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ASSESSMENT OF HYGIENE AND SANITATION AT VARIOUS PRE-SCHOOLS OF DELHI- A FOOD SAFETY STUDY

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ABSTRACT

Food safety has emerged as an important global issue with international trade and public health implications. Diseases related to inadequate water, sanitation and hygiene are a huge burden in developing countries. It is estimated that 88% of diarrheal disease is caused by unsafe water supply, and inadequate sanitation and hygiene (WHO, 2004). Schools often lack a proper system of drinking-water system, sanitation and hand washing facilities; alternatively, where such facilities do exist they are often inadequate in both quality and quantity. Schools with poor water, sanitation and hygiene conditions, and intense levels of person-to-person contact, are high-risk environments for children and staff, and exacerbate children's particular susceptibility to environmental health hazards. Providing adequate levels of water supply, sanitation and hygiene in schools is of direct relevance to the United Nations (UN) Millennium Development Goals of achieving universal primary education, promoting gender equality and reducing child mortality. Children are more exposed to pathogens in the environment because of poor or lack of sanitary habits. This is likely to be especially true of enteric pathogens, which are transmitted by the faecal oral route through water, soil and food. Most important is the immune system, the less developed the immune system in children could lead to more serious infections. The present study was undertaken to assess the hygiene and sanitation status in different pre-schools of East and Central Delhi. The study aimed at obtaining information about the general profile of the employees, handling food, their food handling practices, sanitation processes while preparing food and awareness about general hygiene. Thumb imprint of various food handlers were accounted for along with food contact and non-food contact surfaces. Thumb imprint of the fifteen food handlers and workers were collected during various stages of work from the five preschools. Since, hand hygiene is very critical and affects the quality of food; so hands both unwashed and washed with the available resources were accounted for and also during cooking and serving. The microbial load drastically reduced after the washing step. The results indicate that the personal hygiene needs to be reinforced in the handlers. The rinse method results showed majority of utensils were clean and not contributing to the microbial load although the exception was seen in case of school S2 where all the utensils carried a high microbial load. Among the utensils tested, the pressure cookers were found to be most contaminated which can be attributed to the fact that the gaskets and pressure whistle are not removed and cleaned. The swab data indicated a high level of contamination. After assessment, it was found that there was a strong need for educating the food handlers. Corrective actions were given which could help to fill up the existing lacunae in the prevailing situation by controlling the undesirable practices of the food service providers to ensure food safety. A leaflet was designed to act as a guideline for following correct food safety and hygienic practices in food service institutions.

Keywords: WHO, Hazards, HACCP, Sanitation, Hygiene. Food safeties, Food Borne diseases, Hazards, Settle-plate techniques, Thumb imprint method.

INTRODUCTION

Food is the major determinant of health and nutritional status of the people. Our nutritional status, health, physical and mental strength depends on the food we eat and how we eat it (WHO, 2007). It is therefore, essential to ensure "wholesomeness" of food.

Wholesomeness of food has two important dimensions. Firstly, food should be of good nutritive value so as to provide nutrients for normal body functions. Secondly, food should be free from contaminants which could undermine the health and cause diseases. Therefore, it is the responsibility of any establishment serving food to

serve food that is wholesome as well as microbiologically safe. If food safety is not ensured, it can lead to food borne illnesses. Children particularly pre-schoolers are most susceptible to food borne diseases.

FOOD SAFETY AND FOOD BORNE DISEASES

SANITATION

World Health Organization (WHO) defines sanitation as group of methods to collect human excreta and urine as well as community waste waters in a hygienic way, where human and community health is not altered. Sanitation methods aim to decrease spreading of diseases by adequate waste water, excreta and other waste treatment, proper handling of water and food and by restricting the occurrence of causes of diseases.

HYGIENE

The word "hygiene" is derived from Hygeia, the goddess of health in Greek mythology. Hygiene is defined as "the science of health and embraces all factors which contribute to healthful living" (Park, 2009).

UNICEF has done a recent survey in 2010, where it showed that more than half of primary schools have no adequate water facilities and nearly two thirds lack adequate sanitation. Providing better water, sanitation and hygiene (WASH) services in schools reduces hygiene-related diseases and can help curb the 272 million schools days missed every year due to diarrhoea.

Food borne illnesses are a widespread public health problem globally. Developing countries bear the brunt of the problem due to the presence of a wide range of food-borne diseases. In India an estimated 4,00,000 children below five years age die each year due to diarrhoea. Several millions more suffer from multiple episodes of diarrhoea and still others fall ill on account of hepatitis A, enteric fever, etc. caused by poor hygiene and unsafe drinking water.

MODE OF TRANSMISSION

Most of the pathogenic organisms that cause diarrhoea is transmitted primarily or exclusively by the faecal-oral route. Faecal oral transmission may be water-borne; food-borne, or direct transmission which implies an array of other faecal- oral route such as via fingers, or fomites, or dirt which may be ingested by young children.

HAZARDS ASSOCIATED WITH FOOD

Foods do not cause illness; bacteria and other pathogens do. However, raw foods are contaminated with bacteria common in the food chain. In other cases, healthy food handlers may contaminate food with bacteria common in the human body or diseased food handlers may contaminate food with lesser common pathogens. Food service operations are frequently identified as places where mishandling of foods has led to outbreaks of food borne diseases.

COMMON HAZARDS IN FOOD

- Physical parameters / hazards
- Chemical contaminants/hazards
- Microbiological parameters/ biological hazards

PHYSICAL HAZARDS IN FOOD

Physical hazards are either foreign materials unintentionally introduced to food products or naturally occurring objects. A physical hazard can enter a food product at any stage of production. Hard or sharp objects are potential physical hazards.

CHEMICAL HAZARDS IN FOOD

Chemical hazards are toxic substances that may occur naturally or may be added during processing of food. Eg: Additives, pesticides, colorants etc.

BIOLOGICAL HAZARDS IN FOOD

Biological contaminants are the most important in the Indian context. Biological contaminants include protozoa, yeast, bacteria, moulds, and viruses, which are included under invisible biological contaminants / hazards. Visible includes weevils, caterpillars, flies, worms and cockroaches.

DAY CARE CENTERS FOR CHILDREN

The hygiene of the food served in nursery schools is of great importance in terms of children's health. It is therefore essential to increase the number of studies carried out regarding the food served in nursery school kitchens and regarding hazard analysis and critical control point (HACCP) issues, and to concentrate on the education of the kitchen staff. Child care centers have become an integral part of today's society. While child care centers provide a necessary and important service, they may serve as a focal point for certain types of infectious diseases.

CHILDREN – A SPECIAL CASE

Children may suffer disproportionately from some environmental risks. These risks may arise because children's neurological, immunological, and digestive systems are still in the developmental stages. In addition, children are more exposed to pathogens in the environment because of poor or lack of sanitary habits.

Realizing the importance of hygiene and sanitation in the preschools or day care centres where children are fed with food and water served to them. Preschoolers being more susceptible to infections and food poisoning if proper hygienic practices are not undertaken by the food handlers. The present study was done on preschools (N=5) providing food and drinking water to about 500 children.

OBJECTIVES

Each day millions of children eat food prepared and served in child care facilities. The food must be safely

handled to reduce these children's risk for foodborne illness. Following are the objectives behind the study:

BROAD OBJECTIVE

To critically examine the level of assessment of hygiene and sanitary practices carried out at various Pre-schools of Delhi.

SPECIFIC OBJECTIVES

- Collection of information about preschools using questionnaire-cum – interview
- Checklists to collect general information of personal hygiene among handlers.
- To determine the level of sanitation of different food contact surfaces.
- To determine the level of personal hygiene among the handlers.
- To spread awareness about the good hygienic practices among the staff.

METHODOLOGY

Food safety is vital for any food establishment. Problem of unsafe food arises due to lack of awareness, facilities and management. Enforcing and ensuring sanitation is very crucial in institutions serving food and drinking water particularly to small children. Further it is important to create awareness about hygiene and sanitation among the kitchen staff and food handlers. Therefore, the present study was undertaken to assess the hygiene and sanitation status in different pre- schools of East and Central Delhi. The schools were referred to as S1, S2, S3, S4, S5. The study aimed at obtaining information about the general profile of the employees handling food, their food handling practices, method of preparation, sanitation while preparing and serving food, and their awareness about hygienic practices. This data was supplemented and verified by assessing surface sanitation of various food contact surfaces and non-food contact surfaces. Finally, corrective action or recommendations were given which could help to fill up the existing lacunae in the prevailing situation by checking/controlling the undesirable practices of the food service providers to ensure food safety.

LOCALE OF THE STUDY

The study was conducted in five nursery schools located in East and Central Delhi.

DURATION OF THE STUDY

The study was conducted from July, 2010 to February, 2011.

TOOLS OF INVESTIGATION

The various tools used for gathering information were:

- Collection of information about preschools using questionnaire-cum – interview
- Checklists to collect general information of personal hygiene among handlers

- Assessment of personal hygiene and level of sanitation among food handlers
- To determine the level of sanitation of different food contact surfaces
- Development of a leaflet for the purpose of creating awareness

QUESTIONNAIRE - CUM – INTERVIEW

This tool was used to supplement the information gathered from observation. This was carried out to check and validate various hygiene and sanitation practices carried out by the food handlers.

OBSERVATIONAL CHECKLIST

It was used to assess various hygiene and sanitary practices of the food handlers. Observation of food handling practices and personal hygiene practices provides a true insight into the actual knowledge level of the staff and whether that knowledge is being put into practice.

STUDY DESIGN

The study design includes the following parameters

DATA COLLECTION

As in depth study was carried out by collecting data which included general profile and hygienic practices carried out by food handlers in all of the five schools. Samples were also collected for surface sanitation and hygiene, thumb imprints of various food handlers and the samples for aerial micro flora were also taken.

GENERAL INFORMATION ABOUT THE FOOD SERVICE PROVIDERS

A Performa was made to elicit information about the food handlers which includes age, gender, education, training and work experience.

OPERATIONAL PROCEDURES AND FOOD MATERIAL HANDLING PRACTICES

A questionnaire was used to elicit the information related to the layout, physical facilities, water supply, waste disposal, purchasing and storage of the raw material, pre-preparation and preparation of food, left over management, dish washing, etc.

PERSONAL HYGIENE OF THE FOOD HANDLERS

An observation checklist on the personal hygiene of the food handlers was formulated based on the WHO Golden rules for safe food preparation codes. This was also pretested on some other schools which were not the part of the study, suitably modified and then tested on the schools under study.

ASSESSMENT OF SURFACE HYGIENE

All potential sites which could harbour microbes were selected including the hand and equipment's since poor hygiene in any area of the kitchen can prove harmful.

Bacterial count of utensils, equipment's, working surface, hands, slab etc. are useful means of assessing the standard of hygiene and the efficacy of cleaning procedures adopted in various schools. These were assessed for the level of hygiene.

AIR MICROFLORA

The atmosphere contains all the major group of microbes ranging from the algae to the viruses. Outdoors air, with the changing season of the year, contains a variable of pollen grains, spores of the fungi, algae, ferns, mosses, bacteria and viruses. The microbial flora of air is transient and variable. Air is not a medium in which micro-organisms can grow but it is carrier of particulate matter, dust and droplets, which may be laden with microbes. The numbers and kinds of micro-organisms contaminating the air are determined by the source of contamination in the environment. e.g. Micro-organisms are sprayed by coughing and sneezing from the human respiratory tract, circulation of dust particles from the surface of earth by air currents. The sampling of air to determine its microbial content requires special apparatus and devices, referred to as solid impingement devices or liquid impingement devices.

Settle -plate techniques have been amongst the most widely used methods for studying the microbial contents of the atmosphere. In the settle -plate technique, a petri dish containing a suitable agar medium is horizontally exposed for 5-10 mins. The plates are then incubated at a temperature of 25⁰ C for yeast and mould and the number of colonies are thus counted which develop each colony carrying micro-organisms which has fallen on the agar surface. This technique has been widely used to study the fungal content of the air outdoors and the concentration of bacteria in the air indoors.

RESULTS AND CONCLUSIONS

Many studies have been done for hygiene and sanitation in various hotels, canteen, and hostels but there are very limited studies done for the preschools or day care centres in India. Insufficient information about hygiene and sanitation levels in preschools and child care centres in and around Delhi and also there is no awareness about the good hygienic practices among the food handlers at school level. For these reasons, the study area was selected. The results and discussions are presented in the following sections:

GENERAL PROFILE OF THE WORKERS

There were about varied number of food handlers in various preschools handling food. Their job profile varied from procurement of food material to cooking and serving food and drinking water to the children. These also included the helpers who serve the food, swept the floor, cleaned the bins, washed the dirty utensils, and cleaned the table for serving (Table I).

Table I: Demographic characteristics of the food handlers

S. No.	Variables	Total no. of handlers N=35	%
1.	Age (years)		
	Below 15	2	5.7
	15-19	14	40
	19-30	16	45.7
	Above 30	3	8.5
	Gender		
	Male	5	14.2
	female	30	85.7
3.	Education level		
	Illiterate	6	17.14
	Upto 5 th	26	74.2
	Upto 10 th	2	5.7
4.	More than 10 th	1	2.8
	Training provided		
	Yes	9	26
	No	26	74.2
5.	Work experience		
	NIL	21	60
	1 year	9	25.7
	2 year	4	11.4
	More than 2 year	1	2.8

AGE AND GENDER

As shown in above table, maximum numbers of workers in the preschools were in the age group of 19-30 years i.e. 45% followed by 15-19 years i.e. 40%; out of 35 workers, 14% were males and rest of them were females.

EDUCATION

Only 5% of the handlers were educated, rest of the handlers had studied till 5th standard and most of them were illiterate (17%).

TRAINING

The present study revealed that 74% of the employees at the schools were untrained. None of the food handlers received any formal training and had learnt their job by experience in their previous jobs. It was found only 25 handlers were trained.

WORK EXPERIENCE

60% of the workers were not having any work experience for working in preschools, 25% of the workers had one year experience, 11% had 2 years experience and only 2% had more than 2 year experience.

PREPARATION

All of the food items need to be washed thoroughly before preparation with potable cold water, which removes extraneous matter like dirt, soil,

preservatives, and pesticide residues. Although food items were washed and cleaned before use in all the schools but unfortunately it got re-contaminated. Most of the schools chopping boards were found to be in a good condition however the practice of using chopping boards was not followed so this can be one of the reasons why contamination arises (Fig I). In some of the schools it was observed that after cutting one type of raw material the chopping board was not cleaned or washed rather they were used to cut other raw materials. This practice increased the chances of cross contamination to a great extent. Almost 80% of the schools out of five were using clean utensils and cutleries and almost all schools were washing food items before use.

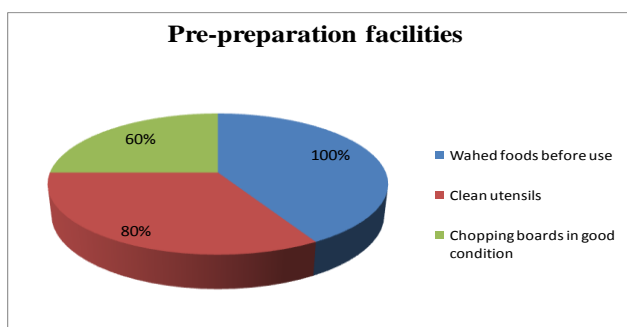


Fig I % desirable pre-preparation facilities

PREPARATION

The work surfaces were not clean in three schools out of five. It also had cracks which provided suitable place for micro-organisms to grow. Out of five schools, 60% of the work area found to be clean, only 40% hands of the workers were clean, and 100% of the schools were using clean utensils for keeping foods. The workers were not using hands for picking foods like spices, sugar; and this was found to be a good practice. However, the major source of contamination was coming from their dusters, because they were not cleaned (Fig II).

% Desirable practices carried out for Preparation

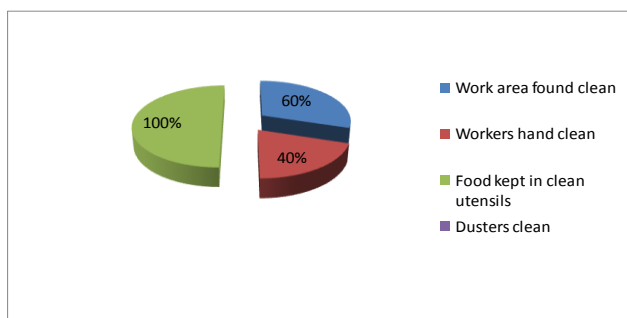


Fig II % Desirable practices carried out during preparation

DISHWASHING

Washing utensils is the most important task but unfortunately it is the most neglected task as well and

usually assigned to lowest grade employees who have little or no knowledge of sanitation.

As the Fig C shows none of the schools were using hot water for washing utensils, however if they used, they can prevent a large amount of cross-contamination. 60% of the schools were keeping utensils in a clean place after washing; 40% schools showed left food residues and oiliness on their utensils. None of the schools out of five were using dusters for wiping utensils and also dusters were found to be very dirty (Fig III).

% desirable dish washing practices

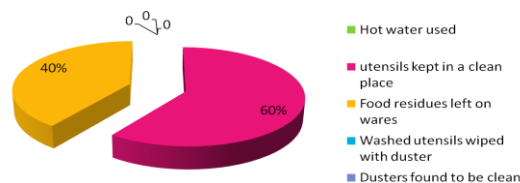


Fig III % desirable dish washing practices

PERSONAL HYGIENE PRACTICES

The personal hygiene practices of the food handlers in the five schools were observed using an observational checklist. As we can show in (Fig IV), only 60% of the employees were wearing apron while working, only 75% of the workers had clean uniform, 25% were wearing untidy uniform. 80% of the workers had short nails. 100% of the food handlers were keeping their hair clean as well covered, though handlers were females and almost 56% of them are allowing accessories and clothes to come in contact with the foods as they were wearing rings, bangles etc. Almost 40% of the workers found to be suffering from cough and cold which was the common problem observed during winters.

% desirable practices

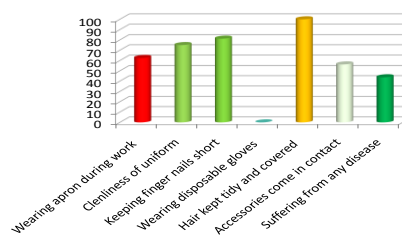


Fig IV showing Personal Hygiene practices among food handlers

The most undesirable practice which was seen among the food handlers was that they were scratching their head or face while cooking and serving food, half of them were cleaning their ear from one hand and from other

they were cooking. About 12% of the handlers were inserting fingers inside the utensils and 18% were blowing into plastic bags.

Table II Observational Checklist for Assessing Personal Hygiene of Food Handlers

Visual Inspection	Total no. of food handlers N=16		% desirable practices
	Yes	No	
Wearing apron during work	10	66	62.5
Cleanliness of uniform	12	44	75
Keeping finger nails short	13	33	81.2
Wearing disposable gloves	--	116	0
Hair kept tidy and covered	16		100
Allowing clothes and accessories come in contact with food	9	77	56.2
Suffering from any disease	7	99	43.7

PERSONAL HYGIENE

Hand hygiene is very critical and affects the quality of food; so hands both unwashed and washed with the available resources were accounted for and also during cooking and serving. In all the cases, the microbial load drastically reduced after the washing step, once again focusing the need of hygiene in food safety. Although during cooking and serving, the increase was seen in

microbial load showing the role of food contact surfaces as a source of contamination. This manifold increase in case of school S1 and S5 can also be contributed to the unhygienic practices followed by the handlers during the day especially not washing hands prior to cooking and serving food.

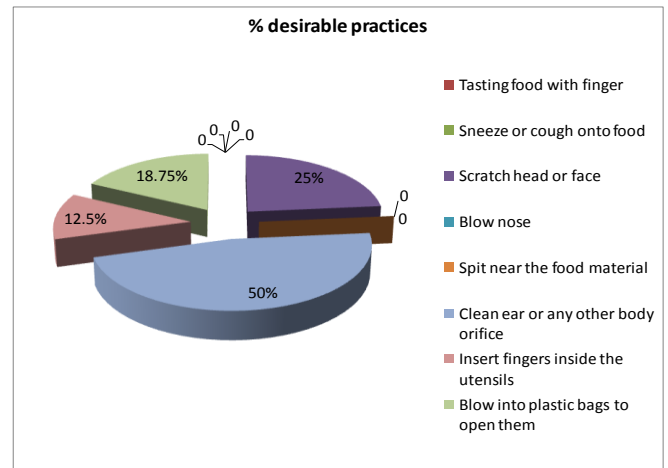


Fig V % desirable practices carried out during kitchen

FOOD CONTACT SURFACES

Table III shows the microbial load in various food contact surfaces such as working areas (slab, gas area, refrigerated area, tables), contact areas (sink), utensils and equipment's such as knife, pressure cooker, plates, katori and glasses.

Table III Results of Swab analysis

Schools	Colony count (CFU/ml)					
	Knife	Slab	Gas area	Sink	Refrigerated area	Table for serving
S1	330	TNTC	TNTC	TNTC	350	9300
S2	150	TNTC	TNTC	TNTC	150	TNTC
S3	TNTC	TNTC	TNTC	TNTC	TNTC	TNTC
S4	TLTC	TNTC	TNTC	TNTC	TNTC	TNTC
S5	TNTC	TNTC	TNTC	TNTC	TNTC	TNTC

The rinse method results table IV indicate majority of utensils were clean and not contributing to the microbial load although the exception was seen in case of S2 where all the utensils carried a high microbial load. Among the utensils tested, the pressure cookers were found to be most contaminated which can be attributed to the fact that the gaskets and pressure whistle are not

removed and cleaned. The swab data as shown in table III indicates a high level of contamination. Higher dilutions upto 10¹⁴ were used but still the result showed colonies more than the prescribed maximum limit as in the standard method. Majority of the plates were found to be TNTC indicating that the contact surfaces were not regularly cleaned and acting as a source of contamination.

Table IV Results of Rinse analysis

S. No.	Code of school	CFU/ml			
		Cooker	Katori	Plates	Glass
1.	S1	200	ND	ND	TLTC
2.	S2	150	145	170	TNTC
3.	S3	15,000	ND	840	TLTC
4.	S4	290	ND	ND	88000
5.	S5	3300	ND	350	1200

Table V Results of Air Microflora

S.No.	No. of Schools	Place	Time of exposure (mints)	Colony identified
1.	S1	Activity room	1	<i>Aspergillus, Cladosporium</i>
		Class room	1	<i>Rhizopus</i>
		Kitchen	1	<i>Alternaria</i>
		Kitchen	2	<i>Alternaria</i>
		Kitchen	3	<i>Penicillium</i>
2.	S2	Activity room	1	<i>Alternaria</i>
		Class room	1	<i>Rhizopus</i>
		Kitchen	1	<i>Rhizopus</i>
		Kitchen	2	<i>Rhizopus</i>
		Kitchen	3	<i>Rhizopus</i>
3.	S3	Activity room	1	<i>Helminthosporium</i>
		Class room	1	<i>Rhizopus</i>
		Kitchen	1	<i>Alternaria</i>
		Kitchen	2	<i>Aspergillus, alternaria</i>
		Kitchen	3	<i>Alternaria</i>
4.	S4	Activity	1	<i>Alternaria</i>
		Class room	1	<i>Rhizopus</i>
		Kitchen	1	<i>Penicillium</i>
		Kitchen	2	<i>Penicillium</i>
		Kitchen	3	<i>Penicillium</i>
5.	S5	Activity room	1	<i>Aspergillus</i>
		Class room	1	<i>Rhizopus</i>
		Kitchen	1	<i>Alternaria</i>
		Kitchen	2	<i>Alternaria</i>
		Kitchen	3	<i>Alternaria</i>



FIG VI Showing plates used for Air Microflora



FIG VII Showing Air Microflora counts

THUMB IMPRINTS

Thumb imprint of the fifteen food handlers and workers were collected during various stages of work from the five preschools. Since, hand hygiene is very critical and affects the quality of food; so hands both unwashed and washed with the available resources were accounted for and also during cooking and serving. In all the cases, the microbial load drastically reduced after the washing step, once again focusing the need of hygiene in food safety shown in the table VI & Fig VIII and IX. Although during cooking and serving, the increase was seen in microbial load showing the role of food contact surfaces as a source of contamination. This manifold increase in case of school S1 and S5 can also be contributed to the unhygienic practices followed by the handlers during the day especially not washing hands prior to cooking and serving food. Thus these results indicate that the personal hygiene needs to be reinforced in handlers.

CONCLUSION

The present study was undertaken to assess the status of hygiene and sanitation in different pre- schools of East and Central Delhi with the focus on the safety of drinking water and food served to the children. All the preschools were taken from high socio economic strata

Table VI showing Thumb imprints of different food handlers

School code	Food handlers	Unwashed hands	Washed Hands	During Cooking	During Serving
S1	A	TNTC	4	TNTC	TNTC
	B	111	61	110	81
	C	46	1	200	150
S2	A	32	12	12	13
	B	66	24	177	188
	C	15	3	45	43
S3	A	17	11	30	31
	B	20	2	155	177
	C	30	7	49	47
S4	A	100	50	87	76
	B	79	66	180	TNTC
	C	125	27	180	197
S5	A	45	32	TNTC	TNTC
	B	140	20	18	30
	C	55	13	199	TNTC



FIG VIII showing plates used for taking Thumb Imprints

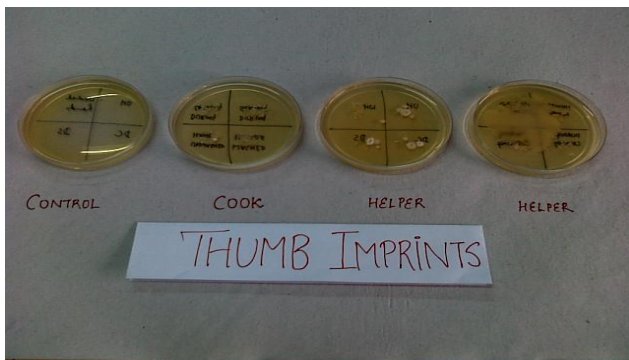


FIG IX Plates showing counts of Thumb Imprints of various food handlers

information about the general profile of the employees handling food, method of preparation, sanitation while preparing and serving food, and their awareness about hygienic practices was collected using questionnaire-cum – interview and checklists. After assessment of the status of hygiene and sanitation in selected preschools, a strong need was there for educating the food handlers, a leaflet

was designed to act as a guideline for following correct food safety and hygienic practices in food service

institutions. Additionally and importantly, it will also guide the food service establishment in charge to institute ideal conditions of food safety and hygiene.

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