IMPROVING THE EXISTING SANITARY CONDITIONS OF A CANTEEN

By

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A C K N O W L E D G E M E N T

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I INTRODUCTION

Health is man's priceless possession, on its solid foundation man's happiness rests. It is the greatest of all the possessions one can have and influencing his activities and shaping his destiny. According to the World Health Organisation (1973) and Karansingh (1975), health is a state of complete physical and mental well-being leading to the development and flowering of the entire human personality and not merely an absence of disease or infirmity.

Complete state of health can be achieved only through practice of sanitation. Longree and Blaker (1971) explain that the word sanitation is derived from the latin word sanus, meaning sound and healthy or clean and whole. The book of leavities states that sanitation as the law of the beast and of the fowl and of every living creature that moveth in the water and of every creeping things that creepth on the earth to make difference between the unclean and the clean and between the beast that may be eaten and the beast that may not be eaten. The dictionary meaning of the word sanitation is, 'the science of safeguarding health'. Sanitation is referred to as the healthy and hygienic conditions of living. It is the science of preserving health, which is devoid of dirt, dust and microorganisms.

Good sanitation can be attained through clean surroundings, home, food, clothing, personal cleanliness and so on. For healthy living, hygienic food is of utmost important. If the food is vested with the homemaker, she takes care in preparation and serving hygienically. But if the homemakers depend on public eating places like restaurants and cafetarias for the sake of saving time and energy in meal preparation, change in meal pattern and for recreation, the hygienic conditions of the foods cooked and served will not be known to them (Pottor, 1970 and Marianna 1975). The responsibility of a food service unit as expressed by Fischback cited by West and Wood (1961) is to provide clean and wholesome meal to the customers. In other words, the prepared food must be palatable, prepared by clean people in clean utensils using clean equipments. It should be served on clean dishes with tableware from a clean table on a clean floor in clean surroundings.

In food service, sanitizing refers to treatment to eliminate pathogenic bacteria from equipment and utensils that are used in the preparation and service of foods (Salle, 1961). Gebbardt and Anderson (1959) have listed three aspects of the restaurant sanitation. They are: (1) the food itself, (2) the food handlers and his techniques in handling and serving food and (3) the eating utensils themselves.

It is found that public health aspects of the problem of restaurant sanitation are rather complex. Often insanitary restaurant conditions which favour the presence of flies, mosquitoes, vermin and rodents make proper care of food impossible. It becomes channels for the spread of certain diseases (Brown, 1976). Micro-organisms in saliva and sputums may be transmitted from the mouth of one person to another by means of eating and drinking utensils that have been inadequately washed. In many establishments where food and drink are served, the provision for washing dishes and utensils are woefully inadequate (Johnson, 1959). Faulty washing technique, lack of sanitation, use of dirty towels for wiping, improper storage and handling were the common problems observed in restaurants (Marianna, 1975).

Brock and Brock (1973) state that any establishment offering food to the public should have an effective food sanitation programme which begins with proper control and training of the food handlers. Freedom of food handlers from infectious diseases is of paramount importance especially because the casual agents of diseases such as typhoid fever, diphtheria and tuberculosis can easily be transferred from the body to food. As wholesome food is sound food fit for

human consumption, maintenance of high standard of sanitation is of utmost importance in all operation within the canteen. Food handlers may serve as an active intermediatry in the transmission of micro-organisms from one customer to another. Moreover the food handlers are uneducated and they are not realize the importance of supplying clean and wholesome meal. Hence, training the personnel is essential. This initiated the investigator to take up a study in Janatha Canteen which is run by Sri Avinashilingam Home Science College for Women, Coimbatore to improve the sanitary conditions with the following objectives:

A. Finding out the existing sanitary practices in Janatha Canteen (meals and snacks sections).

B. Finding out the sanitary conditions by bacteriological examinations of the selected samples.

C. Educating the food handlers and introducing new techniques to improve the sanitary practices.

and D. Evaluating the improved methods by bacteriological assay and observation by the customers.

II REVIEW OF LITERATURE

The literature pertaining to this study are discussed under the following headings:

A. Importance of sanitary practices in public eating places

B. Requirements of an ideal canteen

C. Personal hygiene of the food handlers

D. Educating the food handlers

and E. Sanitary measures to be followed in various activities

A. Importance of Sanitary Practices in Public Eating Places:

Sanitation is defined as the application of scientific and technical knowledge and skills to obtain a beautiful environment (Neme, 1957). As stated by Haskell, sanitation as one engaged in their practical application of sanitary science. 'Science' may be assumed to mean the sum of universal knowledge and 'sanitation' is interpreted as the working out and application of sanitary measures. The National Sanitation Foundation as cited by Park and Park (1976) views, sanitation as the way of life, it is the quality of living that is expressed in the clean farm, business and industry; the clean neighbourhood and the clean community. Being the

way of life, it must come from within the people. It is nourished by knowledge and grows as an obligation and an ideal in human relations.

According to Ehlers and Steel (1965), protection of health and promotion of human comfort and well-being through control of man's environment are responsibilities which modern conditions have forced upon the man. The primary sources of contaminants of public health in connection with quantity food services are men, animals, sewage, air, soil, water and certain foods (Burrows, 1959). Other sources are equipment, eating, drinking and serving utensils and the food service premises themselves (Longree, 1967; Robinson, 1972 and Mc Divitt and Mudambi, 1973). The different sources of contaminations are shown in Figure 1.

Collins (1963) says that there are over 60 diseases, that may be contacted and of these some 25 are associated with food. Kawata cited by Mc Divitt and Mudambi (1973) has classified food borne diseases as food borne intoxication and infections. Frazier (1967) says that food poisoning that occurs two or three hours after eating, is due to bacterial toxin present in food. Fitch (1958) opines that staphylococcus food poisoning which is the most common, belongs to

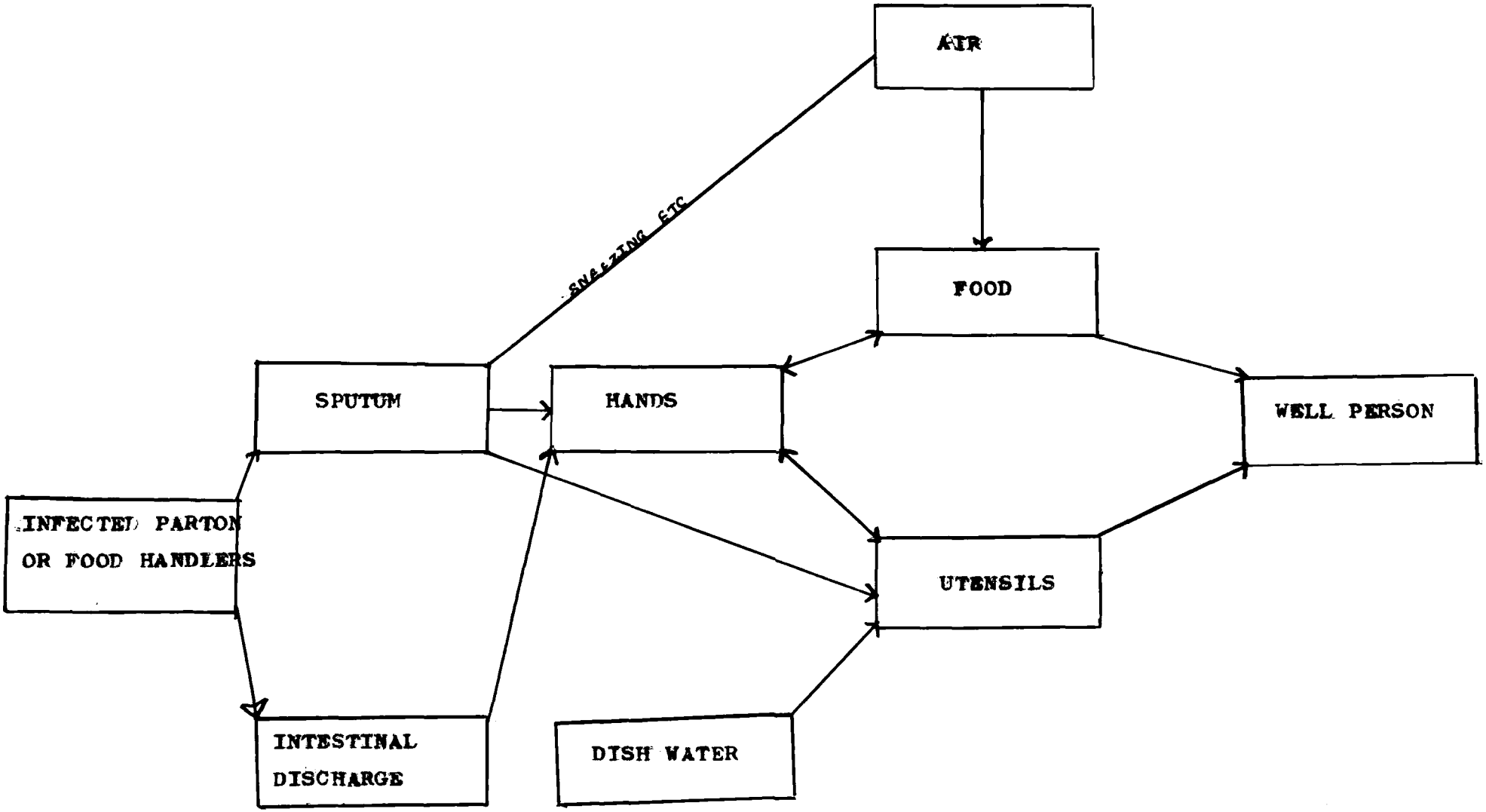

FIGURE 1

SOURCES OF CONTAMINATION

the food intoxication group. Frazier (1967), Salle (1961) and Christie and Christie (1972) state that the organisms generally responsible for these out breaks include the spore forming bacilli, clostridium botulism and various strains of streptococci and staphylococci. Spores of clostridium botulism are extremely resistant to heat and when food is not properly processed, they may survive and later germinate and cause food poisoning through production of heat-liable toxin (Plizer and Reid, 1974).

Parker and Litchfield (1962) stress that the word "insanitary" as used in the Federal Food Drug and Committee Act must be interepted broadly and not restricted to condition affecting health. According to Pottor (1970), the eating and drinking utensils which are not cleaned hygienically are real danger to health, since they come in contact with many hands and many mouths. If improperly cleaned after use, gastero-intestinal as well as certain diseases of the upper respiratory tract may spread from one individual to another.

According to Narayana Rao et al (1954), during the peak rush hours in coffee houses and restaurants, there is a generally a by-passing of the washing, cleaning and rinsing operations, due to increased demand for cleaned utensils and the insuffi-

cient stock of these available at the establishment. The dirty water used for washing towels, insanitary storage conditions and unhygienic handling can contribute to the microbial load of washed utensils in which food is prepared. The soilded utensils, cutleries and crockeries may be dangerous, if not cleaned properly. To prevent from infection, thorough cleaning of utensils and equipment is of extreme importance.

Collins (1963) and Parker and Litchfield (1962) state that greatest danger arises if bacteria are allowed or helped to spread and contaminate other foods through thoughtless food handling or failure to maintain equipment, utensils and the premises themselves in a good state of cleanliness and repair.

Hovis and Hunter (1966) view food hygiene practice as a complicated operation, contributing to an intricate pattern of procedure which are accepted as essential to the achievement of the deserved standards of quality of the end product.

B. Requirements of an ideal Canteen:

The sanitary design, layout and maintenance of building and equipment are of vital interest to management in the food

industries (Ehlers and Steel, 1965). The successful food processes must consider, (1) careful selection of the site, (2) proper design, construction and layout of structure and placement of equipment and (3) care in planning sanitary aspects (Parker and Litchfield, 1962).

1. Site:

A processing unit shall preferably be situated in an open, clean and healthy surroundings far away from road side where lot of dust arises due to vehicle and traffic and lavatory, sink, cesspool or garbage dumps, cattle sheds, open sewage drains or other places likely to breed flies. Indian Standards Institution (1972) recommends that "it shall be free from obnoxious fumes, smoke, odours or excessive dust". There shall not be accumulation of trash, garbage or similar waste in the vicinity of the plant.

2. Buildings:

The physical environment has much to do with the successful operation of the individual food service establishment (West et al 1966). The structure shall be of permanent nature and shall be suitable in size, construction and design to facilitate maintenance and hygienic operations for processing purposes (1963). It should provide sufficient space for

keeping equipment and storage of materials for hygienic conditions in food processing units (Indian Standards Institution, 1972). According to Mc Cullough (1966), ideal premises should be

(i) big enough for the work to be undertaken in an orderly and uncluttered way.

(ii) provided with stores, refrigerators and deep freeze cabinet of sufficient capacity for modern foods.

(iii) planned on work study principles to obviate as much as unnecessary transport exposure of food as possible.

and(iv) equipped with the correct amount of well designed cooking equipment and labour saving devices, all being as far as possible either free standing or mobile.

3. Floor:

Floors in the catering establishment have to stand a good deal of traffic as well as the weight of equipments. They are liable to have water and grease spilt on them (James, 1957 and Collins, 1963).

Parker and Litchfield (1962) and Kilgour (1968) state that floor should be constructed of impervious materials which can easily be cleaned. The Indian Standards Institution (1972) recommends that the floor should be smooth, washable and have a sufficient slope to ensure adequate drainage. Cement floor should be preferable for work room, store room and godown.

4. Walls and ceilings:

The essential requirements of walls and ceilings as explained by Collins (1963) are that the wall should be substantial, durable, smooth, impervious and washable. The junctions of the floor with the walls and between the two walls should be rounded to prevent accumulation of dust. Parker and Litchfield (1962) and Indian Standards Institution (1972) suggest that internal walls and ceilings should have smooth non absorbent, light coloured, free from crevices and sharp angles to facilitate their efficiency. Equipment should always be placed away from the walls to allow cleaning and periodic checking. Cracks should be made good with redecoration as necessary.

5. Kitchen:

A kitchen is built as an independent unit because the noise and odour from kitchen disturb people. But as Winslet (1955) and Walley (1958) point out it is common for kitchen to be a part of a larger building. Cockle (1958), Zickefoose (1961) and West et al (1966) point out that the location of the kitchen should provide adequate dry space, dish washing area, refregeration, dry storage space and space for equipment.

James (1957) suggests that while planning kitchen, it is essential to consider all operations within the kitchen and survey.

Heathwood (1974) recommends efficient mechanical ventilation of the kitchen in all climate not only to remove cooking odour and steam, but also to eliminate as much necessary cleaning as possible. It is important to make the fullest possible use of natural lighting.

6. Dining area:

It is undersirable for the customers to be crowded since it is essential for the waitress to have clear access to every part of every table so that dirty dishes and cutlery can be removed promptly and the tables kept clean. It is suggested that, where the maximum capacity is not more than 50 persons, 15 square feet dining space should be allowed for each person and when the maximum capacity is above 50, 20 square feet would be sufficient. The dining room should be bright and airy and have fresh colour and good ventilation. Soiled floors and tables should be scrubbed and cracks that retain food debris should be replaced (Collins, 1963).

Canteen chairs and tables should be wiped daily using hot detergent water and little damped scouring powder to remove any stubborn marks (James, 1957).

7. Store room:

Store for storing raw materials should be made and maintained rodent proof and free from dampness as far as possible (Indian Standards Institution, 1972). Separate cold and chilled rooms should be necessary. Both rooms should be dry and well ventilated to store vegetables, dried goods and perishable items. Room must be fly and vermin proof with wire mesh outside the window (Collins, 1963).

8. Doors and windows:

Doors and windows should be fly proof with the mesh screens firmly fitted. Such doors should open outwards and additional help in repelling flies from entering can be gained by positioning fans. The processing room should be provided with self closing double door. (Parker and Litchfield, 1962; West et al, 1966 and Indian Standards Institution, 1972).

9. Lighting and ventilation:

According to Rutt (1963), lighting is an important influence on the growth of civilization and its development.

Adequate lighting and ventilation is an important factor in design and operation of a sanitary food plant (Parker and Litchfield, 1962). The quantity of air required for ventilation varies according to factors such as size and types of building, number of employees, atmospheric condition and amount of steam, dust and gas produced by operation (Ministry of Health, 1963).

In some establishments artificial lighting will be required to supplement natural lighting even during the day time, but careful planning will reduce the expenses on this to a minimum. No general rule can be given for determining the probable lighting load allowance, but for average lighting condition, an allowance of 1-4 watts per square foot of area is usually ample.

10. Water supply:

Ample and immediately available supplies of both hot and cold running water are essential (Ministry of Health, 1963) All water used for food preparation and cooking, drinking, washing and cleaning utensils and surface with which food or utensils may come in contact should be public supply main water. The storage tank for water should unless completely sealed, be kept covered with tight fitting lids, examined

regularly and cleaned out atleast once every six months. Since water is easily contaminated, it should be periodically examined as desired by the licensing authority, chemically and bacteriologically (Indian Standards Institution, 1972).

11. Drainage:

According to the Indian Standards Institution (1972), effective drainage should be provided to drain off water used for washing raw materials, machinery, equipment, furniture, floor and so on. Fifteen to thirty centimeter half circular drains with glazed pipe at the bottom should be provided. The drain openings should be provided with screen traps to prevent solid matter from clogging drains. Mesh type cover for the drain prevents habitation of cockroaches and rodents in the closed area of the drain. They should be drained in soakage pits situated at a suitable distance from the building and also the source of water supply.

12. Facilities for food handlers:

Parker and Litchfield (1962) and Collins (1963) remark that toilet for employees should be with self closing tight fitting solid doors. According to Hopkins and Elder (1951), sufficient water closets, urinals and wash-basins must be

provided in accordance with the Factories Act, 1957, the scale laid down is one water closet (WC) for each 25 women, while for men it is one water closet for each 25 upto 100 and then one for each 40. There should be one urinal for each group of 25 men.

C. Personal Hygiene of the Food Handlers:

Stauffer (1964) and Longree (1967) state that cleanliness and clean personal habits are extremely important in any establishment. According to Longree (1967), cleanliness and willingness to learn good health habits reduce the chance for the food handlers to be dangerous reservoirs of pathogens. Jhonson (1960) and Scott (1963) remark that clean hair, skin and garment are essential to reduce the contamination of food with the microbial flora for which the food handlers are the primary sources. Indian Standards Institution (1972) Robinson (1972) and Lillicrap (1973) view that the personal hygiene reduces the possibility of infection. The main points to note are:

1. Regular washing of the skin to improve personal freshness
2. Well groomed hair, neatly cut, covered whenever necessary

3. Clean hands and nails

4. Neat in appearance, with smart, clean and well starched uniform

5. Clean and comfortable shoes essential on their feet most of the day.

6. Workers suffering from cold, stomach upset and other ailments should immediately report to the doctor before continuing work.

Hunter and Hovis (1966) and Frazier (1967) recommend that the hand must be kept clean before and during the preparation and serving of food and before eating. Every trip to the toilet should be terminated by thorough washing of hands (Parker and Litchfield, 1962; Collins, 1963 and Longree, 1967). Bjonson (1960) and Longree and Blaker (1971) opine that caps or nets should be used to prevent hair from contacting food surface and the food itself. The waitress should not carry a cloth for general use because it quickly collects and spreads bacteria. Every use of the handkerchief should be allowed by washing of hands whether the handkerchief was previously used or not (Parker and Litchfield 1971 and Indian Standards Institution 1972). Collins (1963) urges personnel, not to shake out a handkerchief in a food, not to bite the nail because the saliva from the mouth is a fruitful source of infection and to avoid scraching face and fingering the nose since it contaminates the nails.

The use of tobacco should be prohibited in the food service area, store room and in the area where dishes, pots, pans and utensils are washed (Stauffer, 1964). According to Thomson (1969), this is specially to avoid serving with fingers contaminated with saliva.

According to Gebbardt and Anderson (1959), a dirty individual with unpleasing habits is obviously a danger to the community and should not be given the job of handling food. So also persons with infectious diseases, boils, infected wounds, sores, or acute respiratory infections (Indian Standards Institution, 1972 ; Longree, 1967 and Lillicrap, 1973). Gebbardt and Anderson (1959), Longree (1967), Thomson (1969) and Longree and Blaker (1971) recommend medical check up of the workers to certify absence of communicable diseases. Minor cuts or sores should be reported and must be covered by water proof dressing (Lillicrap, 1972).

According to Collins (1963) and Thomson (1969) the ideal person to work with food or in the surrounding of food should have basic good health, energy and physical stamina to do their hard job well, reasonable right and hearing for the safety of consumers, healthy skin, sturdy legs and feet and sufficient height to deal compentently with standard

equipment. Jewellery should not be worn with uniforms, because of the danger of small stones falling into the food (Thomson 1969).

D. Educating the Food Handlers:

Training is education. Education or the principles of personal hygiene is basic to the success of a training programme in food sanitation.

Supervision is important in any food plant industry to improve sanitary contact. Formal teaching can be advantageous and if related to day today episodes in an environment, which is familiar to operators, will help to improve the situation.

Chakrabarti (1967) opines that audiovisual aids are comparatively easy to understand and hence of interest to the people more than the description of anything. Allgood (1965) remarks that the average person is much more impressed by 'seeing' than by 'hearing'. When these two are interestingly combined, the persentation makes a more lasting impressions and creates the desire. The film is undoubtedly an excellent audiovisual aid which is entertaining and therefore helps to create interest in the subject. The most essential things to teach are the basic causes of food poisoning requiring slow and detailed explanation given as simple as possible (Sudgen, 1970).

F. Sanitary Measures to be Followed in Various Activities:

According to Parker and Litchfield (1962), the scope of sanitary practice in the food industries, operate under three major divisions: (1) pest control (2) physical cleanliness of all food contact surfaces and (3) asepsis or the practical sterility of all food contact surfaces.

Sanitation measures for preventing food infection and poisioning include-(1) protection of food at all time from insects and vermin, (2) employment of food handlers who are free from infection and clean in their habits and (3) storage of foods subject to infection at temperature of 60°C or 70°C or above, the latter applying to foods kept on steam tables during serving. (4) cleaning and bacteriocidal treatment of utensils and equipment used in preparation and serving of food, (5) proper sanitary facilities and controls of proper disposal facilities for waste water and garbage and (6) continuous inspection and enforcement of codes and regulations pertaining to food sanitation (World Health Organisation, 1968).

The following sanitary measures should be practiced to prevent food contamination:

1. Preparation:

The food is contaminated when a person handles food in shops, bazaars or food stalls or works in the kitchen of a restaurant, hospital, hostel or cantee-n where meals are supplied to many people. Davidson et al (1973)warn, foods if carelessly handled prior to cookery cause poisoning. Frobish (1963) exhorts that food should be properly cooked to kill micro-organisms.

According to Mc Divitt and Mudambi (1973), the surface dirt is easily removed by thorough washing. An understanding of the characteristics of each food is essential to render it thorough cleaning. Peckham (1969) and Robinson (1972) suggest a soft brush to clean thoroughly the food which may contain large amounts of sand that ordinary washing will not remove.

Rice purchase in any bazaar had to be washed and the washing water discarded. If spoon or fork is used for testing food preparation, it is important that is washed before being used for a second time.

2. Cooking:

According to Pyke (1965) and Mc Divitt and Mudambi (1973), cooking food improves digestability and appearance, develops new flavour and destroys harmful micro-organisms.

Many studies have shown that glass, stainless steel, aluminium and tin are suitable materials for cooking activities. They are insoluble and are not harmful to health (Peet and Thye, 1961; Peckham, 1969 and Ehrankranz and Inman, 1973). The use of galvanized sheets as food contact surface should be the minimum while cadminum and lead should not be used at all (Indian Standards Institution, 1972). All utensils should have unbroken seams. The American Dietetics Association (1968) and Kundsin and Bodmen (1975) recommend that the stoves, work table and swabs should be cleaned frequently before and after cooking. Food must not be left uncovered for longer than necessary at whatever stages it may be (Thomson, 1969).

3. Serving:

Not only must food be well prepared to be palatable, it must also have attractive colour and appearance (Robinson, 1972).

According to Mc Divitt and Mudambi (1969), fancy crockery washed in dirty cold water can be much more dangerous than disposable earthernware cups or banana leaves. Stainless steel and aluminium utensils designed for easy cleaning are the best. Gebhardt and Anderson (1959) pointed out that the

practice of picking up two or three used glasses at a time by the rim, often dipping the fingers into the remaining water in the process and then picking up clean properly sanitized glasses in the same manner should be avoided. Collins (1963) suggests keeping fingers away from food and clean utensils tumblers should be hold only by the base. The dirty plates or utensils should not be placed on the food preparation tables.

4. Dishwashing:

The method to be followed for dish washing depends upon the type of equipment and labour available (Kotschevan and Terrel, 1961). The method generally used for cleaning utensils are divided by Mallmann (1955), Hobbs (1968) and Haskell into two groups: hand washing and machine washing, or manual and mechanical washing.

Hand dishwashing is a very common method followed (Baxon et al, 1951). According to King (1961), the essential requirements for washing dishes by hand are water, suitable detergents, nylon scrubbers and racks for storing. Shiffman (1951), Ministry of Health (1963), Mallmann (1955) and Parry (1969) state sanitary quality of hand dishwashing is

entirely based on the care exercised and the order followed by the homemaker or workers performing the activities. The washing procedure adopted for utensils vary with different materials as enumerated by Ram (1953) and Jones and Buruham (1958).

Englis (1971) claims that machine washed dishes have been found to be relatively free from living micro-organisms.

Peet (1958), Nicholas (1962) and Gross and Lewis (1968) enumerate the steps involved in dishwashing as precleaning, washing, rinsing and sanitizing. Jones and Buruham (1958) opine that only an orderly preparation and precleaning procedure accelarate the washing operations. The foods sticking to the dishes should be removed by soaking in cold water or by scraping.

The American Home Economics Association (1968) and Binnie and Boxall (1974) consider water as a primary agent and the use of any suitable detergent aids the cleaning power of water. Hot water dissolves grease. Detergents increase the wetting power, emulsifies grease and holds the dirt in suspension, so as to make rinsing easier. Beveridge (1968), Weber and Black (1970) and Jindal et al (1974) mention the use of quarternary ammonium products

like surf and vim as effective detergents. Harvey and Hill (1952) and Benarad (1970) point out that the washed utensils should be rinsed in warm water to prevent the redeposition of dissolved materials on to the utensils and dipped in a water at a temperature of about 170°F to destroy the micro-organisms as recommended by Narayana Rao et al (1954) Klueger and Johnson (1959) and Christie and Christie (1972).

III EXPERIMENTAL PROCEDURE

The procedure pertaining to this study includes the following headings:

A .General informations about the selected canteen

B. General sanitary practices followed in the selected canteen.

C. Finding out the sanitary conditions by bacteriological examinations

D. Improving the existing sanitary practices

and E. Evaluating the improved sanitary practices adopted

A. General Informations About the Selected Canteen:

This aspect consisted of the following steps:

1. Selection of the canteen
2. Selection of the method of study
3. Preparing the interview schedule
4. Conducting the study
5. Consolidating and presenting the data

1. Selection of the canteen:

The canteen providing Janatha meals and snacks run by Sri Avinashilingam Home Science College for Women, Coimbatore was selected by the investigator to carry out the study.

2. Selection of the method of study:

Interview method was selected to find out the general information regarding the canteen. As it is viewed by Nisbet and Entwistle (1970), interview is not merely a matter of subjective impression or spontaneous interaction between the interviewer and the subjects, but a direct method of collecting information.

3. Preparing the interview schedule:

In order to ascertain the informations regarding the general details of the selected canteen, an interview schedule was prepared, as shown in Appendix I. This schedule called for informations regarding the details of the canteen, number of persons engaged in various activities, types of vessels used, quantity of food items served per person, benefits given to the food handlers and plan of the canteen.

4. Conducting the study:

After establishing good rapport with the food handlers by frequent visits to the canteen, the general informations were collected using the schedule.

5. Consolidating and presenting the data:

The collected data were consolidated and are discussed under the following headings:

a. Description of the canteen

b. Number of persons involved in various activities

c. Types of vessels used

d. Quantity of food items served per person

and e. Benefits given to the food handlers.

a. Description of the canteen:

The selected canteen was located at the central bus-stand. Meals section was started in May 1976 and snacks section in November, 1976.

The plinth area of meals section was around 1,400 sq.ft. (427 sq.m) and snacks section around 1,110 sq.ft. (338.55 sq.m.) The plan of both the sections are given in Figures 2 and 3.

Meals section was consisted of kitchen, store room, dining room and a separate general washing area. A big hall was converted into dining area on one side and kitchen and store room on the other side. Store room and washing area was situated on both sides of the kitchen. There was no

separate preparation area, but in the kitchen itself the activities were carried out daily. The personnel were using the public facilities for toilet, since there was no provisions.

In snacks section, there was separate kitchen and a dining area. The dining room was separated from the kitchen by a passage. The three centres in kitchen such as cooking, preparation and washing were located in the kitchen itself. Cooking and preparation area were partitioned by a wooden screen and the washing area was straight left to kitchen. The two bath rooms and lavatories were adjoining to the washing area. A separate small store room was located near the kitchen for storing provisions.

A separate general washing area was located outside the dining room of an easy vicinity of the customers, The furniture used in the dining area consisted of formica top tables and steel chairs which were arranged in an orderly way so as to make circulation easy.

The canteen has a mosaic floor in both the sections. The meals section was white washed whereas distempered in snacks section. It has the facilities of proper lighting ventilation, drainage facilities, dust bin and so on. The

meals were served between 11 A.M. and 4 P.M. and the snacks between 7 A.M. and 7 P.M. The time of starting their work in meals section was from 8 A.M. and snacks section was from 5 A.M.

b. Number of persons involved in various activities:

On the whole, 12 and 11 workers were appointed for carrying out the various activities involved in the meals and snacks sections respectively. More than one activity was carried out by the each worker.

Table I shows the number of persons involved in various activities in both the sections.

TABLE I

NUMBER OF PERSONS WORKING IN BOTH THE SECTIONS

S.No.	Activity	Number of persons	
		Meals section	Snacks section
1	Preparation	4	3
2	Cooking	2	2
3	Weighing food items	1	1
4	Cleaning dishes	1	1
5	Serving	5	5
6	General cleaning of the canteen	7	6
7	Issuing ticket	1	1
8	Account-keeping	1	1
9	Supervising	1	1

There was not much difference between the number of persons involved in various activities in the two sections. The food handlers engaged in cleaning, serving and washing activities in both the sections were between 10 and 20 years of age and the rest were above 20 years of age.

c. Types of vessels used:

In both the sections, aluminium utensils and accessory items were used for preparation and tinned brass vessels with a capacity of 30-50 litres for cooking. For preparing fried items, iron frying pans were used. Mud pot was used for making pickles. Aluminium and plastic utensils were mainly preferred in meals section whereas aluminium and hindalium in snacks sectionfbr serving meals and snacks respectively.

d. Quantity of food items served per person:

The amounts of food items served in canteen are presented in Table II.

TABLE II

QUANTITY OF FOOD ITEMS SERVED PER PERSON

Meals section			Snacks section		
Item	Minimum weight in gm.	Cost in Rs.P	Item	Minimum weight in gm	Cost in Rs.P
Rice	500		Idli - 2	100	
Sambar	140		Chutney	50	0.20
Poriyal	50		Sambar	50	
Rasam	120	1.00	Pongal	140	
Appalam	3		Chutney	50	0.40
Pickle	10		Sambar	50	
Butter milk	120 ml.		Uppuma	140	
			Chutney	50	0.35
			Sambar	50	
			Puri - 2	40	
			Kurma	50	0.35
			Coffee	120 ml.	0.30

Note: 'Sambar': Boil the Vegetables with cooked dhal adding masala powder and tamarind juice

'Poriyal' Season the boiled vegetables

'Rasam' Simmer the tamarind juice and season it.

The quantities recommended by the Government of Tamil Nadu for Janatha meals were served at a cost of Re.1/- per meal. The cost of snacks varied from 20 paise to 40 paise. According to the Food Control Order (1976), the addition of each serving for 'chutney', 'sambar', and 'Kurma', the cost of five paise was collected.

The menu normally depends upon the availability of vegetables. But all the snacks mentioned in Table II were prepared daily in snacks section.

e. Benefits given to the food handlers:

Accomodation, transport to and fro canteen, dress and free meals were the benefits given to the food handlers in the selected canteen.

B. General Sanitary Practices Followed in the Selected Canteen:

The interview-cum-observation method was adopted to find out the general sanitary practices in both the sections of the canteen. According to Devadas (1968), observation is the careful and systematic watching of facts, they occur in the course of nature which enhance its scientific value and to avoid the error to which human observation is liable.

The schedule given in Appendix II called for questions pertaining to the existing sanitary practices such as sanitation in canteen arrangement; method of performing the various activities such as purchase of food ingredients, preparation of food items before cooking, cooking; keeping the cooked items before serving; method of weighing the food items; keeping the weighed food items; cleaning before serving and after serving\ personal hygiene of the personnel and general cleaning of the floor and washing of utensils.

Personal contact with the food handlers helped to study the existing sanitary practices in both the sections by the investigator. The data were consolidated and are discussed here below.

Presenting the data:

The consolidated data are discussed under the following headings:

1. General neatness in canteen arrangement
2. Method of performing the various activities
and 3. Personal hygiene of the personnel

1. General neatness in canteen arrangement:

The location of the canteen at the central bus-stand prevent the possibilities of having a completely dust free

atmosphere due to frequent plying of vehicles and large number of people visiting the canteen. However, the general neatness of the meals section was comparatively satisfactory when compared to the snacks section, may be because in the meals section, meals were served only between 11 A.M. and 4 P.M. whereas in the snacks section serving was done from 7 A.M. and to 7 P.M. which kept the area always occupied and the personnel busy with cooking and serving. It may also be due to the crowded arrangement in the snacks section because of lack of space.

a. Kitchen:

The arrangement of utensils equipment and other accessories did not give full satisfaction. This may be due to lack of space and storage facilities. The utensils and equipment did not have well polished surface may be due to the using of hard water for washing dishes.

b. Dining area:

The location and capacity of the dining area were found to be satisfactory in both the sections eventhough in the snacks section, the dining area was comparatively small.

c. Washing area:

The general washing area was located near the entrance to be seen by the customers and the cleanliness was remarkable.

d. Store room:

Eventhough the area was situated at the correct place, the improper arrangement of storage bins reveals crowdness and hence inadequacy of space and lack of storage devices were also noted in snacks section.

e. Bath room:

There was no facilities provided in meals section. The location and space alloted for bathing in snacks section was not at all satisfactory, as it was situated adjacent to cooking and cleaning centres. The cleanliness of the room was not maintained by the personnel properly.

f. Toilet:

The same condition as seen in bath room was felt by the investigator.

g. Other sanitary aspects:

The other sanitary aspects such as lighting, ventilation, provision of garbage bins, drainage etc., gave remark-

c. Washing area:

The general washing area was located near the entrance to be seen by the customers and the cleanliness was remarkable.

d. Store room:

Eventhough the area was situated at the correct place, the improper arrangement of storage bins reveals crowdness and hence inadequacy of space and lack of storage devices were also noted in snacks section.

e. Bath room:

There was no facilities provided in meals section. The location and space alloted for bathing in snacks section was not at all satisfactory, as it was situated adjascent to cooking and cleaning centres. The cleanliness of the room was not maintained by the personnel properly.

f. Toilet:

The same condition as seen in bath room was felt by the investigator.

g. Other sanitary aspects:

The other sanitary aspects such as lighting, ventilation, provision of garbage bins, drainage etc., gave remark-

satisfaction in both the sections.

There was no water problem for drinking and general use as it was supplied by the Municipality. The water could be collected and stored in big drums with proper protection.

2. Method of performing the various activities:

This includes,

a. Purchase of food ingredients

b. Preparation, cooking and weighing food items

c. Serving food items and cleaning the table

and d. Washing the utensils.

a. Purchase of food ingredients:

The food items such as staple foods, condiments and spices and sugar and jaggery were purchased for every 15 days from the Supermarket, while the other items such as oil and appalam were made available once a week. The perishable items such as vegetables and fruits were supplied by the wholesaler daily, to avoid spoilage and wastage. As all the major items purchased were placed in cellophane packets, no cleaning was necessary prior to storing.

b. Preparation, cooking and weighing food items:

Just the needed quantity of water was used for cleaning the cereals, pulses and vegetables. The food provisions such as flour and ravai used in snacks section were sifted to remove the weevils prior to use. The procedures followed in the preparation and cooking of food items were in accordance with the principles to conserve the nutrients. All the cooked items were kept covered using appropriate lids.

All the cooked food items were weighed for individual serving using Hanson Dietetic Scale, prior to serving. Rice bowls with rice were stacked one above the other and they were covered using a clean cloth to avoid dust and flies. Similarly, 'sambar', 'poriyal' and 'butter milk' were weighed just, at the time of serving. 'Uppuma' and 'Pongal' were weighed into serving plates and were kept covered with another plate. The items which were served by number such as 'Idli' and 'puri' were also kept covered prior to serving in the serving vessels themselves.

c. Serving food items and cleaning the table:

The procedure followed for serving meals and snacks and cleaning the table are given below:

(1) Serving food items:

Table III depicts the method of serving meals and snacks in both the sections.

TABLE III

METHOD OF SERVING MEALS AND SNACKS IN BOTH THE SECTIONS

Meals section				Snacks section			
Items	Type of serving utensils	Material	Method of serving	Items	Type of serving utensils	Material	Method of serving
Rice	Vessel	Aluminium	Four bowls one above the other	Idli and Puri	Vessel	Aluminium	Serving from a vessel
Sambar	Catory	Stainless steel	20 at a time in a tray	Uppuma and Pongal	Plate	Hindalium	Carrying serving plates four at a time
Periyal	Catory	Aluminium	20 at a time in a tray	Chutney Sambar Kurma	Vessel	Stainless steel	Carrying serving bowls
Rasam	Bucket with spoon	Stainless steel bucket with aluminium spoon.	Using ladle	Coffee	Davara set	Stainless steel	Carrying a Davara set
Appalam	Vessel	Aluminium	10 at a time in a tray .	Water	Tumbler	Hindalium	Carrying two tumblers at a time
Pickle	Bucket with spoon	Plastic bucket with hindalium spoon	Using spoon				
BuckButter. milk and water salt	Tumbler	Plastic	20 at a time in a tray				
Salt	Small bucket with spoon	Plastic bucket with plastic spoon	Using spoon				

The materials and types of serving utensils used for serving different items varied according to the type of food and the amount to be served. Aluminium and plastic utensils were predominantly used in the meals section and alumiumum and hindalium in snacks section. Stainless steel 'catory' and 'davara set' were used for serving 'sambar' and 'coffee' respectively. This shows that cheap and light metals were preferred for the canteen.

For serving rice, rice bowls and for serving uppuma and pongal, tiffin plates were taken four at a time to the serving table for easy distribution. The other items such as 'sambar', 'poriyal' 'appalam', 'buttermilk' and 'water' were served by using tray to simplify the work. In snacks section, the water was supplied by carrying more than two tumblers at a time in an unhygienic way (Figure 4). This is due to the location of serving unit and the dining table wnear by each other. The remaining items were supplied using a spoon. These show that the personnel were aware of simplification of work and quick serving was given to the customers.

(ii) Cleaning the table:

There was not a separate person for cleaning the table, duties were rotated among the workers so that each

FIGURE - 4

WRONG METHOD OF CARRYING WATER TUMBLER

one gets the cleaning duty of atleast once a week.

The steps involved in cleaning the table is given below:

1. Clearing away drinking and eating utensils
2. Disposing the soiled leaves in the garbage bin
3. Removing the food particles by plantain stem
4. Wiping the table with wet cloth.

The following insanitary practices were noticed in both the sections (i) touching the eating and drinking utensils with the same hand used for cleaning the table and (ii) wiping the dining table with mop which was not cleaned.

d. Washing the utensils:

The procedure adopted for washing the serving utensils after each meal and snack is discussed below:

The serving utensils not used by the customers such as rice bowls and tiffin plates were used again for serving the same dishes without washing. The different utensils used for serving were washed together in the meals section. This is due to lack of time in between serving especially in peak hours, inadequate space in the cleaning area, less number of equipments and lack of knowledge in sanitation.

The different types of utensils used for the whole day in both the sections were washed and kept ready, following the cleaning agents:

Cleaning agent	Material
1. Tamarind plus brick powder	Brass-outside
Soapnut powder	Brass-inside
2. Brick powder	Aluminium
3. Soapnut powder	Hindalium, stainless steel and Plastic.

The scrubbing materials such as nylon scrubber and coconut fibre were used for rubbing different utensils using clean fresh water.

After winding up their day's activities, each area was washed with water using surf powder.

3. Personal hygiene of the personnel:

The personnel involved in various activities such as cook, assisting the cook, cleaning the table, serving dishes, washing the serving utensils etc., were found to be clean and neat in all aspects with regard to the pre-requisites in personal hygiene. But none of them wore apron for neat

and smart look and hair net for preventing hair from falling off to the food.

C. Finding out the Sanitary Conditions by Bacteriological Examinations:

The bacteriological examinations were performed in both the sections to assess the existing sanitary conditions as recommended by Frazier (1967).

The following steps were taken to do the study:

1. Selection of the sample
2. Collecting the sample
and 3. Conducting the experiments

1. Selection of the sample:

The cleanliness of the dining hall, dining table and napkin; serving, drinking and eating utensils and service was considered important in providing hygienic food in any restaurant. Hence five samples were randomly selected in both the sections for bacteriological examinations. They were: dining table and napkin used for wiping hands from meals section and tumbler, tiffin plate for serving and floor of dining hall from snacks section.

2. Collecting the sample:

The investigator visited the canteen without informing the food handlers, the purpose of the visit. The samples were col-lected on three consecutive days following the procedure given below:

Swab rinse technique was followed for collecting samples as recommended by the United States Public Health Service Association (1948), with slight modifications suggested by Dwarkbnath et al (1963). Samples were collected by the use of sterilized absorbant cotton swab, which was autoclaved at 121°C/15lbs/15 mts. Absolute care was taken to sterilize glassware in hot air oven and fluids and media in autoclave at the required temperature.

For collecting the samples, three applications of wet swab were done by soaking in 10 ml. of quarter strength sterilized ringar's solution. The dry swab method was also followed in the reverse direction for ensuring adequate cleaning. The swabs were broken off with sterile forceps in the ringer's solution.

a. Floor:

A mosaic floor area of 10 cm x 10 cm was swabbed.

b. Dining table:

The dining table with formica top was cleaned and dried. An area of 30 cm x 30 cm was swabbed.

c. Serving plate:

The important surface to swab includes the upper half inch of the inner and outer rim of cups, glasses and plates as advocated by Brock and Brock (1955). The sterilized ringer's solution was poured into the hindalium plate having diameter of 12 cm. and the entire inner surface and outer rim were swabbed. The entire quantity of the rinse and the swab were transferred to the test tube.

d. Coffee tumbler:

A capacity of 120 ml stainless steel coffee tumbler was swabbed by following the above procedure, since it comes under the category of drinking utensils.

e. Napkin:

The cotton napkin of 6 cm x 6 cm was cut out after it was washed and dried and it was soaked in ringer's

solution and transferred to the other test tube.

The collected samples were examined in the Microbiology laboratory. Plating of sample was done within the limit of three hours after its collection.

3. Conducting the experiments:

The following bacteriological studies suggested by Park and Park (1976) were conducted:

a. The total bacterial colony counts on nutrient agar incubated at 37°C for 48 hours was done to assess the general standard of hygiene of the selected samples.

b. The coliform organisms of Mac Conkey bile salt media incubated at 37°C for 24 hours was performed to collect the possible contamination of intestinal organisms.

a. Finding out the total bacterial counts:

Four plate method which ensures better distribution of colonies throughout the media as advocated by Gibber and Skinner (1966), Frazier (1967) and Seeley and Vandemark (1970) was followed for quantitative bacteriological examinations of the selected samples.

After vigorously shaking the container with the test sample to liberate the bacteria contained in the swab, 0.1ml.

of the sample was plated on nutrient agar. The preparation of nutrient agar is given in Appendix III.

The procedure for plating the sample on nutrient agar is given below:

i. Nutrient agar tubes (15 ml/each) were melted by placing them in a water bath maintained at 100°C.

ii. It was cooled to about 45°C to 55°C and kept ready

iii. The dilutions of the samples were made with sterile saline solution whenever necessary.

iv. The samples were shaken well in order to ensure a uniform mixing of the sample.

v. With a sterile pipette, 0.1 ml of each test sample was transferred to a sterile petridish

vi. The melted agar (45°C) was poured into the petridish containing the sample. They were mixed thoroughly with rapid to and fro circular motions and allowed to solidify.

vii. The plates were then incubated at 37°C for 48 hours.

The total bacterial count per plate was recorded with the help of a colony counter.

b. Finding out the coliform organisms:

To find out the coliform bacteria in the selected samples, the following tests were carried out as recommended by Park and Park (1976). They were: (i) presumptive test,

(ii) confirmatory test (iii) completed test and (iv) differentiating the coliform organisms.

(i) Presumptive test:

It was done by inoculating 10 c.c. of the sample into tubes of Mac Conkey bile salt lactose broth and incubated the culture at 37°C for 24 to 48 hours. If acid and gas were formed, the test was positive. If they were not formed the test was negative. Positive results were confirmed by confirmatory test.

ii. Confirmatory test:

This was done by streaking plates of Mac Conkey agar with the culture from the positive broth tubes in the presumptive test and incubated at 37°C for 24 to 28 hours. Then the streak plates were examined for the growth of typical coliform colonies.

iii. Completed test:

This test was to ensure the confirmatory test. Selected colonies from the above medium were inoculated into Mac Conkey broth and also on agar slopes. If gas developed in the broth and the organisms grow on the agar slopes, a staining

was prepared. If the slide showed non-sporing gram negative rod like bacteria, the presence of coliform bacteria in the sample was proved.

iv. Differentiating the coliform bacteria:

A large number of tests are available for differentiating the constituent members of the coliform bacteria1. Of these, five tests such as Indole production, Methyl Red reaction, Voges Proskauer reaction, growth in citrate medium and fermentation of lactose at 44°C were carried out as recommended by Indian Council of Medical Research (1963) to differentiate the coliform bacteria as shown in Appendix IV. The coliform bacteria were differentiated with the help of the Table as given in Appendix V.

D. Improving the Existing Sanitary Practices:

The following steps were taken to improve the sanitary practices in both the sections. They were:

1. Educating the food handlers
2. Adopting improved sanitary practices
and 3. Providing facilities.

1. Educating the food handlers:

The total responsibility for outbreaks of food poisoning rests with the food handlers and consequently, their education in food hygiene is of primary importance (Hovis and Hunter, 1966). Hence, an education programme was planned previously. The various methods such as lecture and demonstration and aids such as posters charts and films were chosen to carry out the education programme. To impart knowledge on hygiene and sanitation, important topics were selected. The topics chosen and methods adopted are depicted in Table IV and Figure 5.

TABLE IV

TOPICS COVERED AND METHODS AND AIDS USED UNDER EDUCATION PROGRAMME

S.No.	Topics covered	Methods and aids used
1.	Importance of keeping the canteen and surroundings clean.	Lecture Posters Charts Films
2.	Cleaning the floor of various units	Lecture Demonstration Posters Charts
3.	Sanitary practices to be followed while preparing, cooking and weighing food items.	Lecture Posters Charts Films
4.	Method of serving dishes	Lecture Demonstration Posters Charts
5.	Cleaning the table	Lecture Demonstration Posters Charts
6.	Sanitizing the eating, drinking and serving utensils.	Lecture Demonstration Posters Charts
7.	General washing procedure for utensils and equipment.	Lecture Posters Charts Films.
8.	Personal hygiene	Charts Posters, Films
9.	Causes of food poisoning and its prevention.	Lecture, Posters charts, films
10.	Pest control	Lecture,Posters charts

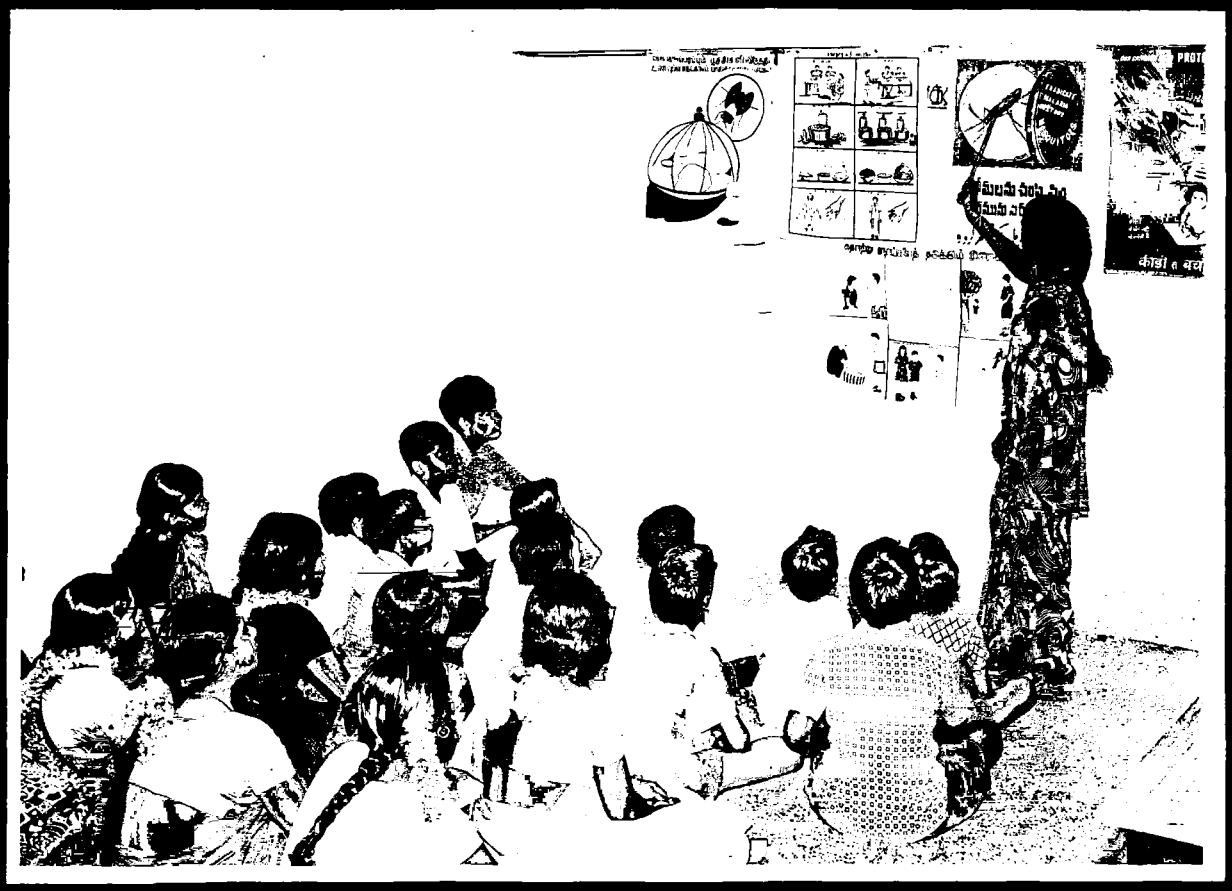

FIGURE - 5

EDUCATING THE PERSONNEL USING AIDS

Almost all the topics were covered by using the selected methods and aids. To teach the hygienic activities such as cleaning the floor, serving, cleaning the table and sterilizing the utensils, lecture cum demonstration was used for easy understanding and quick learning. Film shows were included to make learning interesting and easy. Besides, it provided entertainment also.

Apart from this, the personnel were taught how to move with the customers. The points stressed under various headings are given in Appendix VI.

Education was given for a week after which the activities were carried out by the food handlers in both the sections under the directions of the investigator for a month.

2. Adopting improved sanitary practices:

The activities such as cleaning the floor and table, serving, washing the serving utensils and napkins were selected to improve the sanitary practices. As suggested by Kilgour (1963), the disinfectant such as phenol and detol for cleaning the floor and surf for washing the floor, utensils and napkins were chosen. Right method of serving dishes

were taught to the personnel. To sanitize the utensils, surf powder was chosen for washing as suggested by Jindal et al, 1974 and hot water was made available (170°F) for rinsing, as recommended by Christie and Christie (1972).

The selected activities were taught step by step to bring about the change in their practice. The improved sanitary practices suggested are shown in Table V.

FIGURE - 6

MOPPING THE FLOOR IN SNACKS SECTION

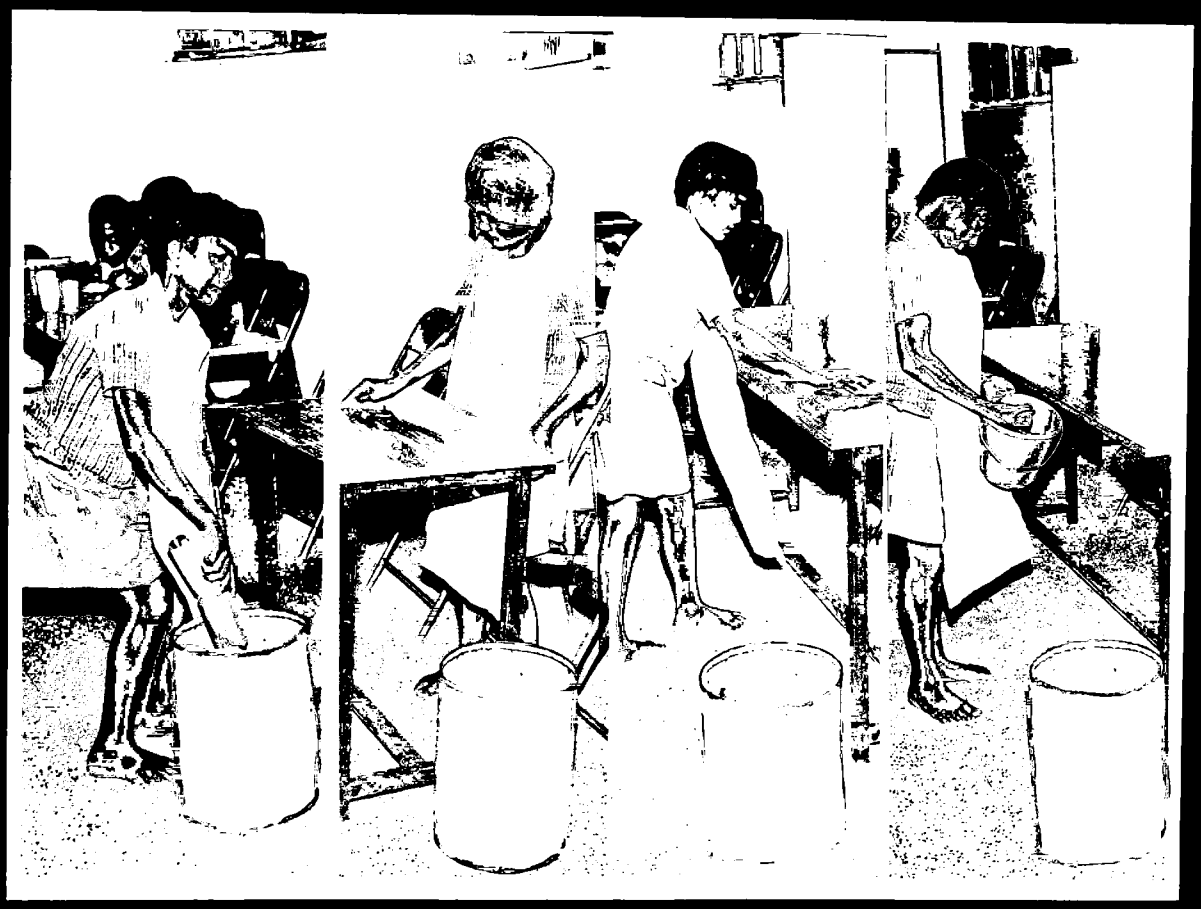

FIGURE - 7

IMPROVED METHOD OF CLEANING THE DINING TABLE

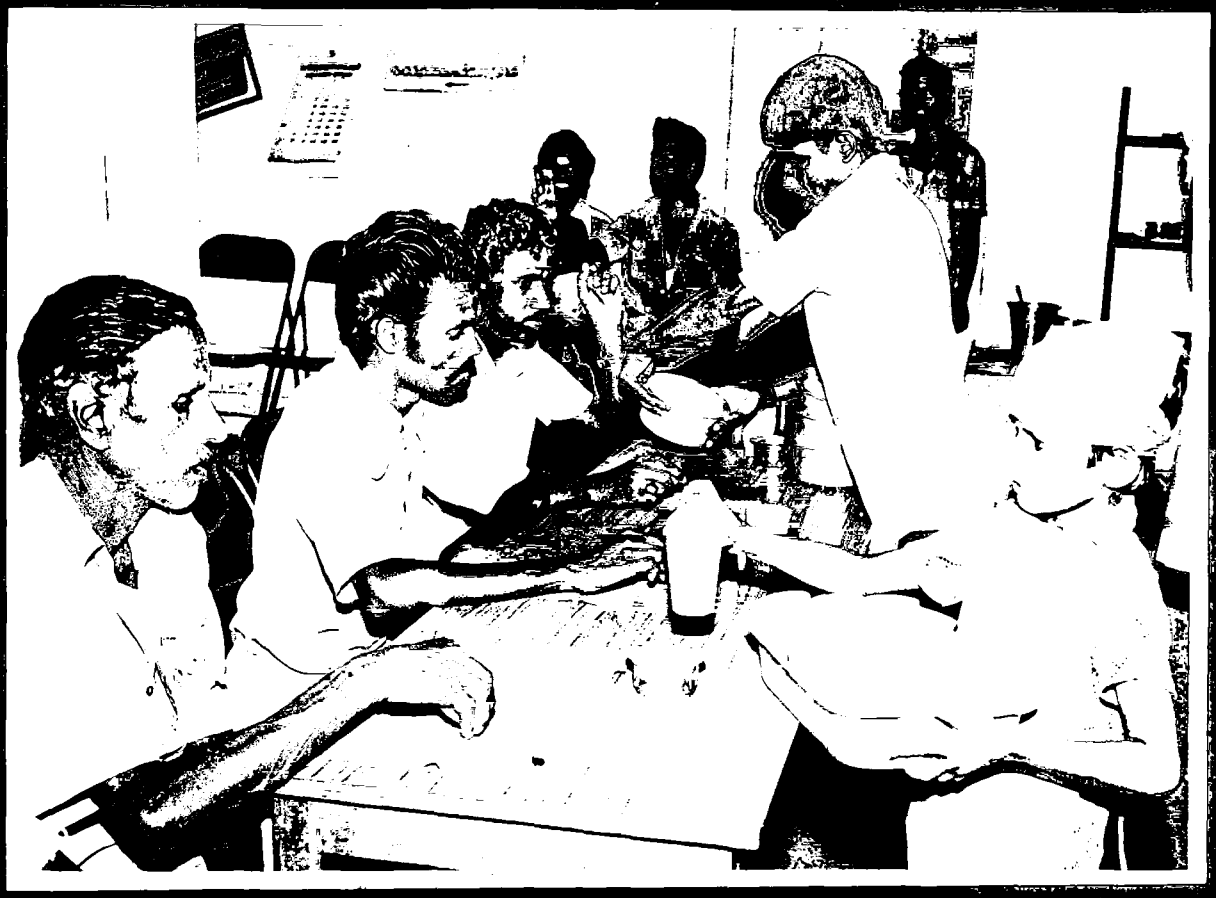

FIGURE - 8

SIMPLIFICATION OF WORK IN CARRYING DISHES

FIGURE - 9

STERILIZING THE SERVING UTENSILS USING NEWLY DESIGNED DIPPER

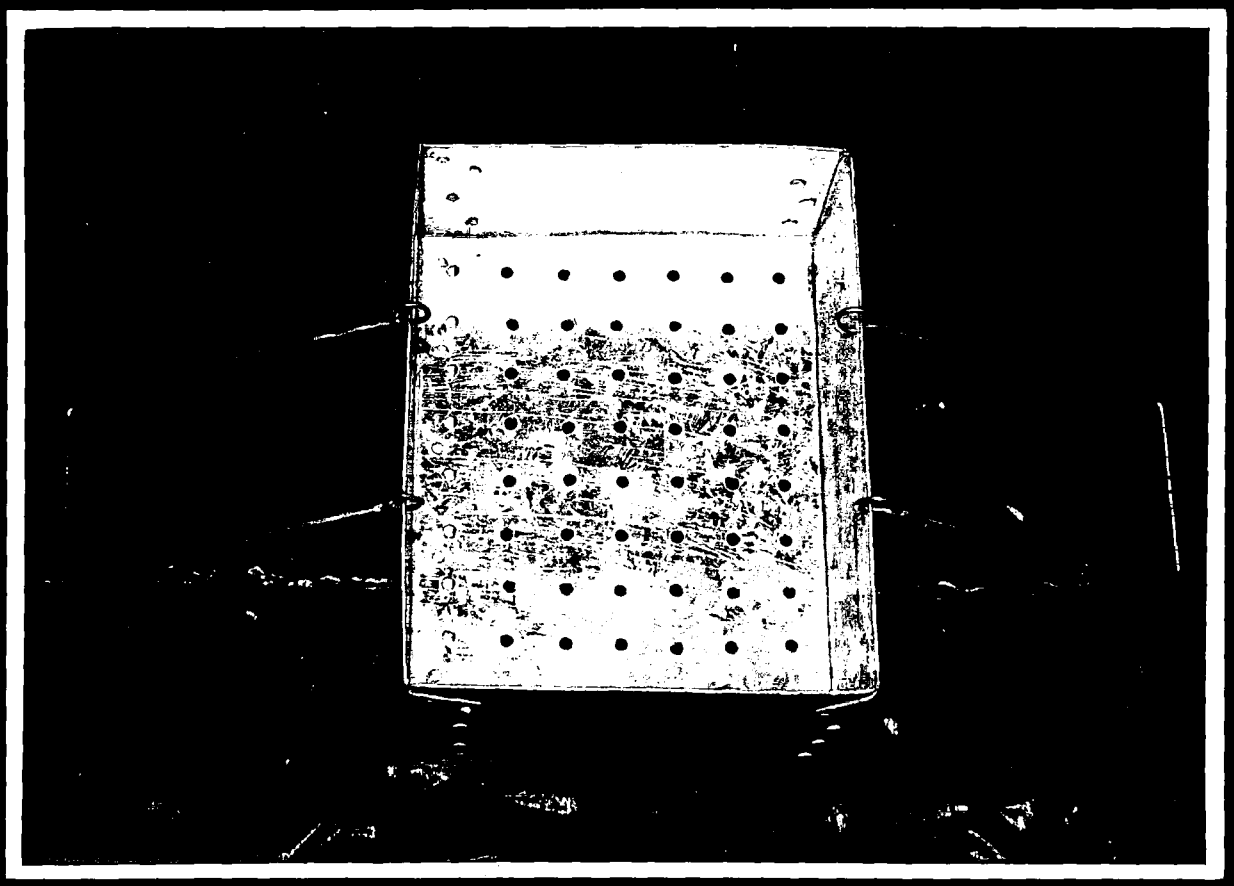

FIGURE - 10

NEWLY DESIGNED DIPPER FOR STERILIZING THE UTENSILS

All the suggested methods were followed in the canteen to ensure supply of hygienic meals.

3. Providing facilities:

According to Haskell, sanitation education cannot succeed if provisions are not made for practicing what is preached. The investigator provided the following materials to improve the sanitary practices in both the sections.

a. Apron:

After taking the body measurements of food handlers, the required quantity of cotton material was purchased and stitched to provide aprons to keep one's clothes clean.

b. Net:

Cotton gauze material was purchased and stitched to supply nets to cover the neatly cut hair to prevent from contacting food surface and the food itself.

c. Mop:

Three mops of light weight gunny material measuring 45 cm x 45 cm each were provided for mopping the floor.

d. Oil-can with oil and a plastic box with mop:

Oil-can with caster oil and a plastic box with cotton absorbent material mop was introduced to give shine to the cleaned dining table.

e. Concrete slab:

The concrete slab measuring 137 cm x 40 cm, having 15 cm thickness was placed in the washing area of snacks section to prevent entering water to kitchen.

f. Dipper:

The newly introduced dipper is described here below:

Two sets of dipper rectangular in shape made of zinc sheet with a size of 30.5 cm x 21.5 cm x 10 cm as shown in Figure 10 were disigned to sterilize the serving utensils. Zinc sheet was chosen because of its resistance to rust. The size was convenient to hold atleast ten serving utensils. Two handles fixed on both the sides were convenient for easy operation. There was holes at the bottom for draining of water. The total cost of each dipper was Rs.15/- which includes the cost of material and labour charges as Rs.10/- and Rs.5/- respectively.

F. Evaluating the Improved Sanitary Practices Adopted:

According to Desingh (1970), evaluation is measurement, assessment or appraisal of any progress made in any undertaking with a view to improving the operational efficiency of any education programme.

The improved sanitary practices adopted were evaluated through, (1) bacteriological examinations of the selected samples and (2) evaluation by the customers.

1. Bacteriological examinations of the selected samples:

The improvement in sanitary practices were confirmed by the bacteriological examinations. The selected samples were collected following the procedure described before. The findings are given in Chapter IV.

2. Evaluation by the customers:

To find out the effect of education programme, a check list was prepared. According to Wrightstone et al (1964), the check list is a selected list of words, phrases, sentence or paragraphs following which an observer records a check to denote the presence or absence of whatever is being observed.

Ten customers frequenting the canteen were selected randomly on the basis of their willingness. After explaining the need for evaluation, the check list prepared for the purpose (Appendix VII) were distributed. The data collected were consolidated and it is given in Chapter IV.

IV RESULTS AND DISCUSSION

The findings of the study on 'Improving the Existing Sanitary Practices of a Canteen' are discussed under the following headings:

A. Evaluation of the improved methods

B. Problems encountered

and C. Suggestions for further improvement

A. Evaluation of the Improved Methods:

This step is discussed under the following headings:

1. Findings of the bacteriological examinations
2. Evaluation of the improved methods by the customers

1. Findings of the bacteriological examinations:

The total bacterial colony counts and differentiating coliform organisms by bacteriological examinations of the selected samples before and after the education given to the personnel are given below:

2. a. Total bacterial colony counts:

Table VI illustrates the total bacterial colony counts of the selected samples., Figures 11 and 12 show the bacterial colony counts of the selected samples before and after education respectively.

TABLE VI

TOTAL BACTERIAL COLONY COUNTS ON SELECTED SAMPLES

S.No.	Sample	Triplicate	Total bacterial colony counts		Difference in total bacterial colony counts.	't' test value
			Before education	After education		
1.	Floor/sq.cm^2	1	3,00,000	> 1,00,000 (Pint point colonies)		
		2	2,70,000	10,000		14.8**
		3	1,20,000	> 50,000 (pint point colonies)		
	Average		2,30,000	3,333	2,26,667	
2.	Dining table/ Sq.cm^2	1	3,000	100		
		2	5,500	300		
		3	4,000	50		16.4**
	Average		4,167	150	4,017	
3.	Per plate	1	440	102		
		2	400	50		
		3	420	25		11.7**
	Average		420	59	361	
4.	Per coffee tumbler	1	100	20		
		2	200	15		
		3	340	-0-		3.31**
	Average		213	12	201	
5.	Napkin/sq.cm^2	1	1,500	27		
		2	2,100	75		
		3	1,500	30		7.8**
	Average		1,700	44	1,656	

Note: Before education - Habitual method
After education - Educating the personnel and improved method adopted
are followed throughout the study

** Significant at one per cent level.

FIGURE - 11

TOTAL BACTERIAL COLONY COUNTS ON SELECTED SAMPLES - BEFORE EDUCATION

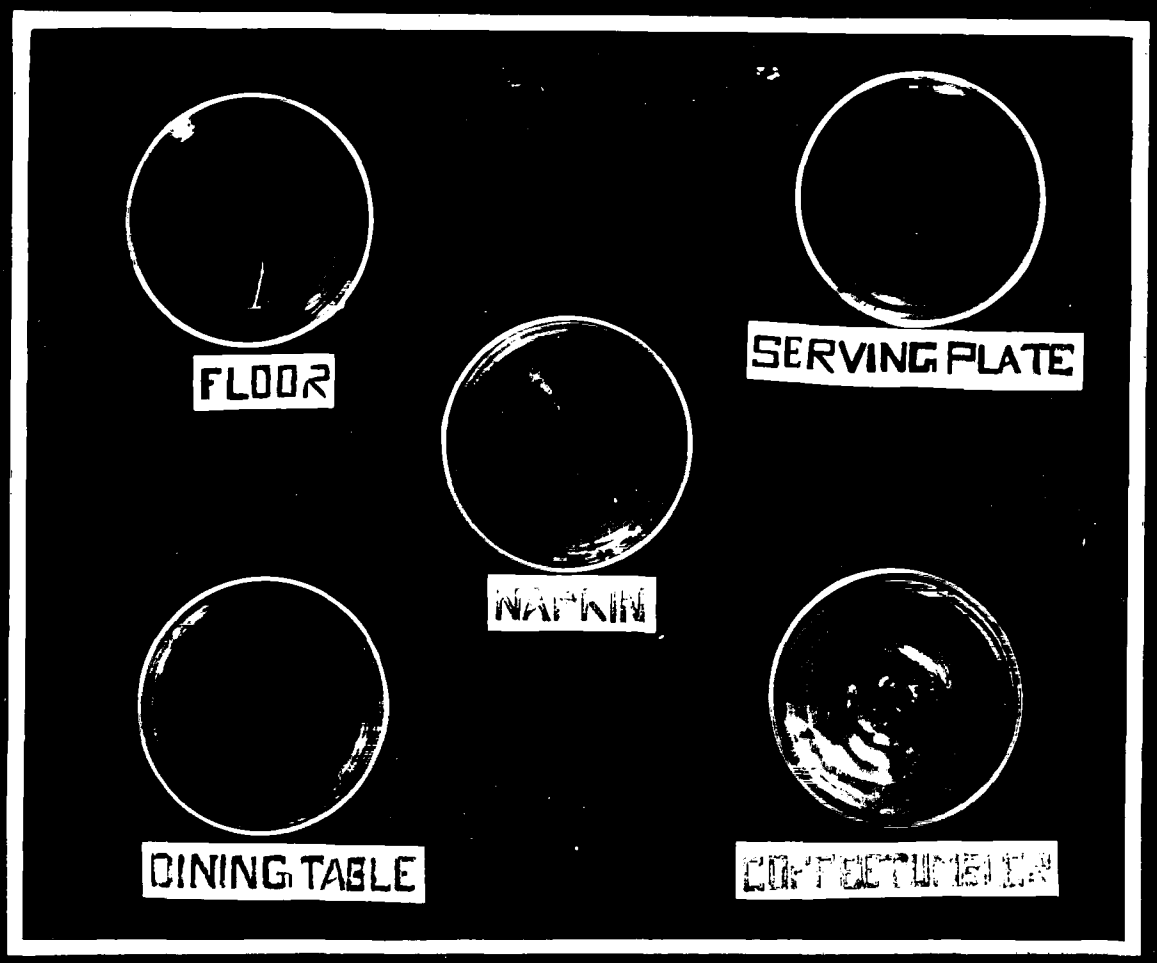

FIGURE - 12

TOTAL BACTERIAL COLONY COUNTS ON SELECTED SAMPLES - AFTER EDUCATION

Tremendous improvements were brought about as a result of the educational programme given to the personnel and also the improved methods adopted to maintain cleanliness and sanitation.

Floor:

Only 3,333 of harmful bacterial colonies along with an average of > 75,000 pint point colonies were noticed after introducing improvements in the method of cleaning the floor. The statistical analysis showed that it is significant at one per cent level (Appendix VIII). Eventhough the catering business was going on throughout the day, the thorough cleaning of the floor at 5 A.M., between 1 P.M. and 2 P.M. and between 8 P.M. and 9 P.M. using disinfectant lotion left the surface clean.

Dining table:

The difference in bacterial colony counts before and after the introduction of improvements showed that the procedure suggested is effective in minimizing the bacterial colony counts by 4017, which is highly significant at one per cent level (Appendix IX). The results suggest thorough wiping of the dining table with a wet clean cloth followed by wiping with a dry clean cloth and frequent rinsing of these mops are absolutely essential in keeping the dining table sanitary.

Serving plate:

The total bacterial colony counts in serving plate was found to be lesser in the early practice of washing (420 colonies per plate) than the standard counts (30 to 500 bacterial colonies per plate) as pointed out by Narayana Rao et al (1954). This shows that the procedure adopted for washing the plates in the habitual method was upto the mark. After introducing the new technique for washing, the number of bacterial colonies were reduced to 361. The statistical analysis proved that this difference was highly significant at one per cent level (Appendix X).

Tumbler:

On an average the number of bacterial colonies in tumbler was only 213 and this was below the standard level as pointed out by Narayana Rao et al (1954) which is 30 to 500 bacterial colonies. This indicates that the method already followed for cleaning the tumbler was quite satisfactory. The practice of sterilizing the tumbler at a higher temperature of water further decreased the total bacterial colony counts as suggested by Mallmann (1955) from 213 to 12. The study conducted by Marianna (1975) for sanitizing the glass tumbler (at a temperature of 82°C for 3 minutes) showed a higher bacterial

colony counts of 300 in improved technique when compared to this, (12) the maximum reduction of the bacterial colonies (201) were due to washing of tumbler in surf water (quarternary ammonium compound) as pointed out by Jindal et al (1974) which has lethal action to most of the micro-organisms, followed by steriligation in hot water after each use. The statistical analysis showed (Kal) there was significant difference between the former and the improved procedure adopted for washing the tumbler at one per cent level (Appendix XI).

Napkin:

On an average 1,700 bacterial colonies were noted which indicated the highly contaminated nature of the napkin used by the personnel for wiping hands. This was decreased to 44, after adopting the new technique. The significant difference proved the improvement brought about in the practice of washing napkin (Appendix XII).

b. Differentiating coliform organisms:

Table VII differentiates the presence of faecal and non-faecal Coliform organisms found in the selected samples.

TABLE VII

DIFFERENCIATING THE COLIFORM ORGANISMS OF THE SELECTED SAMPLES

Sample	Triplicate	Before education		After education	
		Coliform bacteria			
		Faecal	Non-faecal	Faecal	Non-faecal
Floor	1	E.coli I	Nil	E.coli I	Nil
	2	E.coli I	Nil	Coliform irregular (may be faecal)	Nil
	3	E.coli I	Nil	Nil	Nil
Dining table	1	E.coli I	Nil	Nil	Nil
	2	E.coli I	Nil	Nil	Nil
	3	E.coli I	Nil	Nil	Nil
Serving plate	1	Nil	K.aero-genes I	Nil	Nil
	2		K.aero-genes I	Nil	Nil
	3		K.aero-genes I	Nil	Nil
Tumbler	1	E.coli I	Nil	Nil	Nil
	2	E.coli I	Nil	Nil	Nil
	3	E.Coli I	Nil	Nil	Nil
Napkin	1	E.coli I	Nil	Citrobactor ferundii	Nil
	2	Citrobac-tor feru-ndii	Nil	Nil	Nil
	3	Citrobac-tor feru-ndii	Nil	Citrobactor ferundii	Nil

E. coli - Escherichia coli
K. aerogenes - Klebsiella aerogenes.
Citrobactor ferundii - may be faecal.

Prior to the practice of the improved technique, Escherichia coli was found on the floor, dining table, tumbler and napkin, whereas it was absent in the serving plate. The contaminants of serving plate were non-faecal Klebsiella aerogenes. As revealed from the study (Marianna, 1975) that Escherichia coli was present in the habitual method in Restaurant B whereas it was absent in the improved method.

Escherichia coli, Coliform irregular VI (may be faecal) and Citrobactor ferundii (may be faecal) were observed in floor and napkin even after the educational programme. The up and down movements of the food handlers and customers from various levels of income in the dining hall and the frequent use of napkin by the personnel for wiping hands might have contaminated the floor and napkin respectively.

2. Evaluation of the improved methods by the customers:

Evaluation of the general neatness of the canteen by the selected customers are discussed below:

a. General neatness of the canteen

b. Cleanliness in serving food items and cleaning the table

c. Other sanitary aspects

and d. Personal hygiene of the personnel.

a. General neatness:

Table VIII presents the scores awarded for the general neatness of the canteen by the selected customers. Appendix XIII presents the details of scores awarded.

TABLE VIII

SCORES AWARDED FOR THE GENERAL NEATNESS OF THE CANTEEN

S.No.	Particulars	Maximum marks	Marks awarded: Meals section	Marks awarded: Snacks section
1.	Kitchen:			
	a. Neatness	30	26	25
	b. Orderly arrangement of storage bins, utensils, equipments and accessories	30	27.7	24
	c. Appearance of utensils and equipments	30	26	23.5
	d. Appearance of garbage bin	30	25	24
	e. Appearance of water tub	30	27	24
2.	Dining area:			
	a. Neatness	30	28.5	27.5
	b. Orderly arrangement of weighed food items	30	30	30
	c. Arrangement of drinking utensils	30	25	27
	d. Appearance of serving utensils	30	24	19
	e. Appearance of garbage bin	30	28	26
	f. Appearance of serving unit	30	30	30
3.	Storeroom:			
	a. Neatness	30	26	26
	b. Arrangement of storage bins	30	28	25
4.	c. Passage:			
	a. Neatness	30	Nil	26
5.	General washing area:			
	a. Neatness	30	30	27
	b. Appearance of sink	30	29	28
	c. Condition of storage of water	30	28	27
6.	Bathroom:			
	a. Neatness	30	Nil	24
7.	Toilet:			
	a. Neatness	30	Nil	22.5
8.	Cleanliness of exterior	30	29	25

For neatness, the meals section received the highest scores almost in all features when compared with the snacks section. However, athe maximum scores of 30 was obtained for orderly arrangement of weighed food items and appearance of the serving unit. The general appearance of the utensils were not fully satisfactory. This may be due to the washing of the utensils in hard water as pointed out by Rajeswari and Devadas (1969).

b. Cleanliness in serving food items and cleaning the table:

The degree of cleanliness in serving food items and cleaning the table are discussed below:

(i) Serving food items:

Table IX gives the scores awarded for serving in both the sections.

TABLE IX

SCORES AWARDED FOR SERVING

S.No.	Particulars	Maximum scores	Marks obtained	
			Meals section	Snacks section
1.	Before serving:			
	a. Method of cleaning the leaves.	30	22	21
	b. Use of clean water for cleaning the leaves.	30	22	20
	c. Arrangement of leaves in the serving unit before serving.	30	21	24
2.	Serving the food items:			
	a. Handling water tumblers	30	28	28
	b. Method of carrying food items.	30	28	28

Handling water tumblers and method of carrying food items secured the highest scores of 28, whereas cleaning leaves and use of clean water for cleaning the leaves and arrangement of leaves on the serving unit secured less scores (21 to 24). This shows that these could be improved further to get the maximum satisfaction for the customers.

(ii) Cleaning the table:

Table X gives the scores obtained for cleaning the table.

TABLE X

SCORES OBTAINED FOR CLEANING THE TABLE

S.No.	Particulars	Maximum scores	Marks awarded	
			Meals section	Snack section
1.	Method of removing the dishes.	30	28	26
2.	Removing the leaves	30	27	28
3.	Bucket used for disposing leaves.	30	28	26
4.	Regularity in disposing the leaves from bucket.	30	29	30
5.	Cleanliness of napkin for wiping.	30	27	28
6.	Condition of water for cleaning the table.	30	29	28
7.	Method of cleaning the table.	30	30	29

From the above table it is understood that there was not much difference between the scores obtained in the two sections for cleaning the table. This reveals that the acceptance of new procedure reached the desired level as expressed by the customers.

c. Other sanitary aspects:

The other sanitary aspects such as lighting, ventilation, provision for wire mesh, drainage facilities, provision of dust bin and disposing the garbage were fully satisfied in both the sections as revealed by the customers.

d. Personal hygiene of the personnel:

The personal hygiene of the personnel is exhibited in Table XI.

TABLE XI

PERSONAL HYGIENE OF THE PERSONNEL

S.No.	Particulars	Maximum scores	Marks awarded	
			Meals section	Snack section
1.	Neat appearance	30	27	27
2.	Uniform neat	30	24	27
3.	Apron clean	30	21	27
4.	Clean combed hair	30	28	28
5.	Clean hand	30	30	30
6.	Clean nail	30	30	30
7.	Free from cold and other infections	30	30	30

The maximum marks (30) were secured for clean hand, clean nail and physical fitness in both the sections. However, their dress and apron were not clean and hence received less scores of 24 and 21 respectively especially in meals section.

B. Problems Encountered:

The problems encountered by the investigator while improving the sanitary conditions in the selected canteen are given below:

1. The location of the canteen in a place where there is heavy traffic.
2. A passage used as public path, separating the dining area and kitchen in snacks section.
3. Inconvenient arrangement of the cleaning area.
4. Lack of free time for the personnel to attend the educational programme.
5. Lack of interest on the part of the food handlers in changing over to the improved practice which required extra time.
6. Inadequacy of space for sterilizing the serving utensils.
7. Low level of education and maturity of food handlers to understand the need for practicing what they were taught.
8. Lack of interest of the food handlers to continue in their jobs.

C. Suggestions for Further Improvement:

1. The various units must be fumigated atleast once in a month.

2. The canteen must be white washed once in three months both exterior and interior.

3. Monthly medical examination must be arranged for food handlers.

4. There must be constant supervision of the sanitary practices followed by the workers.

V SUMMARY AND CONCLUSION

The findings of the study on 'Improving the Existing Sanitary Conditions of a Canteen' are summarized below:

1. In the earlier practice, the general neatness of the meals section was comparitively satisfactory when compared to the snacks section, due to working time betweenllw A.M. and 4 P.M. and between 7 A.M. and 7 P.M. respectively.

2. The arrangement of utensils, equipment and other accessories did not give full satisfaction due to lack of space and storage facilities.

3. Lighting, ventilation, garbage bins, drainage facilities etc., gave excellent remark in both the sections.

4. Thorough cleaning and washing of cereals, pulses and vegetables were seen with regard to sanitation. The procedures followed in the preparation and cooking of food items were in accordance with the principles to conserve the nutrients.

5. The cheap and light metals of aluminium and plastic in meals section and aluminium and hindalium in snacks section were preferred for the canteen.

6. Method of serving dishes showed that the personnel were aware of the simplification of work and quick supply of meals and snacks.

7. The insanitary practices such as removing the eating and drinking utensils with the dirty hand and wiping the dining table with mop which was not cleaned were noticed in both the sections.

8. After each meal and snack, rice bowls and serving plates were not washed as it was not used by the customers.

9. The unhygienic practice of washing the different utensils together, using the same water was observed in meals section. This is mainly due to lack of knowledge in sanitation.

10. The personnel involved in various activities were found to be neat and clean in all aspects with regard to personal hygiene.

11. The floor of various units were washed using surf powder between 8 A.M. and 9 P.M. daily.

12. To give effective sanitation programme, educational programme was carried out using different aids and methods such as posters, charts and films and lectures and demonstrations repectively. Improved techniques were introduced to change their formal practice and to bring about better sanitation.

13. Highly significant difference was noticed after introducing the improved techniques for cleaning the floor and table, washing the serving and drinking utensils and napkins used for hand wiping.

14. After introducing new method, the total bacterial colony counts on floor/sq.cm^2, dining table/sq.cm^2, per serving plate, per coffee tumbler, and napkin/ sq.cm^2 was decreased from the former practice to 2,26,667; 4,017; 361; 201 and 1,656 respectively.

15. The total bacterial colony counts on serving plate and tumbler were found to be 420 and 213 in the former practice respectively, which was below the standard level. After introducing the new method, the total bacterial colony counts were further minimized.

16. Prior to the practice of the improved technique, Escherichia coli was found on the floor, dining table, tumbler and napkin, whereas non faecal Klebsiella aerogenes was seen in serving plate. Faecal origin of Escherichia coli and Citrobactor ferundii (may be faecal) were noticed on floor and napkin even after introducing the new technique.

17. The general neatness in meals section received the highest scores when compared with the snacks section as expressed by the customers.

18. Regarding serving, the right method of carrying food items secured the marks of 28, whereas low scores of 21-24 were received for cleaning the leaves, arrangement of leaves in the serving unit and so on.

19. The new procedure for cleaning the table was accepted in both the sections which secured the scores of 26 to 30.

20. Regarding personal hygiene of the personnel, their dress and apron were not always clean, hence they secured less scores of 21 and 24 respectively in meals section.

21. The problems such as location of the canteen, the passage between dining room and kitchen in snacks section, lack of free time of the personnel, inadequacy of space for sterilization and lack of interest of the personnel were the problems met by the investigator during the study.

Improvements in sanitation could be brought about through the effective education programme conducted, but constant supervision of the personnel is necessary to sustain their interest in maintaining the standards reached.

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A P P E N D I C E S

APPENDIX I

AN INTERVIEW SCHEDULE TO ELICIT INFORMATION ON GENERAL INFORMATIONS ABOUT A CANTEEN (MEALS AND SNACKS SECTIONS)

Date:

Name of the investigator:

Name of the interviewee:

1. Location:

2. Rented/owned:

3. Date of inauguration of the canteen:

I Number of Persons Involved in Various Activities:

S.No.	Activity	Meals section					Snacks section				
		Number of persons involved	Sex	Age	Type of work	Remark	Number of persons involved	Sex	Age	Type of work	Remark
1.	Preparation										
2.	Cooking										
3.	Cleaning the utensils										
4.	Serving										
5.	Cleaning the canteen										
6.	Issuing ticket										
7.	Account-keeping										
8.	Supervising										
9.	Any other										

II Allotment of Area for Various Activities:

S.No.	Activity	Meals section		Snacks section	
		Location	Carpet area in sq.cm.	Location	Carpet area in sq.cm.
1.	Cooking and preparation				
2.	Washing vessels				
3.	Eating				
4.	Washing hands				
5.	Storing provisions				
6.	Passage				
7.	Bathing				
8.	Toilet				

III Type of Utensils Used for Preparing and Serving Food Items.

A. Preparing:

S.No.	Items	Materials	Capacity in litre	Number of vessels used	*Tinned
1.	**Meals section**				
	a. Rice				
	b. Sambar				
	c. Poriyal				
	d. Rasam				
	e. Appalam				
	f. Pickle				
	g. Buttermilk				

* Brass, bronze and copper only

S.No.	Items	Materials	Capacity in litre	Number of vessels used	*Tinned
2.	**Snacks section**				
	a. Rice				
	b. Uppuma				
	c. Idli				
	d. Puri				
	e. Chutney				
	f. Sambar				
	g. Kurma				

Contd..

B. Serving:

S.No.	Items	Materials	Capacity in litre	Number of vessels used	*Tinned
1.	**Meals section**				
	a. Rice				
	b. Sambar				
	c. Poriyal				
	d. Rasam				
	e. Buttermilk				
	f. Pickle				
	g. Appalam				
	h. Water				
2.	**Snacks section**				
	a. Idli				
	b. Puri				
	c. Uppuma				
	d. Pongal				
	e. Coffee				
	f. Water				

* Brass, bronze and copper only

IV Quantity of Food Items Served/Person:

S.No.	Meals section		Snacks section	
	Items	Quantity in gm.	Items	Quantity in gm
1.	Rice		Idli	
2.	Sambar		Puri	
3.	Poriyal		Uppuma	
4.	Rasam		Pongal	
5.	Appalam		Coffee	
6.	Pickle		Chutney	
7.	Buttermilk		Sambar	
			Kurma	

V Other Details About the Performance of Activities:

S.No.	Other details	Meals section	Snacks section
1.	Duration of working hours		
2.	Peak hours		

VI Benefits Given to the Food Handlers

S.No.	Benefits	Meals section	Snacks section
1.			
2.			
3.			
4.			
5.			

VII Plan of the Canteen:

A. Meals section

B. Snacks section:

APPENDIX II

AN INTERVIEW SCHEDULE CUM OBSERVATION TO ELICIT INFORMATIONS ON THE EXISTING SANITARY PRACTICES IN A CANTEEN

1. Name of the interviewer: Date:

2. Name of the interviewee:

I Sanitation in Canteen Arrangement

S.No.	Particulars	Fully satis-factory	Partially satis-factory	Not at all satis-factory
A.	General neatness of the canteen			
B.	Location of the canteen			
C.	<u>Kitchen</u>:			
1.	Location			
2.	Sufficiency of space for a. preparation b. cooking c. cleaning			
3.	Arrangement of utensils and equipments and accessories in a. preparation area b. cooking area c. cleaning area			
4.	Appearance of the utensils used for a. preparation b. cooking c. serving			

Note: Same schedule is followed in both the sections.

S.No.	Particulars	Fully satis-factory	Partially satis-factory	Not at all satisfactory
	5. Cleanliness of the area:			
	a. preparation			
	b. cooking			
	c. cleaning			
D.	Dining area:			
	1. Location			
	2. Sufficiency of Space			
	3. Cleanliness of the dining area			
E.	General Washing area:			
	1. Location			
	2. Sufficiency of space			
	3. Cleanliness of the wash-basin			
F.	Store room:			
	1. Location			
	2. Sufficiency of space			
	3. Cleanliness of the room			
	4. Arrangement of storage bins, utensils, etc.,			
	5. Adequate storage facilities			
G.	Bath room:			
	1. Location			
	2. Sufficiency of space			
	3. Cleanliness of the room			

Contd..

S.No.	Particulars	Fully satis-factory	Partially satis-factory	Not at all satisfactory
H.	Toilet:			
	1. Location			
	2. Sufficiency of space			
	3. Cleanliness of the room			
I.	Other sanitary aspects:			
	1. Lighting			
	2. Ventilation			
	3. Orientation			
	4. Provision of garbage bins			
	5. Disposal of refuse			
	6. Drainage facilities			
	7. Provisions to prevent files			
	8. Cleanliness of the surroundings			
J.	Storing of water for			
	Drinking			
	General use			

II Sanitary Aspects Performed in Various Activities:

A. Purchase of food ingredients:

S.No.	Ingredients	Place of purchase	Frequency of purchase	Cleaning of the ingredients
1.	Cereals and grain products			
2.	Pulses			
3.	Green leafy vegetables			
4.	Other vegetables			
5.	Roots and tubers			
6.	Spices and condiments			
7.	Sugar and jaggery			
8.	Fats and oils			
9.	Others			

B. Preparation of food items before cooking:

1. Cereals and Pulses:

S.No.	Ingredients	Quantity in gm.	Procedure for washing: Quantity of water used	Number of times washed	Using fresh water	Using same water
a.	Cereals:					
b.	Pulses:					

2. Vegetables:

Items	Quantity in gms.	Procedure for washing					
		Washed after cutting	Washed before cutting	Quantity of water used	Number of times washed	Using fresh water	Using same water
1.							
2.							
3.							
4.							

C. Cooking:

S.No.	Items	Number of times cooked per day	Following sanitary aspects	Remark
1.				
2.				
3.				
4.				
5.				

D. Keeping cooked items before serving:

S.No.	Items	Method of keeping
1.		
2.		
3.		
4.		
5.		

E. Weighing food items:

S.No.	Items	Method of weighing

F. Keeping the weighed food items:

S.No.	Items	Method of keeping

G. Cleaning before serving:

1. Type of furniture used:

S.No.	Type of furniture	Finishes used	Remark

2. Dusting the table before serving the first meal:

3. Served in-

Plate:

Leaf:

4. Leaves are cleaned-

1. Ahead of serving:

2. At the time of serving:

5. Method of cleaning the leaves:

i. Dipping it in water:

ii. Washing under tap water:

iii. Sprinkling water:

Others:

6. Method of serving:

S.No.	Meals section		Snacks section	
	Items	Method of serving	Items	Method of serving

H. Cleaning after serving:

1. Cleaning the dishes:

S.No.	Serving dishes	Cleaning dishes		Remark
		in between course	After the course	

2. Cleaning the dining table:

a.Leaf is removed by-

i. Any one of the servants

ii. The person appointed for the activities

iii. Customers

3. Method of cleaning the table:

4. Method of washing the serving dishes:

S.No.	Items	Container used for serving	Materials	Method of washing		Remark
				With cleaning agent	Without cleaning agent	

I. General washing area:

1. Provision of wash-basin:

Yes ☐ No ☐

2. Number of wash-basin provided:

3. Storing water in the washing area for the customers.

4. Managing the situation, if not.

III. Personal Hygiene of the Personnel:

S.No.	Name	Type of activity	Hygienic conditions of				
			Hand	Nail	Hair	Clothing	Body

IV. Over All Cleaning and washing:

A. Floor:

S.No.	Area	Method of cleaning	Detergent used
1.	Kitchen		
2.	Washing area (inside)		
3.	Dining		
4.	Passage		

B. Utensils:

S.No.	Utensils	Materials	Cleansing agent used
1.	Preparation		
2.	Cooking		
3.	Serving		

APPENDIX III

PREPARATION OF NUTRIENT AGAR

Yeastrel (or meat extract or lemco)	- 3 gm.
Peptone	- 5 gm.
Washed shredded or powdered agar	- 25 gm.
Distilled water	- 1000 ml.

1. Dissolve the yeastrel and peptone in 1000 ml. distilled water in a steam bath.

2. Cool to temperature and adjust the PH to 7.4, using phenol red indicator. Weigh the agar, if shredded, chop it up, place it in a muslin bag, wash it in running water for 15 minutes and after squeezing out excess water, add it to the yeastrel peptone mixture. Autoclave at 15 lbs for 20 minutes (ie.120°c) Filter hot through a plug of cotton, wrapped in two layers if gauze, place in a funnel. The agar should be taken directly from the autocalave and filtered hot, preferably by keeping the whole appartus warm in the steamer (Steam bath). The reaction of the filter is tested at 50°c and adjusted (if necessary) to PH 7.6 tube in 15 ml. quantities and autoclave at 15 lbs (120°c) for 20 minutes. The final reaction of the medium at room temperature should be 7.2.

APPENDIX IV

PROCEDURE FOR DIFFERENTIATING COLIFORM BACTERIA

I. Indole Test:

1. Incubate the peptone water culture at 37°c for 48 hours

2. Remove from incubator and add 0.2 to 0.3 ml. of Kova's reagent, shake the tubes gently.

3. The almost immediate appearance of a red colour (red ring) in the upper layer indicates a positive indole (+) reaction.

2. Methyle Red Test: (M.R. Test)

Incubate at 37°c for two days or three days if necessary. Remove from incubator and add five drops 0.04 percent Methyle Red solution to each.

The production of a distinct red colour denotes a positive (+) test and an yellow colour a negative (-) test. A pink or pale red colour is a doubtful reaction.

3. Voges Proskauer Test: (V.P. Test)

To 1.0 ml. of the culture in glucose phosphate broth, add 0.5 ml. of a 6 per cent solution of a napthol in pure

absolute alchol and 0.5 ml. of a 16 per cent solution of potassium hydroxide. Shake the tubes and allow to stand on the table for half an hour. The production of deep red colour in the mixture constitutes a positive test (+).

4. Growth in Citrate Medium:

Incubate the tube at 37°c for 48 hours. Opacity in the tube is considered as evidence of growth (+). If the medium remains clear, the test is negative (-). If the result is not readily perceivable, add a few drops of 0.008 per cent from the thynol blue solution. Growth is indicated by a change in colour from a pale green to a bluish green or blue.

5. Lactose Fermentation at 44°c:

1. Incubate the inoculated Mac Conkey broth or brilliant green bile broth tube at 44°c ± 0.25°c in a water bath and examine after 6 to 24 hours.

2. If gas is produced in the enclosed Durham's tube, it is positive (+).

3. If gas is not produced within 24 hours period, eventhough acid production and growth occurs. The result should be considered negative (-), if there is no gas formation within this period.

APPENDIX V

DIFFERENTIATION OF COLIFORM GROUP

Name	Growth in Mac Conkey broth at 44°c	Indole	MR	VP	Growth in a citrate medium
Escherichia coli (E.coli.I)	+	+	+	-	-
Escherichia coli (E.coli.II)	-	-	+	-	-
Escherichia coli (E.coli.III)	-	+	+	-	-
Citrobacter ferundii (Cit.ferundii I)	-	-	+	-	+
Citrobacter ferundii (Cit.ferundii II)	-	+	+	-	+
Klebsiella cloaceae (K.aerogenes I)	-	-	-	+	+
Klebsiella cloaceae (K.cloaceae)	-	-	-	+	+
Klebsiella aerogenes (K.aerogenes II)	-	+	-	+	+
Coliform irregular II	+	-	+	-	-
Coliform irregular VI	+	-	-	+	+

Note: Characterised by gelatin liquefaction
M.R. - Methyle Red Test
V.P. - Voges Proskauer Test

APPENDIX VI

POINTS COVERED UNDER EDUCATION PROGRAMME

S.No.	Topics Covered	Points stressed under education programme
1.	General cleanlines	a. General neatness of the canteen b. Keeping the surroundings clean and neat. c. Neatness of the various units. d. Orderliness in arranging the utensils, equipments, storage bins and other accessories. e. General appearance of the utensils and equipments
2.	Preparation before cooking	a. Cleaning the utensils and equipments before preparation. b. Cleaning the cereals and pulses: i. Removing the foreign matter ii. Washing and draining iii. Washing the vegetables before cutting c. Avoid using the spilled foods while preparing.
3.	Cooking	a. Sanitary aspects to be followed while cooking: i. Cleaning the utensils, equipments and other accessories before cooking ii. Avoid putting ladle and lids on the floor iii. Utensils are to be covered iv. Use tinned brass utensils v. Keeping the cooked items covered
4.	Weighing food items	a. Keeping the weighed items covered b. Avoid using the spilled foods c. Avoid keeping the ladle on the floor d. Cleaning the utensils

Contd..

S.No.	Topics covered	Points stressed under education programme
5.	Serving	a. Order of serving. b. Right method of serving.
6.	Cleaning the table	a. Method of cleaning the table. b. Disposing the leaves.
7.	Washing the utensils	a. Importance of careful washing. b. Procedure for sanitising the utensils: i. Rising in water ii. Washing in soapy water iii. Sterilizing in hot water c. Using cleansing agents such as soapnut powder, surf, det, vim for washing
8.	Cleaning	a. Removing the cobweb once in a week. b. Dusting the furniture once in three days. c. Sweeping the floor before mopping. d. Method of mopping the floor. e. Use of disinfectants such as detol, phenol etc. f. Use of cold soapy water daily for cleaning the floor.
9.	Other aspects in cleaning	1. Covering the drinking water. 2. Checking the drainage. 3. Disposing the refuse.
10.	Personal hygiene	a. Importance of personal cleanliness. b. Causes of infectious diseases and their prevention. c. Daily bath d. Clean dress e. Clean combed hair f. Clean hands and nails g. Clean teeth h. Using fresh napkin for hand wiping i. Purpose of wearing apron j. Importance of washing hand after every visits to toilet.

APPENDIX VII

CHECK LIST TO EVALUATE THE IMPROVED SANITARY PRACTICES IN A CANTEEN

S.No.	Particulars	Fully satisfactory (3)	Partially satisfactory (2)	Not at all satisfactory (0)	Remark
I	General Neatness of the Canteen				
II	Kitchen:				
A.	General neatness				
B.	Neatness in - a. Ceiling b. Wall c. Floor				
C.	Preparation area:				
1.	Neatness				
2.	Storage of- a. Bins b. Equipments c. Accessories				
3.	Appearance of utensils and equipments				
4.	Washing of cereals, pulses and vegetables				
5.	Preparation before cooking				

Contd..

S.No.	Particulars	Fully satisfactory (3)	Partially satisfactory (2)	Not at all satisfactory (0)	Remark
D.	Cooking area:				
1.	Neatness				
2.	Cooking utensils: a. Appearance b. Brass vessels tinned				
3.	Arrangement of utensils and equipment				
4.	Storage of- a. Bins b. Cooking utensils and equipment				
5.	Garbage bins				
6.	Preparation of items				
E.	Washing area:				
1.	Neatness				
2.	Water tubs (storage of water)				
3.	Provisions for keeping cleaning agents				
III.	Dining area:				
A.	General neatness				
B.	Neatness in- 1. Ceiling 2. Wall 3. Floor				

Contd..

S.No.	Particulars	Fully satis-factory (3)	Partially satis-factory (2)	Not at all satis-factory (0)	Remark
	C. Serving unit				
	D. Arrangement of weighed food items				
	E. Protection from flies				
	F. Arrangement of serving utensils				
	G. Appearance of the utensils				
	H. Before serving:				
	1. Method of cleaning the leaves				
	2. Condition of water for cleaning the leaves				
	3. Arrangement of leaves before serving				
	I. Serving the food items:				
	1. Order of placing the customer				
	2. Cleanliness of serving utensils				
	3. Order of serving				
	4. Carrying water				
	5. Carrying food items				
	6. Method of cleaning the serving utensils				

Contd..

S.No.	Particulars	Fully satis-factory (3)	Partially satis-factory (2)	Not at all satis-factory (0)	Remark
J.	Cleaning the table:				
	1. Removing the leaves				
	2. Bucket used for disposing leaves				
	3. Regularity in disposing the leaves				
	4. Plantain stem for removing food particles				
	5. Napkins for wiping				
	6. Condition of water for cleaning the table				
	7. Method of cleaning the table				
	8. Neatness of the table				
	9. Method of removing the dishes				
IV.	General washing area:				
A.	Neatness of the area				
B.	Sink				
C.	Drainage				
D.	Faucet tight				
E.	Supply of water				
F.	Provisions for storing water				

Contd..

S.No.	Particulars	Fully satis-factory (3)	Partially satis-factory (2)	Not at all satis-factory (0)	Remark
V.	Store room:				
	A. General neatness				
	B. Neatness in-				
	1. Ceiling				
	2. Wall				
	3. Floor				
	C. Adequate storage facilities				
	D. Arrangement of provisions				
VI.	Passage:				
	Neatness				
VII.	Bath room:				
	A. General neatness				
	B. Neatness in-				
	1. Ceiling				
	2. Wall				
	3. Floor				
	C. Adequacy of storage facilities				
VIII.	Toilet:				
	A. General neatness				
	B. Neatness in-				
	1. Ceiling				
	2. Wall				
	3. Floor				

S.No.	Particulars	Fully satis-factory (3)	Partially satis-factory (2)	Not at all satis-factory (0)	Remark
IX.	Other Sanitary Aspects:				
	A. Lighting				
	B. Ventilation				
	C. Provisions for wire mesh				
	D. Drainage				
	E. Dust bins				
	F. Disposing the garbage				
X.	Personal Hygiene of the Personnel:				
	A. Neat appearance				
	B. Uniform neat				
	C. Apron clean				
	D. Clean combed hair				
	E. Clean hand				
	F. Clean nail				
	G. Free from cold and other infections				

APPENDIX VIII

TEST FOR THE TOTAL BACTERIAL COLONY COUNTS OF FLOOR/SQ.CM^2 BEFORE AND AFTER EDUCATION

Triplicate	Total bacterial colony counts		Difference in total bacterial colony counts	't' test value
	Before education	After education		
1	3,00,000	> 1,00,000 (pint point colonies) (0)	3,00,000	
2	2,70,000	10,000	2,60,000	14.8**
3	1,20,000	> 50,000 (pint point colonies) (0)	1,20,000	
Averge	2,30,000	3,333		

The difference is Zero

$$t = \frac{\bar{d}-0}{\sigma/\sqrt{n}}$$

$$\bar{d} = \frac{3,00,000 + 2,60,00 + 1,20,000}{3}$$

$$\bar{d} = 2,26,666$$

$$\sigma = \frac{\Sigma x^2}{n} - \bar{x}^2$$

$$\frac{\Sigma x^2}{n} = \frac{3,00,000^2 + 2,60,000^2 + 1,20,000^2}{3}$$

$$= \frac{172000000000}{3}$$

$\bar{d} = \bar{x}$

$\bar{x}^2 = \bar{d}^2$

$\bar{x}^2 = 226666^2 = 51377475556$

$$S = \sqrt{\frac{1,72,000000000}{3} - 51377475556}$$

$$= \sqrt{57,333,33,3333 - 51377475556}$$

$$= \sqrt{595585777}$$

$S = 24425.6$

$\sqrt{3} = 1.6$

$$S/\sqrt{3} = \frac{24425.6}{1.6} = 1526.6$$

$$t = \frac{226666 - 0}{1526.6} = 14.8^{**}$$

Table value for 't' test at one per cent level = 2.55

Five per cent level = 1.73

't' test value = 14.8**

It is greater than table value.

Hence it is highly significant at one per cent level.

APPENDIX IX

't' TEST FOR THE TOTAL BACTERIAL COLONY COUNTS OF DINING TABLE/3Q.CM^2

Triplicate	Total bacterial colony counts		Difference in total bacterial colony counts	't' test value
	Before education	After education		
1	3,000	100	2900	
2	5,500	300	5200	16.4**
3	4,000	50	3950	
Average	4,166	150		

Table value at -

one per cent level = 2.55

five per cent level = 1.73

't' test value = 16.4**

** It is highly significant at one per cent level.

APPENDIX X

't' TEST FOR THE TOTAL BACTERIAL COLONY COUNTS OF A SERVING PLATE

Triplicate	Total bacterial colony counts		Difference in total bacterial colony counts	't' test
	Before education	After education		
1	440	102	438	
2	400	50	350	11.7**
3	420	25	395	
Average	420	59		

Table value at -

one per cent level = 2.55

five per cent level = 1.73

't' test value = 11.7**

** It is highly significant at one per cent level.

APPENDIX XI

't' TEST FOR THE TOTAL BACTERIAL COLONY COUNTS PER TUMBLER

Triplicate	Total bacterial colony counts		Difference in total bacterial colony counts	't' test value
	Before education	After education		
1	100	20	80	
2	200	15	185	3.31**
3	340	0	340	
Average	213	12		

Table value at -

one per cent level = 2.55

five per cent level = 1.73

't' test value = 3.31**

** It is significant at one per cent level

APPENDIX XII

't' TEST FOR THE TOTAL BACTERIAL COLONY COUNTS OF NAPKIN/SQ.CM^2

Triplicate	Total bacterial colony counts		Difference in total bacterial colony counts	't' test value
	Before education	After education		
1	1,500	27	1473	
2	2,100	75	2025	7.8**
3	1,500	30	1470	
Average	1,700	44		

Table value at -

one per cent level = 2.55

five per cent level = 1.73

't' test value = 7.8**

** It is highly significant at one per cent level.

APPENDIX XIII

DETAILS OF SCORES AWARDED FOR THE GENERAL NEATNESS OF THE CANTEEN

S.No.	Particulars	Maximum marks	Marks obtained	
			Meals section	Snacks section
1.	Kitchen:			
	a. General neatness	30	27	24
	b. Neatness of-			
	i. Ceiling	30	28	27
	ii. Wall	30	28	25
	iii. Floor	30	27	25
	Preparation area:			
	c. General neatness	30	22	23
	d. Orderly arrangement of storage bins, utensils, equipments and accessories	30	29	23
	2. Appearance of utensils and equipments	30	28	24
	Cooking area:			
	f. General neatness	30	26	27
	g. Orderly arrangement of storage bins, utensils, equipments and accessories	30	26	23
	h. Appearance of utensils and equipments	30	24	23
	i. Appearance of garbage bin	30	25	24
	Washing area:			
	j. General neatness	30	24	24
	k. Appearance of water tub	30	27	24
	l. Orderly arrangement of cleaning agents	30	28	26

Contd..

S.No.	Particulars	Maximum marks	Marks obtained	
			Meals section	Snacks section
2.	Dining area:			
	a. General neatness	30	27	25
	b. Neatness of -			
	i. Ceiling	30	30	30
	ii. Wall	30	30	30
	iii. Floor	30	27	25
	c. Appearance of serving unit	30	30	30
	d. Orderly arrangement of weighed food items serving	30	30	30
	e. Appearance of serving utensils	30	24	19
	f. Arrangement of drinking utensils	30	25	27
3.	Store room:			
	a. General neatness	30	26	26
	b. Neatness of -			
	i. Ceiling	30	29	29
	ii. Wall	30	30	30
	iii. Floor	30	27	22
	c. Arrangement of storage bins, utensils etc.	30	28	25
4.	Passage:			
	General neatness	30	Nil	24
5.	Bath room:			
	a. General neatness	30	Nil	23
	b. Neatness of -			
	i. Ceiling	30	Nil	25
	ii. Wall	30	Nil	26
	iii. Floor	30	Nil	28
6.	Toilet:			
	a. General neatness	30	Nil	22
	b. Neatness of-			
	i. Ceiling	30	Nil	24
	ii. Wall	30	Nil	22
	iii. Floor	30	Nil	22
7.	General Washing area:			
	a. Neatness	30	30	27
	b. Appearance of sink	30	29	28
	c. Condition of storage of water	30	28	27