and gaining knowledge regarding the food hygiene, good handling practices, sanitation, usage of insulated boxes and waste management the final mean score obtained by the food handlers was increased to 8.2 thus ensuring the safety and retaining the shelf life of the processed food products.

Attitude of the food handlers

As the knowledge level of the food handlers had increased it brought about a change in their attitudes is given in Table III. Around 80% of the food handlers strongly agreed on working in good sanitary

TABLE I

Socio-Economic Profile of the Food Handlers

Age Group	No. of food handlers (n=50)	% of Food handlers
Less than 20	2	4%
20-35	23	46%
36-50	19	38%
More than 50	6	12%
Gender		
Male	8	16%
Female	42	84%
Education		
Primary School	13	26%
High School	18	36%
College	17	34%
Illiterates	2	4%
Income in (₹)		
Less than 5000	2	4%
5000-10,000	18	36%
10,000-15,000	22	44%
15,000-20,000	8	16%

TABLE II

Mean Change in Knowledge Level of the Food Handlers (n=50)

Change in Knowledge Level	Initial Score (out of 20)	Final Score (out of 20)	Difference
Food hygiene	9	16	7
Good handling practices	11	18	7
Personal hygiene	10	18	8
Waste management	8	14	6
Storage of ice creams	10	16	6

conditions. Whereas 8% of the food handlers were not for the regular disinfecting in the work area and surfaces. Nearly 62% strongly agreed for the importance of hand washing and 78% strongly agreed to have proper waste management and 44% strongly agreed to wear head gear, aprons and gloves.

Practices of the food handlers

The food handlers were also observed on the practices which they had adopted while working in the processing unit like preliminary preparation such as selecting, sorting, washing, self-grooming and proper storage methods which should be followed to prevent the spoilage of the food product.

Table IV depict that 88% of the food handlers learned to practice how to store and preserve the fruit pulps properly for a longer duration of time in the cold storage. They became more cautious while handling the perishable food items so that cross contamination can be prevented. Around 86% of the food handlers adopted the use

TABLE III

Attitude of Food Handlers

Statements	Strongly Agree (%)	Agree (%)	Not Sure (%)	Disagree (%)
Importance of hand washing	61.5	35	3.5	0
Wearing head gear, mask, aprons and gloves	44	42	4	10
Regularly disinfecting the surfaces	67	23	2	8
Working in good sanitary conditions	80	20	0	0
Proper waste management	78	17	5	0

TABLE IV

Practices of Food Handlers

Practices adopted	Yes (%)	No (%)
Proper washing of fruits and vegetables	82%	18%
Sorting of fruits and vegetables	80%	20%
Proper storage of fruits and vegetables	88%	12%
Hands, nails, skin and hair kept clean	84%	16%
Usage of insulated boxes and deep freezers	86%	14%
Regularly cleaning the deep freezers and chillers	74%	26%

of thermal insulating boxes which helped them in transporting the ice creams from one place to another without melting.

Conclusion

The KAP study on ice cream factory based in Palakkad gave immense joy and satisfaction. The survey and training became very fruitful to the food handlers. They were very active, keen to learn and adopted the positives which would enhance the quality and quantity of the processed product.

Acknowledgment

Authors thank Mr. K. Mrithuvarnan, the Founder and Managing Director of K.K. Foods Alathur, Palakkad for granting permission to conduct the survey as well as train the food handlers.

Conflict of interest

The author(s) declare(s) that there is no conflict of interest.

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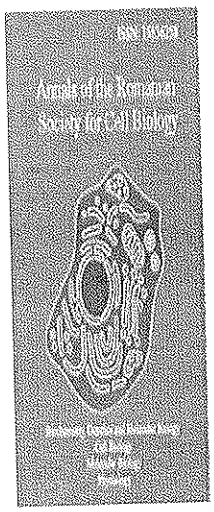
1. Barrie, D. The provision of food and catering services in hospital. *J. Hospital Infect.*, 1996, **33**, 13-33.
2. Scarborough MF(2002) Master's Thesis, Emory University, Hand Washing in Georgia's Public Schools-A Community Needs Assessment and Intervention Study, Atlanta, GA, USA.



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- Frequency: Monthly
- Contact: editor@annalsofrscb.ro
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Improvement of sanitation and hygiene practices, equipment of food handlers by swan test and providing a portable wash solution to reduce of bacterial load and pesticide residue content in fruits and vegetables

Anil James Thirumani Devi A

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Crop Yield Prediction by using Machine Learning Techniques

K Gangadhara Rao Assistant Professor, Keerthi Yashwanth, M Sridhar Goud

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Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 2544-2550
Received 25 April 2021; Accepted 08 May 2021.

Assessment of sanitation and hygiene of hands, equipment of food handlers by swab test and finding a suitable wash solution to reduce of bacterial load and pesticide residue present in fruits and vegetables

Anit James* and Thirumani Devi A.**
*Research Scholar, Department of Food Science and Nutrition
**Professor Department of Food Science and Nutrition
Avinashilingam Institute for Home Science and Higher Education for Women
Bharati Park Road Tatabad, Forest College Campus, Saibaba Colony Tamil Nadu 641043
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ABSTRACT

Sanitation and hygiene play an important role in preventing many food borne illness. Regular washing of hands with soap and disinfecting the work area before and after processing minimize the risk and reduce the pathogens which contaminate the food which help in preventing serious health hazards. The present study on "Assessment of sanitation and hygiene of hands, equipment of food handlers by swab test and finding a suitable wash solution to reduce of bacterial load and pesticide residue present in fruits and vegetables." was done as a part of pilot study in processed fruits and vegetable industries. Sixty pre and post swab samples were taken to determine the total bacterial count present on the hands of food handlers. An experiment was also conducted to determine the total bacterial count present on the surface of tomato by washing and soaking for 15 minutes in different washing solutions like tap water, saline, turmeric solution, chlorine, vinegar solution and two commercial washes like Nim wash and Veggie clean. The mean Pre Total bacterial count was502.33 SD± 118.03 whereas as the mean E coli was4.066SD± 8.97. After pouring and rubbing the hands of the food handlers with 70% alcohol based sanitizer the mean total bacterial count came down to 102 SD±29.59 E coli was absent in post swab test.The total bacterial count present on the surface of tomato before wash was 80cfu/g but after washing in tap water it was 55cfu/g, chlorine 22cfu/g, saline 21cfu/g, vinegar 18cfu/g, turmeric 14cfu/g,Nim wash 14cfu/g and Veggie clean was 9cfu/g.Personal hygiene and sanitation should be strictly followed in all processing unitsto ensure the safety of food products and adopt good handling practices regarding proper washing of fruits and vegetables to eradicate germs and pesticides from the surfaces of fruits and vegetables.

Key Words:-Sanitation, Hygiene, Hazards, Pesticides, Good Handling Practices.

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Received 25 April 2021; Accepted 08 May 2021.

1. INTRODUCTION

The term "hygiene" is employed to talk over with the behaviours or measures, as well as however on the far side the management of human ordure, that square measure accustomed break the chain of infection transmission within the home and community. Whereas the majority acknowledge that hygiene suggests that 'hand laundry. Food hygiene plays a very important role all told the process units. It refers to the practices and safety measures that square measure adopted in any respect stages of production to make sure quality and helps in retentive the period of time of the merchandise. Poor personal hygiene, basically dirty hands has been recognized as a major risk factor contributing to food contamination which results in illness. Hand hygiene plays a vital role in safeguarding food. **(Curtis V, et.al (2003)**

Personal hygiene and cross contamination are the key factors which promote the transmission offood-borne diseases. Researches have shown that proper handling of food should made mandatory at each stage of processing so as to ensure safe and good quality food. The primary principles of food safety should be practices and implemented in all the processing units.

The fruits and vegetables are loaded with pesticides and chemicals, if they are consumed they create various health hazards in human beings such as damage the nervous system, digestive system and some carcinogenic effects in the body. Thus it comes very important for the food handlers to properly wash the fruits and vegetables before processing so as to eradicate the harmful microorganisms.

OBJECTIVES

- Detect microbial contamination present on hands, equipment, work area and machinery of fruits and vegetables processing industries.
- Find out the suitable wash solution to reduce bacterial load and pesticide residue present in fruits and vegetables.

2. MATERIALS AND METHODS

The pre and post swab tests were taken from the hands and surfaces of fruits and vegetables process units. Pre swab take a look at was done as a surprise check to seek out out that the chosen food handlers had washed their hands before beginning their work. The pre Swab take a look at was done exploitation alkaline organic compound water, agar, sterile H2O and cotton swab.The cotton swab was swaybacked zero.1% organic compound resolution and rolled over the hands. The samples were kept in self-sealing packets and tagged for microorganism assay. Post Swab take a look at was done after rubbing their hands, surfaces with seventy% alcohol primarily based sanitizer. The cotton swab was swaybacked zero.1% organic compound resolution and rolled once again on the hands.

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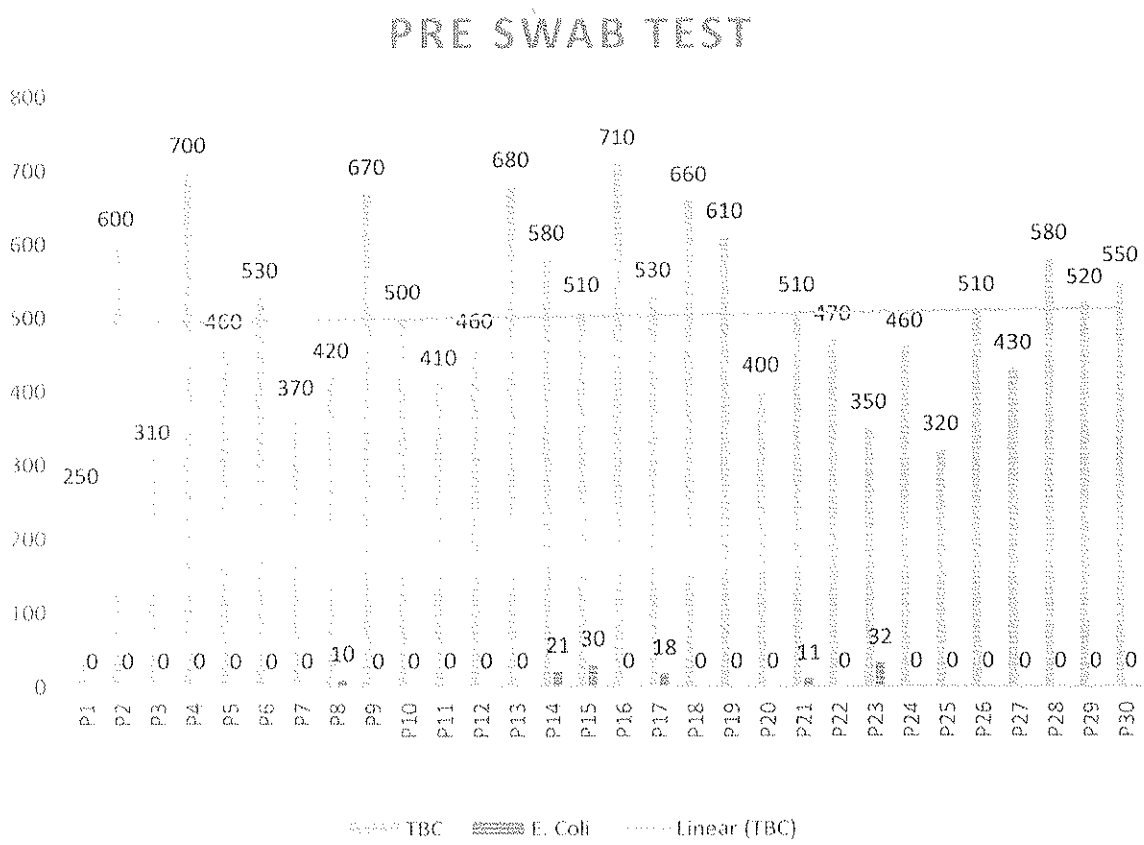
The swab sticks were kept in self -sealing packets and tagged.Sixty Pre and Post Swab samples were collected from the food handlers. The pre and post swab plates were inoculated with agar and was incubated at 35°C to see the full microorganism Count and E Coli.

An experiment was conjointly dole out to work out the entire microorganism load on the surface of tomato by laundry in numerous laundry solutions like traditional water, chlorine, saline, vinegar, turmeric answer and two commercial washes of table game wash and green groceries clean. The fruits and vegetables were washed and soaked for quarter-hour to scale back the microorganism load effectively when within the individual solutions. The parts of table game wash area unit citrus fruit extract and tree that helped to get rid of the germs. On the opposite hand green groceries clean was composed of common salt, Na Cocoyl salt, Lauryl glycoside, metal stuff, EDTA and acid, these were delicate surfactants derived from oil kernels that helped to get rid of the pesticides and germs.

3. RESULT AND DISCUSSION

The results of swab samples and microbial analysis of tomato were tabulated in Microsoft excel. Mean , Standard deviation and t test was done using SPSS version 23.

1. Pre Swab



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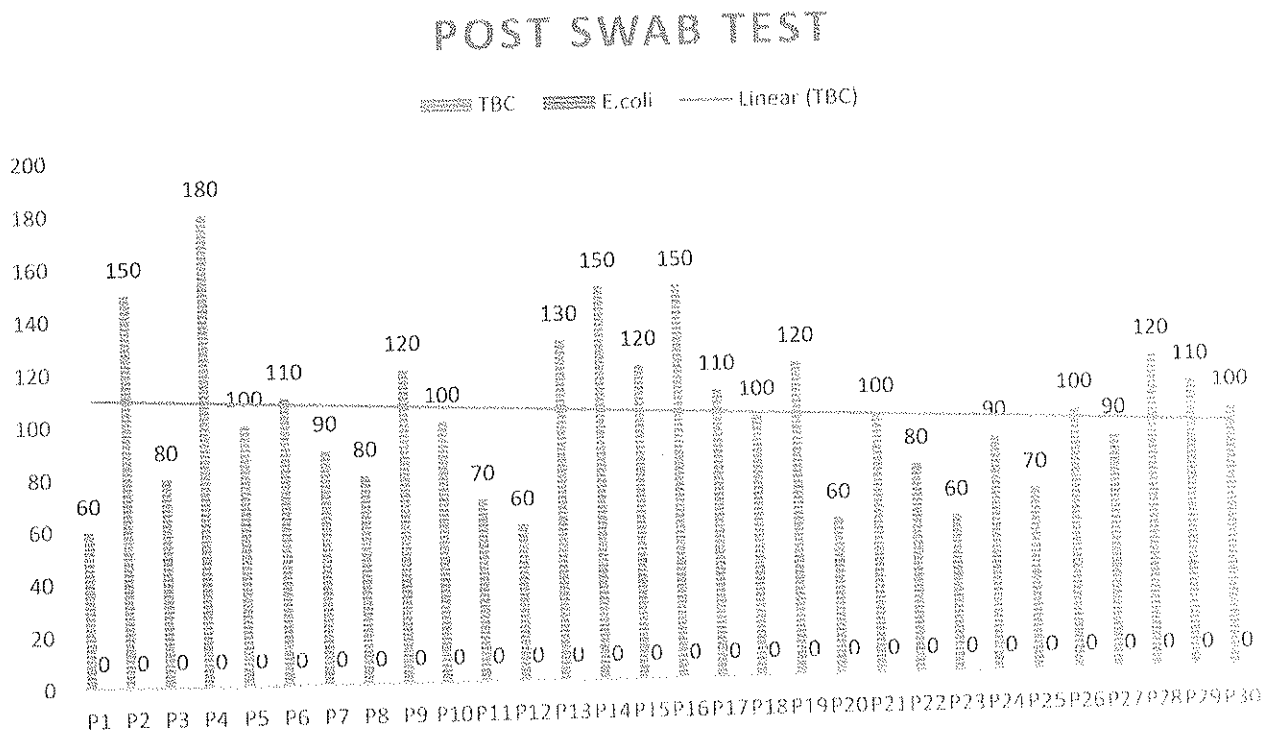
The above graph depicted 30 pre swab test samples which were taken from the hands and surfaces of the food handlers. Total bacterial count was found in all samples whereas E. Coli was found in very few food handlers.The above graph showed the 30 pre swab test which was taken from the hands of the food handlers. The pre mean TBC was 502.33 SD± 118.03. The mean E coli was4.066SD± 8.97.

2. Post Swab Test



The above graph depicted 30 post swab test which were taken from the hands and surfaces of the food handlers. Total bacterial count was found to be less as compared to the pre swab test whereas E. Coli, Coliform and salmonella were absent after using alcohol based sanitizer. The above graph showed the 30 post swab test which was taken from the hands of the food handlers. The post mean TBC was 102 SD±29.59 E coli was absent in post swab test.

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Received 25 April 2021; Accepted 08 May 2021.

Microorganisms	Pre Swab		Post Swab	
TBC	**Mean :** 502.33	**SD :** ±118.03	**Mean :**102	**SD:** ±29.59
E. Coli	**Mean:** 4.066	**SD :**± 8.97	**Mean:** 0	**SD** :± 0

TBC t=18.0198 df =58 p< 0.0001
E.colit= 2.4828 df =58 p=0.0160

The t value for Total Bacterial count was t=18.0198 with a p< 0.0001 which is considered to be extremely statistically significant, whereas the t value for E coli was t= 2.4828, with a p=0.0160 which is considered to be statistically significant.

3. **Microbiological Analysis of Tomato**

S. No.	Sample	Wt. of Tomato	Soaking Time	Amt. of Solvent	Volume of Solution	TBC Result
1.	Before Wash	74.40gm	-	-	100ml	80cfu/g
2.	Tap Water	58.63gm	15min	-	100ml	55cfu/g
3.	Chlorine	84.95gm	15min	0.1ml in 100ml water	100ml	22cfu/g
4.	Saline	85.63gm	15min	2gm in 100ml water	100ml	21cfu/g
5.	Vinegar	75.55gm	15min	1:3 (Vinegar: water)	100ml	18cfu/g
6.	Turmeric	63.21gm	15min	1gm in 100ml water	100ml	14cfu/g
7.	Nim Wash	53.75gm	15min	2ml in 100ml water	100ml	14cfu/g
8.	Veggie Clean	64.35gm	15min	0.5ml in 100ml water	100ml	9cfu/g

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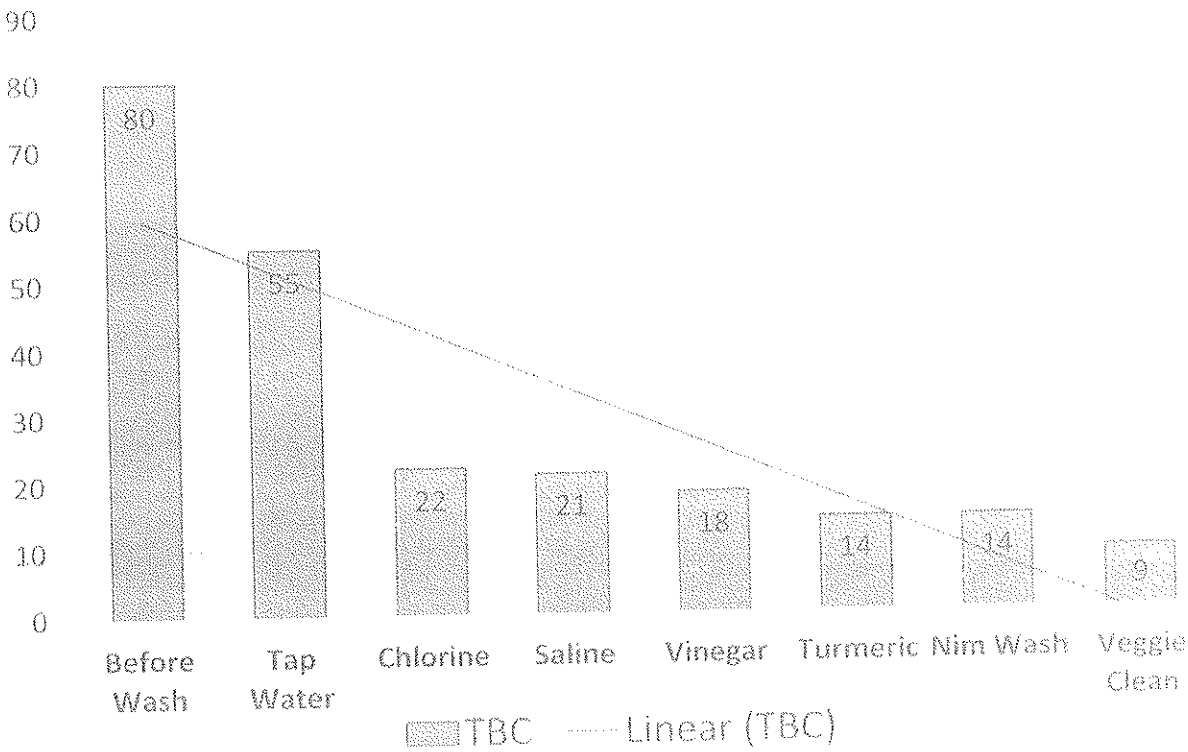
Received 25 April 2021; Accepted 08 May 2021.

The above table represents the various solutions which were used to clean fruits and vegetables like tap water, chlorine, saline, vinegar, turmeric, nim wash and veggie clean. Around 88.75% of germs, pesticides were eradicated from the surface of the fruits and vegetables.

Microbiological Analysis of Tomato



The above graph depicted that the total bacterial count before wash of the tomato was 80cfu/g, whereas the total bacterial count after wash using tap water was 55cfu/g, chlorine 22cfu/g, saline 21cfu/g, vinegar 18cfu/g, turmeric 14cfu/g, nim wash which is a commercial wash was 14cfu/g and veggie clean was 9 cfu/g. The composition of nim wash are citrus fruit extract and neem which helped to remove the germs. On the other hand veggie clean is composed of Sodium Chloride, Sodium Cocoyl Glutamate, Lauryl Glucoside, Potassium sorbate, EDTA, Citric acid which helps to remove the pesticides and germs, thereby reducing the total bacterial count from 80cfu/g to 9 cfu/g.

4. CONCLUSION

The study confirmed that the total bacterial count found on the surfaces and hands of food handlers were responsible for causing various food borne illness. Proper hand washing as well as training and creating an awareness on proper handling of fruits and vegetables should be practised to ensure safety and quality processed products. Food safety norms should be

practiced by the food handlers in order to reduce of food borne diseases from food industries and alternative public eating counters.

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We would like to acknowledge the owners of fruits and vegetables of processing units for allowing us to take the swab samples and the food handlers for their active participation.

AUTHOR CONTRIBUTIONS

Anit James was responsible for the conception, writing, proofreading, editing of the article writing and tables/figure preparation. Thirumani Devi A. is the corresponding author of this article and was involved in writing and reviewing.

CONFLICT OF INTEREST

'The author(s) declare(s) that there is no conflict of interest.

Reference

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2.	Roll No. and Year of Registration	18PHFNF002, 2018
3.	Department	Food Science and Nutrition
4.	Name of the Research Guide	Dr. A. Thirumani Devi
5.	Title of the Thesis / Dissertation	Effect of Food Safety Intervention on Safe Handling Practices among Food Handlers and Microbial Assays of Processed Food Products of Fruits and Vegetable Industries
6.	Similarity Content (%) Identified	**5 %** (Excluding Review of Literature)
7.	Software Used	Turnitin
8.	Date of Verification	27/10/2021

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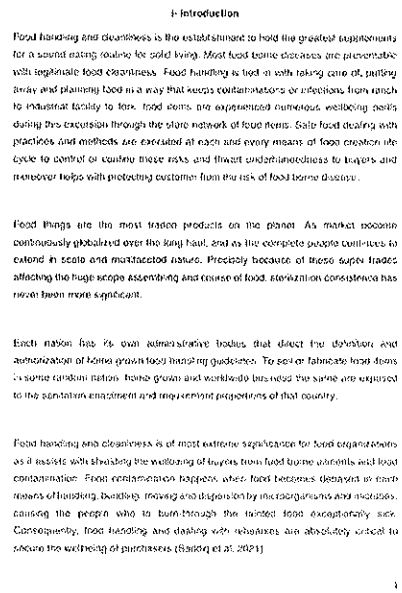

1 Introduction

Food handling and cleanliness is the establishment to hold the greatest supplements for a sound eating routine for solid living. Most food borne diseases are preventable with legitimate food cleanliness. Food handling is tied in with taking care of, putting away and planning food in a way that keeps contaminations or infections from ranch to industrial facility to fork. food items are experienced numerous wellbeing perils during the excursion through the store network of food items. Safe food dealing with practices and methods are executed at each and every means of food creation life cycle to control or counter these risks and thwart underhandedness to buyers and moreover helps with protecting customer from the risk of food borne disease.

Food things are the most traded products on the planet. As market economy continuously globalized over the long haul, and as the complete people continues to extend in scale and manufactor nature. Precisely because of these super trades affecting the huge scope assembling and course of food, sterilization consistence has never been more significant.

Each nation has its own administrative bodies that direct the definition and authorization of home grown food handling guidelines. To sell or fabricate food items in some random nation, home grown and worldwide businesses the same are exposed to the sanitation enactment and requirement regardless of that country.

Food handling and cleanliness is of most extreme significance for food organizations as it assists with shielding the wellbeing of buyers from food borne ailments and food contamination. Food contamination happens when food becomes debased at each means of handling, dealing, moving and disposition by microorganisms and microbes, causing the people who to burn through the tainted food exceptionally sick. Consequently, food handling and dealing with rehearses are absolutely critical to secure the wellbeing of purchasers (Salehi et al. 2021)

Effect of Food Safety Intervention on Safe Handling Practices among Food Handlers and Microbial Assays of Processed Food Products of Fruits and Vegetable Industries

by Anit James

Submission date: 27-Oct-2021 10:49AM (UTC+0530)
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Word count: 42552
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Appendix L2

(Item No 5 of Check List)
Details of Research Publications

S.No	Article	Journal	Other Details Vol/No/Page No/ Year	Published in UGC-CARE / Scopus Indexed/ Web of Science (*List of Journals in that category including the particular Journal to be attached)
1	KAP study of an Ice Cream Factory at Palakkad	Indian Journal of Nutrition and Dietetics	Supplement -2 January –March 2021. ISSN -0022-3174, Online ISSN-2348-621X. Pages 8-12.	UGC-CARE
2	Assessment of sanitation and hygiene of hands , equipment of food handlers by swab test and finding a suitable wash solution to reduce bacterial load and pesticide present in fruits and vegetables	Annals of Romanian Society for Cell Biology	ISSN:1583-6258,Vol .25 Issue 6 , 2021, Pages 2544-2550.	Scopus

Scholar : Anit James

Supervisor : Dr. A Thirumani Devi

Checked By:

HoD/Dean

03.12.2021

From

Sindhu.M.S (16PHZOP002)

Ph.D. Research Scholar (Part Time)

Department of Zoology

Avinashilingam Institute for Home Science and Higher Education for Women

Coimbatore - 641 043.

To

The Controller of Examinations,

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Coimbatore - 641 043.

Respected Madam,

Subject : Submission of the Ph.D. thesis – Reg

I Sindhu.M.S Ph.D. Research Scholar, **(**16PHZOP002**)** Department of Zoology, submit my thesis titled Validating the potential of Plectranthus amboinicus against lung cancer-In silico, in vitro and in vivo approaches under the guidance of Dr M.Poonkothai, Associate Professor, Department of Zoology.

Here with I am submitting three hard copies and one soft copy in CD of the thesis. Hence I request you to kindly accept my submission of the thesis.

Thanking You.

Yours sincerely

SINDHU.M.S

Signature of the Supervisor **Signature of the HOD**

Annexure - II

Questionnaire

“Effect of Food Safety Intervention on Safe Handling Practices among food handlers and Microbial assays of processed food products from Fruits and Vegetables Industries

Department of Food Science and Nutrition

I Demographic Profile

Name :

Age :

Gender :

Education :

Marital Status :

Designation :

Work Experience :

Job responsibilities :

Attended Food Safety Training :

Tenure of Training Period :

Acquisition of Knowledge on Food Training :

Vaccination of Food Handlers :

Monthly Income of Food handlers :

I Knowledge questions related to food safety

Q1. Is food poisoning due to pathogenic microbes?

a) Yes b) No

Q2. Is consumption of raw or improper cooking / processing food products not good for health?

a) Yes b) No

Q3.Is poor washing or unwashing of vegetables and fruits high risk for food for food poisoning

a) Yes b) No

Q4. Does unhygienic practices of food handlers the main cause for food contamination and food poisoning?

a) Yes b) No

Q5.Does uncovered / poor quality food items / poor or incorrect temperature for long time leads to food contamination, spoilage and poisoning?

a) Yes b) No

Q6. Is it essential to have proper refrigerator temperature?

a) Yes b) No

Q7.Is contact of ready to eat perishable vegetables and fruits with unhygienic / bare hands not good for health?

a) Yes b) No

Q8. Does correct method of thawing frozen products help to maintain the quality of products?

a) Yes b) No

Q9.Is food poisoning the main cause for severe diseases?

a) Yes b) No

Q10.Do healthy food handlers play an important role in maintaining food quality?

a) Yes b) No

II .Attitude questions related to food safety

Q11. Are safe food handling practices important responsibility of food handlers in the industry?

a) Yes b) No

Q12.Has learning about food safety through training course updated your knowledge?

a) Yes b) No

Q13. Does proper checking and maintaining the temperature of fridge / freezer prevent food spoilage / poisoning / contamination?

a) Yes b) No

Q14. Are raw and processed food products stored separately?

a) Yes b) No

Q15. Are food handlers also source of food borne diseases and need to wash their hands before handling?

a) Yes b) No

Q16.Are thorough washing and cleaning of fruits and vegetables safe for human consumption?

a) Yes b) No

Q17. Does thorough washing and cleaning of fruits in clean water with good cleaning agent help to maintain the quality and quantity of products?

a) Yes b) No

Q18. Can beards, long finger nails, ornaments spoil and contaminate food products with food borne microbes?

a) Yes b) No

Q19. Can raw vegetables and fruits not be cut by the same cutting, boards, choppers and knifes?

a) Yes b) No

Q20. Is periodic medical check-up essential for food handlers?

a) Yes b) No

III. Practice questions related to food safety

Q21. Do food handlers wear gloves while handling food products?

a) Yes b) No

Q22. Are good quality water and cleaning agents used to wash hands?

a) Yes b) No

Q23. Do you wash hands after using rest room?

a) Yes b) No

Q24.Are food handlers advised not to work when they have diarrhoea, lesions, boils, burn etc.?

a) Yes b) No

Q25.Are food handlers allowed not to work with long nails, untied hair?

a) Yes b) No

Q26. Are processed fruits and vegetables used in correct temperature?

a) Yes b) No

Q27. Are the vegetables and fruits washed thoroughly before processing?

a) Yes b) No

Q28. Are proper containers and packaging materials used for distribution?

a) Yes b) No

Q29. Are suitable soaps solutions used to wash fruits and vegetables?

a) Yes b) No

IV. Knowledge related questions on Hazard Analysis Critical Control Point

Q30. Is HACCP an effective system for all food industries?

a) Yes b) No

Q31. Are qualified staff need for training in food safety and hygiene?

a) Yes b) No

Q32. Are physical, chemical and microbiological hazards included in HACCP?

a) Yes b) No

Q33. Is it essential to keep track of and to record every step of food production in HACCP System?

a) Yes b) No

Q34. Can HACCP identify possible hazards and control / eliminate the hazards?

a) Yes b) No

Q35. Can proper training programmes ensures hygienic environment?

a) Yes b) No

Q36. Can good manufacturing processes minimize the risk of food contamination?

a) Yes b) No

Q37. Are the food safety management system certification programs are on the basis of HACCP?

a) Yes b) No

V. Attitude based question on HACCP

Q38. Is it essential to have expertise in evaluation of the hazards?

a) Yes b) No

Q39.Can physical, chemical and biological hazards contaminate the food products?

a) Yes b) No

Q40. Can the use of specific temperature, pH, time and major procedure identify the preventive measures?

a) Yes b) No

Q41.Are continuous monitoring of the control point essential to maintain this standard of the products?

a) Yes b) No

Q42. Are records needed to show the critical limits and the system is in control?

a) Yes b) No

VI. Practice questions related on HACCP

Q43. Are HACCP team members involved conduct a hazard analysis for each step to identity threats to human health?

a) Yes b) No

Q44. Can biological hazards living on organisms that can make food unsafe for human consumption?

a) Yes b) No

Q45. Are harmful chemicals associated with chronic and acute health issues?

a) Yes b) No

Q46. Can physical hazards of a food that cause illness to the human consumption of foods?

a) Yes b) No

VII Knowledge questions related to cross contamination of foods

Q47. Can washing hands before handling fruits and vegetables will help to prevent food contamination?

a) Yes b) No

Q48.Can germs and bacteria easily spread from ready to eat foods?

a) Yes b) No

Q49. Can Proper storage temperature and time help to prevent food contamination?

a) Yes b) No

Q50. Do you use different containers for different foods while handling foods?

a) Yes b) No

Q51. Can clean water and cleaning agents be helpful to prevent food spoilage, contamination?

a) Yes b) No

Q52. Are people, animals, raw foods the main sources of contamination in processed foods?

a) Yes b) No

Q53. Are hands, cloths, equipments food and hand contact surface vehicles and routes of contamination?

a) Yes b) No

Q54. Are raw and cooked foods kept separate to prevent cross contamination?

a) Yes b) No

VIII. Attitude questions related to cross contamination of foods

Q55. Are well cooked foods free of contamination?

a) Yes b) No

Q56. Can proper hand hygiene prevent food borne diseases?

a) Yes b) No

Q57. Are the foods kept closed or covered properly after cleaning?

a) Yes b) No

Q58. Cans, jars and containers of foods are also closed or covered?

a) Yes b) No

Q59.Is it necessary to check the temperature of refrigerators and freezers periodically to reduce the risk of contamination

a) Yes b) No

Q60. Do you use thermometer to check the temperature and keep the fridge temperature below 5℃?

a) Yes b) No

Q61.Do you use gloves if you have abrasions or cuts on their hands?

a) Yes b) No

Q62. Are all food items covered to avoid food contamination?

a) Yes b) No

XI Practice questions related to cross contamination of foods

Q63. Are Defrosted foods refrozen again?

a) Yes b) No

Q64. Are the worktops, knives, utensils washed properly?

a) Yes b) No

Q65. Are the dish cloths washed periodically?

a) Yes b) No

Q66. Are the used chopping and cutting boards separated and properly sanitized to prevent cross contamination?

a) Yes b) No

Q67. Are the raw food commodities stored on the bottom shelf of refrigerators or freezer?

a) Yes b) No

Q68. Is the health status of the workers assessed before employment?

a) Yes b) No

Q69. Are the finger rings and watch removed to reduce the risk of contamination during contamination?

a) Yes b) No

Q70.Are the refrigerators and deep freezers kept free from objectionable odour?

a) Yes b) No

X Knowledge questions related to Good Handling Practices

Q71. Is poor quality of water is the potential source of contamination and vehicle of spreading contamination?

a) Yes b) No

Q72. Does contact of dirty water with fresh produce indicates the potential for pathogen contamination?

a) Yes b) No

Q73. Can good handling practices control or minimise microbial contamination from processing water?

a) Yes b) No

Q74. Can contaminated hands transmit infectious diseases?

a) Yes b) No

Q75. Is hand washing with warm water more effective than cold water?

a) Yes b) No

Q76. Are Thorough scrubbing, rinsing and drying of the hands important aspects considered for GHP?

a) Yes b) No

Q77. Are common or shared towels shared for hand washing?

a) Yes b) No

Q78. Are hand washing stations well equipped with basin, clean water, soap solution hand drying devices, waste containers etc.

a) Yes b) No

Q79. Are toilet and rest room need to be properly maintained?

a) Yes b) No

XI Attitude questions related to good handling practices

Q80. Does Consumers have the right to expect safe, hygienically prepared and good quality food?

a) Yes b) No

Q81. Does handling of food produce require care to prevent the hazards?

a) Yes b) No

Q82. Are Good hygiene practices set of requirements to prevent contamination of food?

a) Yes b) No

Q83.Is good handling practices are important component to provide quality and safe food to the consumers

a) Yes b) No

Q84.Are Good environmental hygiene and good hygiene practices followed in food industries?

a) Yes b) No

Q85. Is proper and suitable transport are essential for distribution of food in good condition?

a) Yes b) No

Q86. Is proper personal hygiene considered for good handling practices?

a) Yes b) No

Q87. Are cleansing, maintenance and personal hygiene important factors consider for GHP

a) Yes b) No

XII Practice questions related to good handling practices

Q88. Is training an important aspect of GHP?

a) Yes b) No

Q89. Is cleaning the machinery and equipments, utensils etc considered for GHP?

a) Yes b) No

Q90. Are food products packed, stored and transported on the basis of food safety regulation and standards?

a) Yes b) No

Q91. Do you wash your hands prior entry in the production unit?

a) Yes b) No

Q92. Is safe water i used in preparation and also cleaning process?

a) Yes b) No

Q93. Is good handling practice for food safety and hygiene important to safeguard consumers health and reputation of food business

a) Yes b) No

Q94. Are the food ingredients purchased from licenced / standard suppliers?

a) Yes b) No

Q95. Are the food commodities checked to remove unwanted substances?

a) Yes b) No

Q96.Are the refrigerators and freezers kept clean and free from spills?

a) Yes b) No

Q97.Are the refrigerator over stacked and opened frequently?

a) Yes b) No

Q98. Are the opened, canned foods stored in refrigerator?

a) Yes b) No

Q99. Do you use tongs or spoons to pick up food?

a) Yes b) No

Q100.Are the foods properly evaluated in the sensory laboratory?

a) Yes b) No

XII. Knowledge questions related to personal hygiene

Q101. Are your hands washed and dried thoroughly and frequently during handling of foods?

a) Yes b) No

Q102 Is smoking, chewing gums, spitting eating allowed while food handling?

a) Yes b) No

Q103. Is coughing or sneezing over food or where the food preparation and storage is being carried out allowed?

a) Yes b) No

Q104 Do you wear clean protective clothing like apron, gloves, masks, while working in the processing unit?

a) Yes b) No

Q105. Do you keep personal belongings like mobile phone, rings, watch etc. away from food preparation and storage units?

a) Yes b) No

Q106. Are the hair tied, nail kept short without nail polish because it will chip into the food

a) Yes b) No

Q107. Are the cuts, wounds, boils, burns covered with proper waterproof bandages

a) Yes b) No

Q108. Are the hands washed after going to toilet blowing nose, handling waste / garbage , smoking etc.

a) Yes b) No

XIII .Attitude questions related to personal hygiene

Q109. Are the food handlers aware of food borne infections like typhoid, diarrhoea?

a) Yes b) No

Q110.Are the wounds like cuts, burns covered?

a) Yes b) No

Q111.Are the finger nails kept short, smooth, well -shaped?

a) Yes b) No

Q112. Is smoking not permitted inside the industries?

a) Yes b) No

Q113. Are the Hair kept covered with cap?

a) Yes b) No

Q114.Are the foods tasted using spoon /spatula etc.?

a) Yes b) No

Q115. Is Eye Care considered important in food industry?

a) Yes b) No

Q116. Are the hands washed periodically to avoid cross contamination?

a) Yes b) No

Q117. Are Jewellery or finger rings allowed?

a) Yes b) No

Q118.Is attention given to feet and foot wares to avoid stress and strain?

a) Yes b) No

Q119. Is nose picking or fingering the nose not allowed?

a) Yes b) No

Q120. Are protective clothing kept clean and appropriate uniform worn?

a) Yes b) No

Q121. Are regular medical health check -up arranged for food handlers?

a) Yes b) No

Q122.Are adequate rest rooms and locker facilities available for food handlers?

a) Yes b) No

Q123. Are recreation and exercise encouraged?

a) Yes b) No

Q124. Are nutritious foods provided for the food handlers?

a) Yes b) No

XIV Practice questions related to personal hygiene

Q125.Do the food handlers take bath before entering into the processing units?

a) Yes b) No

Q.126. Are there frequent cleaning of work spots, floors, work unit with disinfects

a) Yes b) No

Q127. Do the health inspectors and food safety officials visit to the processing unit?

a) Yes b) No

Q128. Is first aid available in case of emergencies for the food handlers?

a) Yes b) No

Q129.Is proper training needed for the food handlers regarding storage time, temperature and quality of foods

a) Yes b) No

XV Knowledge questions related on infrastructural facilities

Q130. Are all processing and storage areas must be kept clean and tidy?

a) Yes b) No

Q131. Are floors are kept clear to allow access by food handlers and vehicles?

a) Yes b) No

Q132. Are the waste products and food products cleared from floor or work top quickly?

a) Yes b) No

Q133. Are the processed units, floors, walls and roofing have periodic washing and cleaning?

a) Yes b) No

Q134. Are the windows, doors, shelves cleaned to remove the dirt in order prevent contamination?

a) Yes b) No

Q135. Are the drainage cleaned properly to remove the accumulated waste?

a) Yes b) No

Q136. Are the waste materials and waste products placed in waste bins for easy disposal?

a) Yes b) No

Q137.Are the waste bins are emptied frequently?

a) Yes b) No

Q138. Is there proper water facilities available in the processing unit?

a) Yes b) No

Q139. Are the walls and floors properly titled and cleaned?

a) Yes b) No

Q140. Are the ceilings properly maintained?

a) Yes b) No

Q141. Did the Sinks had hot and cold running water?

a) Yes b) No

Q142. Are the overhead pipes free from leakages and well insulated?

a) Yes b) No

Q143. Are the water or ice purchased or available in the same place?

a) Yes b) No

Q144.Is electricity –heavy power line used?

a) Yes b) No

Q145.Are fuel – LPG Gas line, cylinders used properly?

a) Yes b) No

XVI Attitude questions related to infrastructural facilities

Q146. Do food handlers needed to have healthy and safe environment in work spot to produce the good products?

a) Yes b) No

Q147. A safe and clean environment increases productivity and profits

a) Yes b) No

Q148.. Food handlers should be trained in good safety habits like keep all areas clean and dry?

a) Yes b) No

Q149. Use of proper protective clothing, gloves, and slippers helped to prevent accidents in the work spots

a) Yes b) No

Q150 Are the operational instructions on equipments help to maintain the good conditions?

a) Yes b) No

Q151. Water quality and standard need to be marked for prevention of contamination?

a) Yes b) No

Q152. It is advisable to have pest control for safety and personal hygiene

a) Yes b) No

Q153. Are there proper ventilation and lighting for effective production and profits?

a) Yes b) No

Q154 Are the furniture, chairs and tables clean and swept or dusted systematically?

a) Yes b) No

Q155. Are the equipments or dishes with a dried residue soaked before washing?

a) Yes b) No

XVII Practice questions related to infrastructural facilities

Q156. Do infrastructural facilities have direct impact on food safety?

a) Yes b) No

Q157.Is production unit away from pest infestation animal, waste products, chemicals?

a) Yes b) No

Q158.. Is internal design, structure, plan of the food preemies and equipments planned in clear convenience and perfect manner?

a) Yes b) No

Q159. Is the water quality, pipes, storage and distribution perfect without having any contamination?

a) Yes b) No

Q160. Are the ventilation system, air filters, exhaust fans must be properly constructed and maintained for easy cleaning?

a) Yes b) No

Q161.Is the disposal of waste products, sewage and drainage system constructed perfectly which do not affect the quality of produce?

a) Yes b) No

Q162. Are the cold storage and deep freezing facilities used to maintain the quality of products produced?

a) Yes b) No

Q163. Are separate areas for raw and processed products, packed products, cleaning agents and essential maintained carefully?

a) Yes b) No

Q164.Are the receiving area kept clean and neat?

a) Yes b) No

Q165 Are the food and supplies stored properly?

a) Yes b) No

Q166.Are the storage place and floor kept clean and dry?

a) Yes b) No

Q167.Is the first in first out policy observed in the processing unit?

a) Yes b) No

XVIII. Knowledge questions related to packaging, labelling and transportation

Q168. Packaging of food is the covering to protect food from quality and quantity spoilage damage, contaminating, pest attacks?

a) Yes b) No

Q 169 Packaging is labelled with nutrition information?

a) Yes b) No

Q170. Are different types of package materials are available to pack the food products

a) Yes b) No

Q171. Are packaged foods are identified with label text and content?

a) Yes b) No

Q172. Advisable to use reuse or recycle packaging materials?

a) Yes b) No

Q173. Cling films are useful to stop drying of foods and protecting from contamination?

a) Yes b) No

Q174. Food labelling is a communication between the producer and consumers?

a) Yes b) No

Q175. Expired products are discarded and used for dispatching process?

a) Yes b) No

Q176. Vehicles used to transport foods must be maintained in good conditions and kept clean

a) Yes b) No

Q177.Are the food perfectly protected during transport?

a) Yes b) No

XIX Attitude questions related to packaging, labelling and transportation

Q178. Food packaging is the most important part of food processing for distribution?

a) Yes b) No

Q179. Food packaging helps to protect and extend the shelf life.?

a) Yes b) No

Q180. Food packaging is helpful to know about the nutritional content and shelf life of the products?

a) Yes b) No

Q181. Food labelling helps the consumers to prevent unnecessary food borne diseases and other allergic conditions?

a) Yes b) No

Q182. Vehicles and storage containers for transferring food should be in the state of clean and good condition?

a) Yes b) No

Q183.Are the foods adequately protected from any other external contamination during transportation?

a) Yes b) No

XX Practice questions related to packaging, labelling and transportation

Q184. Does proper packaging preserves the quality of foods and attracts the customers?

a) Yes b) No

Q185. Customers like to judge the food quality from the packaging?

a) Yes b) No

Q186. Packaging is uniquely designed to pack and protect foods from external hazards?

a) Yes b) No

Q187. Packed foods are free from contamination and enhance the shelf life of the food products?

a) Yes b) No

Q188. Proper labelling of food products is a great market tool?

a) Yes b) No

Q189. Proper packaging and labelling help the customers to remember and purchase the products?

a) Yes b) No

Q190.Labelling builds brand recognition in the market?

a) Yes b) No

Q191. Proper transportation of perishable food products fulfil the customer demands?

a) Yes b) No

Q192. Transportation ties farms, retailers, restaurants, packers, processers and distributors

a) Yes b) No

Q193.Transportation ensures to retain the quality and reduce the chance of getting external hazards until it reaches the destination

a) Yes b) No

Q194.Do you check the date of manufacture/ expiry for packed food item?

a) Yes b) No

XXI. Training of Food Handlers

Q195. Are all the people working in food processing Unit well trained?

a) Yes b) No

Q196. Did your organization have any training before regarding food safety?

a) Yes b) No

Q197. What were the topics covered in that training?

Q198. During the training was there any demonstration regarding proper hand washing techniques?

a) Yes b) No

Q199. Were you given any certificate after finishing this training?

a. Yes b. No

Q200. Are there internal audit done periodically?

a. Yes b. No

Q201. Do you conduct awareness session or lectures on personal hygiene for your employees?

a. Yes b. No

Q202. Do you keep awards or incentives for your employees for maintaining proper hygiene and sanitation in the processing Unit?

a. Yes b. No

Thank you for your valuable time and information.

Date:- Signature of the Participant

Annexure III

Procedures

Determination of Acidity

I. Materials:

Phenolphthalein indicator

Burette

Burette clamp and stand

Weighing balance

Graduated cylinder

Beakers, Conical flask

0.005N NaOH solution

II. Procedure:

1. Take 1gm sample into a 250 ml conical flask
2. Add 100 ml of Distilled .water.
3. Add 3 to 4 drops of Phenolphthalein indicator
4. Titrate the sample with 0.005 N NaOH
5. In end point, record the milliliters of NaOH used.
6. Calculate the acidity using the following formula:

$$\% \text{ acidity} = \frac{\text{ml of NaOH used} \times \text{Normality of NaOH} \times \text{milliequivalent factor} \times 100}{\text{Weight of sample in gm}}$$

Reference: FSSAI/AOAC 18th Edition

Annexure IV

Determination of moisture:

- Weigh accurately about 2-5 gm of sample in a tarred aluminum dish.
- Dry in an air oven at 100 ±2° C for 5 to 6 hours. Cool in desiccator and weigh. Dry again for 30 minutes and cool in a desiccator and weigh.
- Repeat the process of heating and cooling in a desiccator until the difference in two successive weighing is less than 1 mg.
- Record the lowest weight. Carry out the determination in duplicate.

Calculation :

$$\text{Moisture (\%)} = \frac{(W1 - W2)}{(W1 - W)} \times 100$$

Where, W = Weight in gms of Aluminum dish. W1 = Weight in gms, of Aluminum dish + sample before drying. W2 = Weight in gms, of Aluminum dish + dried sample.

Ref: FSSAI/AOAC

Annexure V

Determination of the pH

SCOPE:

To determine the pH by electrometric method.

STANDARDS:

- The pH of the standard solution should be 4, 7 and 10.

PROCEDURE:

Instrument Calibration:

- Calibrate the pH meter with the buffer solutions of the required pH
- If the pH meter value and the pH of the buffer solution didn't match each other, adjust the pH meter to show the value matching with that of the buffer.

pH Measurements:

- Remove, clean and dry the electrode after calibration.
- Take aliquot of sample in a beaker and measure the pH directly with the pH meter.
- After measurement remove, clean and dry the electrode, and deep it in storage solution.

Reference: FSSAI/BIS

Annexure VI

Standard operating procedure for Enumeration of Micro-organisms Colony Count Technique at 35°C (TBC)

1. SCOPE

This SOP specifies a horizontal method for the enumeration of microorganisms, by counting the colonies growing in a solid medium after aerobic incubation at 35 °C.

2. REFERENCES IS 5402:2012/ISO 4833:2003, BAM, DGHS Manual (2005)

3. PRINCIPLE

Two poured plates are prepared using a specified culture medium with specified quantity of sample (if liquid) or Initial suspension (If solid) & other pair of plates prepared under same condition with decimal dilution of test sample incubated at **35°C for 48 ± 2 hrs**

4. CULTURE MEDIA AND DILUTION FLUID

4.1 Diluents

0.1% Peptone salt solution – Himedia M1748 Sterilized by autoclaving at 121° C/15 lbs pressure

4.1.1 Initial Suspension/ Food Homogenate

1gm of the test sample (Grind if required) added to 9ml of diluents – 10^{-1}(or)
25gm of the test sample (Grind if required) added to 225 ml of diluents – 10^{-1}
Non viscous liquid measure volumetrically 10 ml sample added to 90ml of diluents- 10^{-1}
Viscous liquid weigh the sample 10± 1 g sample in 90ml of diluents- 10^{-1}

4.1.2 Decimal Dilution

1ml of initial dilution to the 9 ml diluents 10^{-2} , 1ml from 10^{-2} to 9ml diluents 10^{-3}…..10^{-4},10^{-5} accordingly

4.2 Culture Media [Plate Count Agar (PCA)]

4.2.1 Media Preparation: Himedia MO91 - pH 7.0±0.2

Suspend 2.35 grams in 100 ml distilled water. Heat to boiling to dissolve the medium completely. Sterilize by autoclaving at15 lbs pressure (121°C) for 15 minutes. Cool in water bath at 44 °C to 47 °C before use, Mix well before pour into sterile Petri plates.

5. APPARATUS AND GLASSWARE

5.1 Apparatus for dry sterilization (oven) or wet sterilization (autoclave)

5.2 Incubator, capable of operating at 35°C ± 1°C.

5.3 Petri dishes, made of glass or plastic, 90 mm to 100 mm in diameter

5.4 Pipettes, of nominal capacity 1 ml.

5.5 Water bath, capable of operating at 44 °C to 47 °C.

5.6 Colony-counting equipment magnification of about 1,5 X

5.7 pH-meter, having an accuracy of calibration of ± 0,1 pH unit at 25 °C.

5.8 Test tubes, flasks or **bottles,** of appropriate capacity and not greater than 500 ml

6.0 PREPARATION OF TEST SAMPLE

Weigh 1.0 g of Sample crush if required in sterile motor and pistil and dilution made as per procedure (4-4.1.2)

If liquid add 1 ml of sample directly to diluents

Mix using vortex mixture (5 to 10 sec) allow the particles to settle and then transfer

7. PROCEDURE.

7.1 Dilution

As discussed in (4-4.1.2)

7.2 Inoculation

- Take two sterile Petri dishes transfer to each dish, by means of a sterile pipette 1 ml of the test sample (liquid)/ 1 ml of the initial suspension (Solid/Semisolid) ($10^{\square}$dilution).
- Take two other sterile Petri dishes transfer to each dish, by changing the tip 1 ml of the test sample $10^{\square}$dilution for solid /semisolid , 10^{2} dilution for liquid .
- Fallow similar procedure until the required dilution to be plated
- Pour about 12 ml to 15 ml of the plate count agar (5.2) at 44 °C to 47 °C into each Petri dish; carefully mix the inoculum with the medium by rotating the Petri dishes.
- Allow the mixture to solidify by leaving the Petri dishes standing on a cool horizontal surface
- If suspected over growth over lay 4ml of medium

(Note: The time elapsing between the preparation of the initial suspension / dilution and the product is moment the medium poured into the dishes shall not exceed 45 min.)

7.3 Incubation

Invert the prepared dishes and incubate at 35 °C for 48 h $\pm\square$ 2 h. Do not stack the dishes more than six high. Stacks of dishes should be separated from one another and from the walls and top of the incubator.

7.4 Counting of the colonies

Spreading colonies shall be considered as single colonies. If less than one-quarter of the dish is overgrown by spreading- count the colonies on the unaffected part of the dish and calculate the corresponding number of the entire dish. If more than one-quarter of the dish is overgrown by spreading discard the count.

8. EXPRESSION OF RESULTS

8.1 Method of calculation general case (counting of total colonies or typical colonies)

The number *N* of microorganisms present in the test sample per ml (liquid products) or

per gram (other Products).

$$N = \frac{\sum C}{V \times 1.1 \times d}$$

Where

$\sum C$ is the sum of the colonies counted on the two dishes retained from two successive dilutions, at least one of which contains a minimum of 10 colonies
V is the volume of inoculum placed in each dish, in ml
d is the dilution corresponding to the first dilution retained [*d* 1 when the undiluted liquid product(test sample) is retained].
Round off the calculated result to two significant figures

8.2 Method of calculation: low counts

8.2.1 Less than 10 colonies

The Estimated number *x* of microorganisms present in the test sample per ml (liquid products) or per gram (other Products).

$$N = \frac{\sum C}{[(1 \times n_1) + (0.1 \times n_2) \times (d)}$$

8.2.2 10 to 250 Colonies

The Number *N* of microorganisms present in the test sample per ml (liquid products) or per gram (other Products).

$$N = \frac{\sum C}{[(1 \times n_1) + (0.1 \times n_2) \times (d)}$$

where:
N = Number of colonies per ml or g of product

∑ C = Sum of all colonies on all plates counted
n_1 = Number of plates in first dilution counted
n_2 = Number of plates in second dilution counted
d = Dilution from which the first counts were obtained

8.2.3 If the dish containing the test sample does not contain any colonies

Less than 1/*d* microorganisms per millilitre" (liquid products) or

Less than 1/*d* microorganisms per gram" (other products)

Where *d* is the dilution factor of the initial suspension or of the first dilution inoculated or retained (*d* = 1 where the directly inoculated test sample of liquid product is retained).

8.2.4 If the dish containing the test sample contain more than 250 colonies

Case	Criteria	Formula	Reporting
Less than 10	Estimated number of M.org	$N = \frac{\sum C}{[(1 \times n_1) + (0.1 \times n_2) \times (d)}$	<10 cfu/gm/ml
General(10-250) N	Number of M.org present	$N = \frac{\sum C}{[(1 \times n_1) + (0.1 \times n_2) \times (d)}$	1.1-9.9 X 10x/ Whole number cfu /g (or) /mL
No colonies	M.org /g/ml	-	<1
More than 250 colonies	Number of M.org present	-	Too numerous to count TNTC

9. REPEATABILITY

Should not be greater than the repeatability limit,

r = □0.25, log10 per ml

r = 1.8 normal scale per ml

10. REPRODUCIBILITY

Should not be greater than Reproducibility limit

R = 0,45 log10 per ml

R = 2.0 normal scale per ml

Annexure VII

Standard operating procedure for Total fungal count (yeast and Mold count) by Colony Count Technique at 25°C

1. SCOPE

This standard specifies the method for viable fungal count in products intended for human consumption or feeding of animals by means of the colony count technique at 25°C.

2. REFERENCES IS 5403:1999 Reaffirmed 2005

3. PRINCIPLE

Two poured plates are prepared using a specified culture medium with specified quantity of sample (if liquid) or Initial suspension (If solid) & other pair of plates prepared under same condition with decimal dilution of test sample incubated aerobically at **25°C for 3, 4 or 5 days.**

4. CULTURE MEDIA AND DILUTION FLUID

4.1 Diluents

0.1% Peptone salt solution – Himedia M1748 Sterilized by autoclaving at 121° C/15 lbs pressure

4.1.1 Initial Suspension/ Food Homogenate

1gm of the test sample (Grind if required) added to 9ml of diluents – 10^{-1}(or)
25gm of the test sample (Grind if required) added to 225 ml of diluents – 10^{-1}
Non viscous liquid measure volumetrically 10 ml sample added to 90ml of diluents- 10^{-1}
Viscous liquid weigh the sample 10 $\pm$ 1 g sample in 90ml of diluents- 10^{-1}

4.1.2 Decimal Dilution

1ml of initial dilution to the 9 ml diluents 10^{-2} , 1ml from 10^{-2} to 9ml diluents 10^{-3}…..10^{-4},10^{-5} accordingly

4.2 Culture Media [Chloramphenicol Yeast Glucose Agar]

4.2.1 Media Preparation: Himedia M1008 - pH 6.6 ±0.2

Suspend 4.0 grams in 100 ml distilled water. Heat to boiling to dissolve the medium completely. Sterilize by autoclaving at15 lbs pressure (121°C) for 15 minutes. Cool in water bath at 44 °C to 47 °C before use, Mix well before pour into sterile Petri plates.

5. APPARATUS AND GLASSWARE

5.1 Apparatus for dry sterilization (oven) or wet sterilization (autoclave)

5.2 Incubator, capable of operating at 25°C ± 1°C.

5.3 Petri dishes, made of glass or plastic, 90 mm to 100 mm in diameter

5.4 Pipettes, of nominal capacity 10 ml &1 ml.

5.5 Water bath, capable of operating at 45 °C ± 1°C.

5.6 Colony-counting equipment magnification of about 1,5 X

5.7 pH-meter, having an accuracy of calibration of ± 0,1 pH unit at 25 °C.

5.8 Test tubes, flasks or **bottles,** of appropriate capacity and not greater than 500 ml

6.0 PREPARATION OF TEST SAMPLE

Food Homogenate prepared as per procedure 4.1.1

Mix using vortex mixture (5 to 10 sec) allow the particles to settle and then transfer

7. PROCEDURE.

7.1 Dilution

As discussed in (4-4.1.2)

7.2 Inoculation

- Take two sterile Petri dishes transfer to each dish, by means of a sterile pipette 1 ml of the test sample from 10^{-2} dilution or desired
- Take two other sterile Petri dishes transfer to each dish, by changing the tip 1 ml of the test sample from the next dilution.
- Fallow similar procedure until the required dilution to be plated
- Pour about 15 ml of the Chloramphenicol Yeast Glucose Agar (4.2) at 45 °± 1°C into each Petri dish; carefully mix the inoculum with the medium by rotating the Petri dishes.
- Allow the mixture to solidify by leaving the Petri dishes standing on a cool horizontal surface

(Note: The time elapsing between the preparation of the initial suspension / dilution and the product is moment the medium poured into the dishes shall not exceed 15 min.)

7.3 Incubation

Invert the prepared dishes and incubate at 25 °C ±□1 °C for 3,4,5 Days. Do not stack the dishes more than six high. Stacks of dishes should be separated from one another and from the walls and top of the incubator.

7.4 Interpretation

Count the colonies on each plate after 3, 4 and 5 days of incubation. After 5 days, retain those plates containing fewer than 150 colonies. If over growth observed count the number of colonies at 3^{rd} & 4^{th}day and mention the incubation time in report. It is advisable to examine the plates at the end of three days for yeast colonies as they are likely to be overgrown by mold growth. If only yeast counts are required, add

0.25 percent of sterile sodium propionate solution to the plate at the time of pouring to inhibit the growth of molds.

7.4 Counting of the colonies

Count the colonies using colony counter after required incubation

Use counts from plates containing fewer than, 150 colonies.

8. EXPRESSION OF RESULTS

8.1 Method of calculation

The number *N* of microorganisms present in the test sample per ml (liquid products) or

per gram (other Products).

$$N = \frac{\sum C}{[(1 \times n_1) + (0.1 \times n_2) \times (d)}$$

Where

. ∑C= the sum of the colonies counted on all the plates;

nl = the number of plates counted in the first dilution;

nl = the number of plates counted in the second dilution

d= the dilution from which the first counts were obtained (for example, 10-1).

Round the result obtained to two significant figures.

The result shall be expressed as a number between 1.0 and *9.9* multiplied by 10x, where x is the appropriate power of 10.

Annexure VIII

Training Manual on Food Safety and Safe handling practices of Food Handlers

Food is a perishable item. If not handled properly, it spoils quickly and allows disease-causing microorganisms to grow. Infections are caused by various microorganisms that we cannot see; they can only be seen under a microscope.

All food handlers must understand their role and responsibility in food contamination prevention. Food handlers must be knowledgeable and skilled in food processing/manufacturing, packing, storing, and serving. Food hygiene and safety, as well as personal hygiene requirements, must be taught to all food handlers. Evaluations of efficacy and efficiency on a regular basis.

Food handlers should be aware of the link between malnutrition and infection and work to break the vicious cycle of malnutrition and infection. Food not only causes infection, but it can also spoil if not properly stored and handled. Food spoilage renders it unfit for consumption and results in waste.

Food safety is the assurance that food will not cause harm to the consumer when prepared and/or consumed as directed. Food quality is the sum of a product's features and characteristics that bear on its ability to meet stated or implied needs.

I. Food safety and standards

Food safety can be assessed by examining food items for pathogenic microbial load, chemical contaminant content, or the presence of physical foreign matter in the produce.

Standards serve as common frames of reference for product definition. Food standards specify specific criteria to ensure that products fulfil their stated purposes and meet consumers' legitimate expectations**.** Standards are thus useful to consumers, the food industry, and regulatory bodies. Specifications for product appearance, quality, nutritional value, and product safety may be included in food standards, labelling, packaging, analytical methods, and sampling.

Grading is based on certain characteristics, which are generally related to external appearance attributes such as product size, shape, and colorization. Typically,

grading does not imply food safety criteria. Grading standards are developed and adopted by private industry or national bodies, and they may be required for export.

Fresh produce is inspected by governmental agencies or other authorised bodies to ensure that it complies with quality, wholesomeness, and food safety regulations, as well as specific mandatory requirements within the supply chain. Inspections are usually required and involve official authorities.

Good food handling practises can help us achieve food safety.

- Choosing high-quality, wholesome food from reputable sources and avoiding contaminated or poisonous food or food from untrustworthy sources.
- Keeping food free of contaminants such as harmful microorganisms, poisons, allergens, and foreign bodies.
- Preventing bacteria from multiplying to the point where they cause illness in consumers or early spoilage of foods, as well as a reduction in nutritional value.
- Eliminating microorganisms in food or the food environment.
- Throwing out or removing unsafe, unfit, or contaminated foods.

Fresh fruits and vegetables are highly perishable commodities that can spoil or deteriorate during produce handling from the producer to the final retailer**.** Fresh produce spoilage and deterioration frequently lead to rapid decay and, as a result, product loss for human consumption.

Signs of Spoilage in Food

When purchasing food, we should choose clean, wholesome food that is at the appropriate stage of maturity. Food should only be purchased from reputable licenced suppliers. Some of the most common signs of spoilage in foods that we consume on a regular basis are listed below.

Fruits and vegetables

- Discoloration and mushy texture, as well as the presence of mould
- The leaves have become wilted and limp.
- The presence of insects or worms
- Damaged or bruised skin or peel

- The potatoes are sprouted and green.
- Overripe and over mature fruits and vegetables

II. Hazards present in foods

Hazards and the risks that they may pose to consumer health must be fully understood in order to develop proper production practises and methods. Understanding the agents that affect fresh fruit and vegetable safety and quality allows for the mm of practises to reduce potential negative impacts. The most common potential risks associated with fresh fruits and vegetables and informs consumers about the role of fresh produce in the transmission of foodborne diseases and their impact on consumer health.

Farming, harvesting, post-harvest treatment, and processing are all part of the process of producing fresh fruits and vegetables. Specific hazards exist within all of these activities that affect product safety and quality, potentially posing a health risk to the consumer.

To reduce this risk and improve product safety, it is necessary to first assess the potential hazards in the manufacturing environment. Once the potential sources of produce contamination or other hazards have been identified, practises to control, reduce, or eliminate them can be implemented.

Biological hazards

Biological hazards in fresh produce are caused by microorganisms such as bacteria, fungi (yeasts and moulds), protozoans, viruses, and helminths (worms), all of which are also known as microbes. In some cases, pests introduce microbial contamination indirectly. Pests are any animals of public health importance, such as rodents, birds, and insects (e.g., cockroaches, flies, and their larvae), that may carry pathogens that can contaminate food.

Raw produce may contain microorganisms capable of causing human disease. As a result of soil and environmental contaminants, they can become a part of the fruit or vegetable microflora. In other cases, they are introduced into or on food as a result of poor agricultural production or post-harvest handling practises.

Bacteria

Bacteria are ubiquitous in our environment and pose a common food safety risk. Pathogenic bacteria have the potential to contaminate fruits and vegetables at all stages of production. The number of individual bacteria required to cause actual human disease varies depending on the type of organism as well as the host's age and condition. If the conditions are favourable, the generation time of bacteria can be as short as 15 –30 minutes, allowing the bacterial population to reproduce very quickly. Under ideal conditions, a single cell could produce a population of over one million cells in less than ten hours.

Basic growth requirements of microorganisms

Microorganisms, like humans, require specific conditions for growth and multiplication. For microbes, the terms growth and multiplication are interchangeable. Growth results in an increase in the number of microbes.

The following are the fundamental growth requirements:

Food-Microorganisms use our food to obtain nutrients for growth. If other growth conditions are favourable, they grow rapidly in protein-rich foods such as milk, meat, poultry, and leftover moist cooked food.

Moisture–Microorganisms require moisture to grow. Food that has had moisture removed from it by drying or dehydration, such as papads and dried beans, will not spoil. Microorganism growth is dependent not only on total moisture but also on available moisture in food, which is water that is not bound to sugar or salt and that microbes can use for growth.

Temperature-Microorganisms thrive in temperatures ranging from 5°C to 63°C. This temperature range is known as the "Danger Zone" because it is hazardous to our health. Multiplication is greatest between 15°C and 49°C and slows towards both ends of the danger zone. They die after a few minutes of being exposed to temperatures above 63°C, and their growth is slowed at temperatures below 5°C. They do not die when food is refrigerated or frozen; instead, they become dormant. Cooking does not kill all microorganisms, and there is a high risk of re-contamination of food. Pathogenic microorganisms or their spores frequently remain in food and multiply rapidly to numbers large enough to cause food-borne illnesses.

Time-Microorganisms require time to multiply to the point where they can contaminate our food. When temperature, food, and moisture conditions are favourable, bacteria multiply through a process known as Binary Fission, dividing into two every 20 minutes.

pH- Most microorganisms thrive best at a pH of 7. Molds and yeast grow in foods with an acidic pH of4, whereas bacteria do not. This is why acids like acetic acid and citric acid are used to preserve food because they can control microbial growth.

Osmotic pressure- Bacteria cannot grow in high concentrations of sugar and salt, such as jam and pickle. Moulds and yeasts can grow in high osmotic pressures or high sugar and salt concentrations and spoil such foods.

Viral hazards

Viruses are extremely small organisms that cannot reproduce and multiply outside of a living cell and thus cannot grow on or inside food as bacteria do. Raw fruits and vegetables, on the other hand, may become contaminated by viral particles if they come into contact with contaminated water, soil, dust, or surfaces. If the product is consumed raw, the virus could infect the consumer. Because the infective dose of most viruses is extremely low (as few as 10 viral particles), contamination prevention is critical.

Parasitic hazards

Parasites are organisms that feed and are protected by other living organisms known as hosts. Parasites come in a variety of sizes and shapes, ranging from tiny single-celled organisms (protozoa) to larger multicellular worms (e.g. helminths). They can be passed down from animals to humans, humans to humans, or humans to animals. Several parasites have emerged as significant causative agents of water borne diseases. Parasites live and reproduce within infected human and animal hosts' tissues and organs, and are frequently excreted in faeces. They can be passed from host to host through the consumption of infected food or water, or through oral contact with infected surfaces.

Chemical hazards

When chemicals and single substances contaminate fresh fruits and vegetables in significant concentrations, they can pose a serious health risk to the consumer. Contamination can be caused by both naturally occurring substances or synthetic chemicals that are added or present during agricultural production, post-harvest treatment, and further processing, such as pesticides (pesticides and fertilizers). Compounds and elements that are toxic (e.g. lead, zinc, cadmium, mercury, arsenic, cyanide)

Physical hazards

Physical hazards such as glass, wood, stones, and insulation plastic may be introduced as foreign material into fresh fruits and vegetables at various points along the production chain.

III. Cross Contamination leading to foodborne diseases

Cross contamination is the transfer of pathogens from contaminated food (usually raw) to ready-to-eat foods through direct, drip, or indirect contact with a vehicle such as hands, a cloth, or cutting boards and knives. Cross contamination can occur at any stage of processing, transportation, storage, distribution, or consumption.

Cross contamination can occur as a result of any of the following.

• Raw food is placed on the surface, followed by cooked food on the same surface.

• Food-to-food exchange

• Transfer from one surface to another

• Transfer of food to the surface

• Failure to wash hands after handling each item.

Diseases caused by agents that enter the body through food ingestion and are typically infectious or toxic in nature. The causing agents (hazards) can be of various kinds (biological, chemical, physical).

Existing data on foodborne disease outbreaks and prevalence show that pathogenic microorganisms cause nearly half of all foodborne diseases. Bacteria are the most common microbial cause of foodborne disease worldwide, with viruses and parasites

playing minor roles. Chemical substances, such as naturally occurring toxins (e.g., toxins from fungi and algae) or synthetic substances, are the other major cause of all incidents (e.g. agrochemicals). Physically induced foodborne illnesses are uncommon. The fact that fresh produce is frequently consumed raw, with no intervention to reduce, control, or eliminate pathogens prior to consumption, increases its potential as a source of foodborne illness. However, foodborne illnesses caused entirely by fresh produce account for only a small percentage of all foodborne diseases, estimated to be 20%.

Foodborne diseases are a common and growing public health issue in both developed and developing countries. Despite recent significant efforts by governments and the food industry to implement food safety measures to prevent foodborne diseases, they are still considered emerging today. The contamination of fresh food and drinking water is responsible for a large proportion of these cases.

The impact of foodborne disease on human health is highly dependent on the constitution of those affected. Infants, children, the elderly, pregnant women, and people with compromised immune systems (e.g., HIV) are the most vulnerable, and foodborne disease can have serious consequences, including death.

Pathogens or disease-causing agents enter food via

- Food (contaminated food and drink infected by food handler or from the farm, diseased animals and their products)
- Fingernails (unwashed hands and dirty, grown fingernails)
- Faeces (sewage contaminated food, water and unwashed hands after using the toilet)
- Fomites (unclean utensils, equipment, door knobs, taps, towels)
- Insects (pests like houseflies, cockroaches, rats, mice)

Microorganism is the causative agent, it is critical to keep these potential sources of contamination under control. Food, fingers, faeces, termites, and flies must all be kept under control to avoid food spoilage and food-borne diseases.

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IV Worker’s Health and Hygiene

Taking care of employees' health boosts productivity and aids in the prevention of produce contamination by microbial pathogens transmitted by sick or injured workers. As a result, maintaining good and stable worker health is critical for food safety and the long-term economic success of operations.

In every fresh produce production operation, proper hygiene procedures are a critical component of food safety. As a result, proper practises must be established and incorporated into hygiene and health training programmes for all employees. The level of knowledge and awareness of employees varies according to their functions, responsibilities, and areas of activity.

The following are important factors to consider when it comes to worker hygiene:

• Accidents and first aid
• Hand washing and personal hygiene
• Dealing with sick employees
• Water consumption.

It is impossible to overstate the importance of food workers clearly understanding and practising proper hygiene. Workers may unintentionally contaminate fresh produce, water supplies, and handling equipment, as well as transmit diseases to co-workers or consumers. Visitors, inspectors, and maintenance workers from outside the facility must also follow proper hygiene practises.

First aid and injuries

• Exposed wounds pose an immediate threat of contamination and must be treated as soon as possible.
• First aid kits for proper injury treatment should be available at all work sites.

Proper hand washing

• Hands should be washed frequently and after any possible contamination.
• Proper washing procedures include applying soap to wet hands, scrubbing the entire hand for at least 20 seconds, rinsing with water, drying with a paper towel, and turning off the knob with a towel.
• Train and test all employees on hand-washing procedures on a regular basis.

Proper personal hygiene

• Bathing or showering on a regular basis, washing hands, and keeping nails clean and short;
• Using toilets, including on field sites;
• Wearing clean cloths and hairnets.

Sick workers

Workers who exhibit symptoms of illness (e.g., diarrhoea, vomiting, dizziness, fever, abdominal cramps) should be assigned to tasks that do not require contact with fresh produce.

• Sick workers should strictly adhere to proper hygiene in order to prevent contamination/transmission.
• Employees should be trained to recognise disease symptoms and report them to supervisors.

V Packing, Storage and Transportation

Packing and storage

Packing facilities that are well-designed and properly operated can help reduce pathogen contamination as well as the chemical and physical hazards associated with packing and storage activities. Failures in facility and system management have the potential to amplify local contamination, widely redistribute pathogens or other contaminants, and introduce new hazards into the manufacturing environment.

Because of specific local needs and the types of commodities handled and processed for shipment, packing and processing facilities may differ in design. Good manufacturing practises are essential regardless of the size of the operation to prevent the physical facility and its equipment from becoming a source of microbial, chemical, and physical contamination and to ensure consistent quality of fresh fruits and vegetables.

Hygienic selection and storage of food

We need to clean and store safe, wholesome food that we purchased from authorized/reliable outlets. Before storing food for later use, clean the packages to remove dust and microbes from the godowns or warehouses. Pests such as rats may be present in such areas, necessitating the cleaning of bottles and cartons

before placing them in the refrigerator or storing them. Fruits such as pineapple and green leafy vegetables may contain inedible portions of food and visible soil that must be removed before storing. Every storage area should be cleaned on a regular basis.

Transportation

Operators and food handlers involved in the transport of fresh produce are encouraged to inspect product transportation at each level of the system, including transportation from the field to the cleaning, cooling, and packing facility, and then to shipment for export or distribution to market terminals. Transporting fresh produce properly reduces the risk of microbial contamination and produce spoilage caused by unsafe transporting practises. To ensure the success of management programmes and proper practises for fresh produce transportation that are designed to deliver safe food to consumers, it is critical to raise active awareness among those involved in produce shipment and transportation.

Packing procedures

• Establish routine cleaning and sanitising programmes for all food contact surfaces;
• Clean and sanitise packing area at the end of each working day to minimise produce damage and maximise accessibility for cleaning and sanitising.

Containers and handling boxes

Containers and boxes should be made of non-toxic materials and built to be easily cleaned; repair or discard damaged containers and handling boxes; always clean pallets, containers, and boxes before use. Separate containers (by specific labelling or colouring) should be used for transporting produce before and after washing.

Storage of packing material

a. Keep the storage area clean, dry, and free of trash, pests, and animals;
b. Keep the storage area separate from areas with hazardous material (e.g., chemicals, compost);
c. Keep unformed or empty containers and packing material off the floor and away from contamination.

Storage of fresh produce

- Adjust and regulate temperature and humidity according to a commodity's specific requirements;
- Store fresh products in a clean location using an organised system based on codes and inventories;
- Keep containers and boxes off the floor and provide enough space in between containers and wall for air circulation and ease of access for cleaning and pest inspections.
- Keep containers and boxes off the floor and leave enough space between them and the wall for air circulation and cleaning and pest inspections.

Proper transport of fresh produce

• Only use containers or trailers that are specifically designed for food transport;
• Before loading, inspect transportation vehicles and trailers for cleanliness and insist on trailer or container clean-out if necessary;
• Transportation units should be dry and free of condensation water;
• Hermetic sealing of transport units is highly recommended to prevent pest access and contamination;
• If a container has previously been used for transport of hazardous commodities such as meat, eggs, or fish, ensure that the container has been thoroughly cleaned and disinfected prior to loading with fruits or vegetables.
• A container should ideally be sanitised after each load.
• Maintain proper temperature to ensure produce quality and safety
• Carefully load produce to minimise damage to produce;
• Ensure that transporters uphold the integrity of the lot identification and traceback system currently in use.
• Make certain that all personnel involved in the loading/unloading process maintain proper hygiene.

Considerations for refrigerated transportation

• Refrigeration and humidity control units should be checked for proper operation prior to each trip;

• Temperature and humidity should be set in accordance with specific commodity requirements;
• Reduce the amount of time between removal from cooling storage and loading into a refrigerated container.
• Proper stacking allows for proper air circulation within the transportation unit;
• Prevents product contamination from condensation water from refrigeration units;
• Maintains temperature and humidity control during transport and records all data
• Provide regular temperature control training to drivers and personnel involved in the loading process.

VI. Waste Management, Cleaning and Sanitation

Waste management

Trash and waste products from fruit and vegetable processing operations may contain microbiological contamination. Decomposing organic matter can spread microorganisms throughout the facility and produce offensive odours, attracting insects and other pests carrying pathogenic organisms. For the daily management of waste and trash in a food processing facility, the following good handling practises should be followed.

Proper trash and waste handling

- Designate a specific confined area well outside the processing facility for the temporary storage of all waste;
- Construct this area to be easily cleaned and to prevent the accumulation of residues and bad odours:
- Place trash and waste containers in convenient locations throughout the facility's operations sectors. They should be clearly labelled and suitable for a tight seal.
- Remove all trash and waste products on a regular basis, and incorporate waste collection procedures into daily cleaning activities;
- Train all staff to ensure that waste collection procedures are correctly followed and handled;
- Separation of organic and inorganic waste material, with proper recycling, is recommended.

Cleaning and sanitation

Strict cleaning and sanitising procedures must be followed in all handling facilities and sectors, with all equipment, machinery, utensils, tools, and containers, to reduce the risk of produce contamination within the processing facility. All surfaces that come into contact with fruits or vegetables during the production process must be cleaned and sanitised on a regular basis.

Cleaning procedures

Cleaning properly entails using both physical methods, such as scrubbing, and chemical methods, such as the application of detergents, to remove dirt, dust, food residues, and other debris from surfaces. These methods can be used individually or in combination.

A detergent is a chemical agent that reduces the surface tension of water, thus helping particles become dislodged from surfaces and suspended in water. By rinsing with water, the particles can be washed away. A good detergent should have complete and rapid solubility, be non-corrosive to metals, feature good moistening action, offer good dispersion or suspension and rinsing properties. A good detergent should have complete and rapid solubility, be non-corrosive to metals, have good moistening action, good dispersion or suspension and rinsing properties, and exhibit germicidal action.

Proper cleaning

Cleaning tools are required for effective cleaning. Cleaning tools, on the other hand, can be a major source of biological hazard if not handled properly:

- Always rinse and sanitise all cleaning tools after use;
- Replace cleaning tools on a regular basis to prevent microbe growth on their surfaces.

Sanitizing procedures

Proper cleaning procedures cannot guarantee the elimination of microorganisms, but they can help to reduce the formation of biofilm. All food contact surfaces must be treated with sanitising agents, also known as disinfectants, to eliminate microorganisms. Proper sanitising or disinfection procedures result in a 99.9% reduction of representative microbe populations.

When choosing a sanitizer for specific food contact surfaces, keep the following factors in mind:

• The type of sanitising equipment and the type of surface being sanitised

• The hardness of the water

• The availability of sanitising equipment;

• The effectiveness of the sanitising agent against specific pathogens

• The effectiveness under practical conditions.

VII. Infrastructural facilities in the processing units

Harmful organisms can infiltrate food service establishments via food, people, unsanitary facilities, unsanitary equipment, disease-carrying pests, and so on.

Food Preparation areas: design and facilities- Premises, equipment, and facilities should be located, designed, and built in such a way that contamination is kept to a minimum. Also, ensures that the design and layout allow for proper maintenance, cleaning, and disinfection while minimising airborne contamination.

Food Establishment: design and facilities-

Depending on the nature of the operations and the risks involved, premises, equipment, and facilities should be located, designed, and built to ensure that contamination is minimised; and design and layout allow for appropriate maintenance, cleaning, and disinfection while minimising airborne contamination.

Kitchen: design and facilities- Surfaces and materials, particularly those in contact with food, must be non-toxic, clean, long-lasting, and simple to maintain. Temperature, humidity, and other controls, such as pest access and harbourage protection, should be available where appropriate.

Drinking water

• Water for worker consumption must be potable and of high quality at all work sites.

• Ensuring workers have free access to proper drinking water prevents diseases and contamination risks.

Sanitary field stations

To reduce the risk of serious microbial produce contamination, workers in the field should have access to proper sanitary facilities. Any insufficient or improperly accessible facility risks contaminating the soil, water, crops, and workers themselves. The following practises should be taken into account:

• Keep toilets at least 400 metres away from crop fields and water sources, and no more than 600 metres away from the work area.

• Connect the toilet to an evacuation or sewage system, and maintain the outlet system on a regular basis.

• Make the facility easily accessible to all employees and allow them to use the restrooms as needed.

• Provide an adequate number of toilets – at least one toilet for every 20 workers of the same gender.

• Sanitation stations must be in good working order and clean. Provide clean water, soap, and paper towels.

Essential sanitary requirements

Location of Food Establishments- Our kitchens or food establishments should be designed and laid out in a way that allows for good food hygiene practises, such as protection against cross-contamination while preparing food. They should usually be kept away from:

• Polluted areas and industrial activities that pose a serious threat of contaminating food

• Flood-prone areas unless adequate safeguards are provided

• Pest-infested areas

• Areas where waste, either solid or liquid, cannot be effectively removed.

Internal structures and fittings

- The surfaces of walls, partitions, and floors should be made of impervious materials that will not have a toxic effect in their intended use; and

- Walls and partitions should have a smooth surface up to a height appropriate for the operation.
- Floors should be built to allow for proper drainage and cleaning; working surfaces that come into direct contact with food should be in good condition, durable, and simple to clean and sanitize.
- There should be no cracks or crevices for dirt or pests to hide in.
- They should be made of smooth, non-absorbent materials that are not affected by food, detergents, or sanitizers.
- Stainless steel table tops or naturally occurring stone platforms built into the wall with sealed edges, such as kadappa, granite, or marble, are recommended.
- Ceilings and overhead fixtures should be built and finished in such a way that dirt, condensation, and particle shedding are minimised.
- Windows should be easy to clean, built to minimise dirt build-up, and, if necessary, fitted with removable and cleanable insect-proof screens.
- Also, the doors that are fixed should be smooth and non-absorbent.

Air quality and ventilation

In all areas, adequate natural or mechanical ventilation is required. Air pollution occurs in overcrowded, poorly ventilated rooms due to an increase in carbon dioxide, increased humidity, and an increase in ambient temperatures, as well as air-borne pathogens and pollutants such as smoke. It causes the following symptoms in our bodies: headache, irritability, poor concentration, loss of appetite, and decreased energy to respiratory infection. Ventilation systems must be designed and built in such a way that air does not flow from contaminated to clean areas, and they must be properly maintained and cleaned. Exhaust fans, chimneys, and ventilation hoods installed over gas ranges and cooking units can keep the air in kitchens free of grease, food odours, cooking fumes, and smoke.

Lighting

Adequate natural or artificial lighting should be maintained to allow us to work in a sanitary manner by making dirt visible and making cleaning easier. It improves food safety and avoids accidents. To avoid eye strain, the light intensity should be

adequate, with no glare or flicker and as little shadow as possible. In addition, all kitchen lighting fixtures should be protected to prevent food contamination.

Maintenance and Sanitation

•Facilities should be designed and built to allow for simple cleaning and sanitation procedures.

• Buildings should be screened with barriers to keep all animals and pests out.

• All windows should be closed or covered with mesh;

• Packing and storage areas should be separated, with different personnel handling each;

• Lights should be covered with protection screens to prevent produce contamination from broken glass;

• All floors should be built with a slight slope to avoid water accumulation in processing areas;

• To prevent water accumulation, all buildings must have a proper, functional sewage system.

General principles for all facilities and equipment

• All packing and storage areas must be kept free of harvest residues, chemicals, and waste materials

• All facility sectors must be cleaned on a regular basis, with all visible debris, dirt, and waste removed

• Comprehensive sanitation standards operating procedures (SSOP) and maintenance programmes should be put in place, as well as integrated pest management (IPM).

• Equipment and machinery in contact with produce should be kept as clean as possible.

• All equipment and utensils should be thoroughly inspected to ensure proper operation and to prevent loose parts from falling off.

• All paint used on machinery, walls, and ceilings must be food processing approved. Painting that has peeled away should be removed and replaced. Rust on metal parts should be removed and further rusting avoided.

• Avoid oil leaks and excessive lubrication. On machinery, only use food-grade oil and lubricants.
• Implement a comprehensive cleaning and maintenance programme for machinery and equipment.

VIII General Requirement for Labelling

Every pre-packaged food shall bear a label containing the information required hereunder, namely a. The particulars of declaration required under these Regulations to be specified on the label shall be in English or Hindi in Devanagari script; provided, however, that nothing herein contained shall preclude the use of any other language in addition to the language required under this Regulation.

b. Pre-packaged food shall not be described or presented on any label or in any labelling manner that is false, misleading, or deceptive, or that is likely to create an incorrect impression about its character in any way**.**

c. Labels on pre-packaged foods must be applied in such a way that they do not come loose from the container.

d. The label's contents must be clear, prominent, indelible, and easily legible by the consumer under normal purchase and use conditions.

e. If the container is wrapped, the wrapper must contain the necessary information, or the label on the container must be easily legible through the outer wrapper and not obscured by it.

f. The licence number shall be displayed on the main display panel in the following format: Labelling of Pre-packaged Foods In addition to the General Labelling requirements stated above, every package of food must bear the following information on the label, namely

• Food name
• Ingredient list in descending order
• Nutritional information
• Specify whether you are a vegetarian or a non-vegetarian.
• Declaration on food additives

• Manufacturer's or packer's full name and address
• Net weight or volume content
• Manufacture / Packing Date
• Identification of the lot, code, or batch
• Expiration Date
• Useful information
• Importer information and country of origin for imported goods

The label's contents must be clear, prominent, indelible, and legible. The following declarations must be included on a food product's label or primary pack.

1. The food's name, which includes the trade name or description on the package. It should be provided in large, clear type that contrasts sharply with the background.
2. The ingredient or ingredient list - The ingredient list must have a proper title, namely "Ingredients," and the ingredients must be listed in descending order of prominence in the product composition.
3. Nutritional information - this must be declared on the label in numerical terms per 100 gm, 100 ml, or per serving of the food. Energy value (kcal), protein (gm), carbohydrate (along with sugar), and fat (gm), saturated fat, trans-fat, minerals and vitamins in metric units, and nutrient for which a claim is made must all be included. When making a claim about the amount or type of fatty acid or the amount of cholesterol, the amount of SFA, MUFA, and PUFA (in gm), trans-fat (in gm), and cholesterol (in mg) must be declared.
4. If food additives are used, the class title of the food additive, as well as the INS number as specified in the rules, must be provided.
5. The vegetarian logo, which consists of a green-filled circle within a square with a green outline, must be declared on the package.
6. Manufacturer's name and address, as well as the complete address of the manufacturing unit/premises
7. Where the manufacturer is not the packer, the packer's name and complete address must be printed on the label.
8. Every Manufacturer and Packer address must include a valid License number, prefixed with: License No.
9. The FSSAI logo should include the Manufacturer License No. The License No. of the company manufacturing unit would be used for products manufactured at company plants. License No. would be the company marketer's License No. and the

manufacturing licence of the manufacturing / packing unit for products manufactured at a third-party location. The name and address of the manufacturing / packing company, as well as the company on whose behalf it is manufactured / packed, must be included on the label for products manufactured / packed at a third party location.

10. The net quantity of the package's contents - the net content must be expressed in standard units of weight or measurement. The space above and below the declaration must be at least twice the height of the numeral, and the space to the right and left must be at least twice the height of the numeral.

11. In the case of a food enriched with a mineral, vitamin, or protein, the amount of such enriched nutrient must be specified.

12. The food's category.

13. If the food is proprietary, the words "proprietary food" should be used.

14. Best Before date - the shelf life must be indicated with the words "BEST BEFORE.... MONTHS FROM PACKAGING / MANUFACTURE" (as appropriate).

15. A distinct batch number beginning with Lot / Batch / Code No.

16. The date/month of manufacture/packaging of the product, as well as the year, must be specified.

17. The retail sale price of the food package must be declared in the following format: "MRP Rs. XX inclusive of all taxes."

18. The name, address, phone number, and, if available, e-mail address of the person or office to be contacted in the event of consumer complaints.

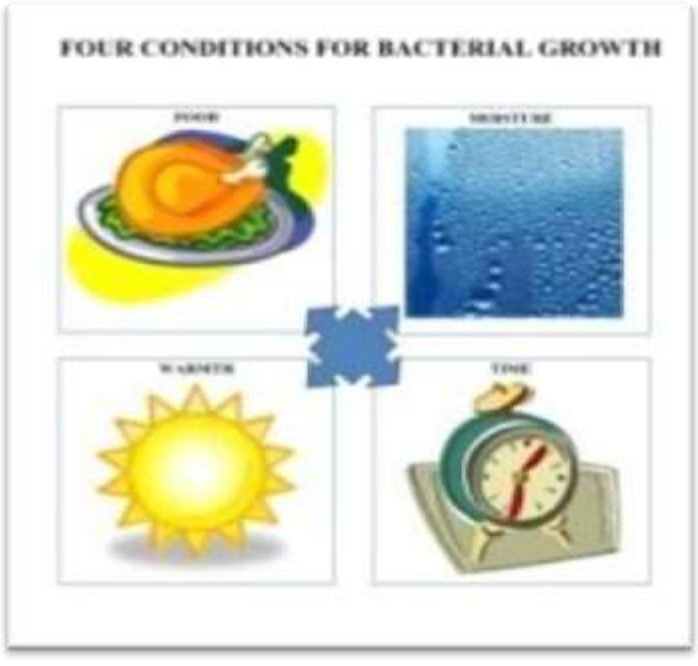
19. The letter height for all declarations must be at least 1 mm. Nutritional information is not required in the case of raw agricultural foods, drinking water, single ingredients, and bulk food. When claiming the amount or type of fatty acid or the amount of cholesterol, the amount of saturated fatty acids, monounsaturated fatty acids, and polyunsaturated fatty acids in grams and cholesterol in milligrams should be declared. In addition, the amount of trans-fatty acids in grams should be stated.

Annexure IX

Posters

Common Symptoms of Food Poisoning

Contamination of Foods



Conditions for Bacterial Growth

Sources of Food Poisoning

Cross Contamination

Personal Hygiene

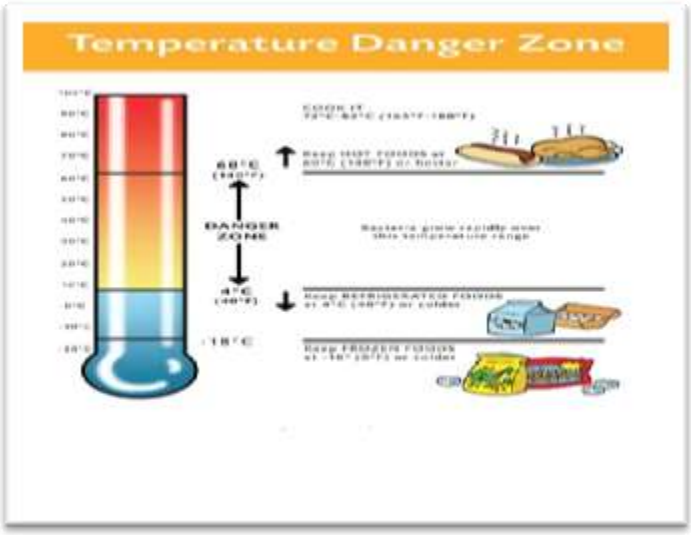
Safety Rules before starting work

Hand

washing Techniques

When to wash hands

Principles of Food Safety



63℃

Pest Control

Temperature Danger Zone 5℃ to

Source:

INDIAN INSTITUTE OF PUBLIC HEALTH HYDERABAD

fssai

RSPH
ROYAL SOCIETY FOR PUBLIC HEALTH
VISION, VOICE AND PRACTICE