RF_NUT_2_SUDHA

GLOSSARY

ANTIBIOTICS: Drugs which kill bacteria.

BACTERIOLOGY: The study of bacteria (germs).

CARRIER: A person whom, following an attack of a disease (which may be so mild as to be unnoticed) still carries the infection which can be passed on to other people.

COMMENSALS: Bacteria which live in association with humans or other animals but do not normally cause disease.

CROSS INFECTION: Infection spread from person to person or utensil to utensil.

DEFAECATION: The act of passing a stool.

E.H.O.: Environmental Health Officer (formerly Public Health Inspector). Includes Food Inspectors.

ENDOGENOUS INFECTION: An infection from within the patient, himself or herself.

EXOGENOUS INFECTION: An infection from a source outside the person infected.

FAECES: Stools, the solid waste excreted by the body.

FERMENTATION: The action of certain bacteria and yeasts, etc., upon sugars leading to the production of gas and alcohols. Used to differentiate bacteria.

GERMINATION: The process of change of bacteria from the spore form to the vegetative form. (Compare the "germination" of seeds.)

IMMUNITY: The capacity to resist infection. May be total or only partial.

LESION: A piece of diseased tissue.

M.O.E.H.: Medical Officer for Environmental Health. Responsible (among other things) for the control of all infectious disease in his Borough, including food poisoning and food-borne disease.

NOTIFIABLE DISEASES: Those diseases which, if known to a Doctor, must be notified to the Medical Officer for Environmental Health. They include food poisoning, Typhoid Fever, Cholera and Brucellosis, etc.

PASTEURIZATION: The treatment of food which kills all pathogens but not all bacteria therein.

PATHOGENS: Bacteria which cause disease.

RESISTANCE: The capacity to resist a particular infection.

SAPROPHYTES: Bacteria which do not cause disease.

SPORES: The "cyst" or "seed" form which certain bacteria may adopt in unfavourable circumstances.

STERILIZATION: The treatment of food (or other things) which leads to the killing of all bacteria present.

THERMAL DEATHPOINT: The temperature which kills bacteria. (This varies according to the particular bacteria concerned.)

TOXIN-EXO-ENDO-EXOTOXIN: A poison produced outside bacteria.
Endotoxin: A poison produced inside bacteria and only liberated when they die.

TURBIDITY TEST: A test to determine the degree of purity of milk or milk products.

VEGETATIVE FORM: The normal form of bacteria in which they are susceptible to outside adverse influences.

Source - The Royal Institute of Public Health & Hygiene

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ST JOHN'S MEDICAL COLLEGE AND TEACHING HOSPITALS, BANGALORE 560034

CERTIFICATE COURSE IN FOOD HYGIENE AND HANDLING OF FOOD

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1. To highlight the importance of ensuring the safety and wholesomeness of food at all stages from its growth and production until its final consumption
2. To instruct on the causes, consequences and prevention of infections transmitted through food
3. To make aware the legal provisions for ensuring safety of food
4. To highlight the causes, effects and prevention of food-poisoning
5. To impart knowledge of the various measures employed in the protection and preservation of food stuffs
6. To obtain improvement in the handling and distribution of food through persuasion, consent and Health Education of the managements and their staff

Course components: As per attached syllabus

Fees: Tuition fees Rs.150/- per candidate

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p.t.o.

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ROSS INSTITUTE UNIT OF OCCUPATIONAL HEALTH

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The natural history of food. Source. Transport. Treatment. Storage.
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Monitoring.
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Sources of infection. The spread of infection.

3. Food Poisoning

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Chemical, vegetable and bacterial food poisoning. Needs of bacteria, and types causing food poisoning. Their methods of spread.
The body's defences against food poisoning and food borne disease.
Natural immunity, immunisation. Defences in acute infections.
The prevention of food poisoning and factors which encourage its spread.
Foods which commonly cause food poisoning and those which rarely do so.

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The inter-related agencies concerned with the control of food.

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1. The Digestive Process

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   c) Students should be able to re-produce the drawing of the digestive system as shown on page 5 of the lecture notes.

   d) What is peristalsis and what happens in the body when vomiting and diarrhoea occurs?

2. Food Poisoning and Food Borne Diseases and their Prevention

   a) What is food poisoning and what different types of outbreaks occur?

      What is toxin, extoxin and endotoxin?

   b) How can chemical, vegetable or bacterial food poisoning be caused? The student must be able to give examples of each type of poisoning.

   c) In bacterial food poisoning, what do germs need to grow and multiply?

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   e) How can the different types of food poisoning be prevented? e.g. in looking at the problem from the point of view of preventing contamination of food, premises and food handlers.

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d) How widespread is food poisoning? Is the number of cases increasing or decreasing? Are there any new types of food poisoning being experienced? Has, for example, the increase in size of the broiler chicken industry any significance in food poisoning patterns?

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c) Responsibility of the employees in food premises regarding food hygiene practices and notification of food poisoning and food borne diseases.

7. The Protection of Food:

a) Why is hand washing particularly important after use of the W.C. and after coughing or sneezing?

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b) What is cross contamination, and how many forms can it take in passing food poisoning from a contaminated source to a healthy human being?

c) What water temperatures are effective for:-
i. washing food room surfaces and equipment surfaces
ii. sterilising food room surfaces and equipment surfaces?

d) Students must be able roughly to describe a standard type of washing machine used in a large catering kitchen, and what the correct water temperatures should be.

e) What dangers-bacterial and otherwise, arise from infestations of rats mice, flies, wasps and cockroaches in food premises? What dangers can arise from the presence of domestic pets or birds?

f) What preventive measures can be taken to keep infestations out of food premises, when new premises are constructed, or where existing premises have been cleared of an infestation?

g) Students should have some knowledge of the materials used in the construction of food premises and particularly the surface finishes of walls, ceilings and floors in food rooms. Surface types of preparation tables, chopping blocks and cold storage rooms should also be known.

h) What is cooking, pasteurisation and sterilisation of food? What significance does pasteurisation have as regards milk, ice-cream and liquid eggs? What basically happens in the canning of food?

i) What are the dangers associated with re-heating of foods which have been cooked? What re-heating temperatures are satisfactory and what other conditions should apply in making re-heated foods acceptable?

j) Why must food awaiting immediate consumption in catering premises be kept either under 50°F or above 145°F?

k) In which foods is there bacterial growth which is likely to cause food poisoning? What types of common foods are hardly ever associated with bacterial food poisoning, and why?

l) At what temperature does a domestic refrigerator, a deep freeze and an ice-cream conservator normally operate?

What happens when food, contaminated with bacteria, is placed in a domestic refrigerator or deep freeze?

What should a housewife do to maintain properly a domestic refrigerator, and to obtain the maximum benefit from it?

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7. The Protection of Food

The transmission of bacteria to food.
Personal hygiene.
Cross contamination.
Cleaning surfaces and equipment.
The design of equipment and premises.
Infestation.
The destruction of germs in food.
The prevention of bacterial multiplication, including refrigeration.

8. Health Education

Definition. Principles. Problems of Health Education.
Methods.
Evaluation.

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ST JOHN'S MEDICAL COLLEGE
BANGALORE 34

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Conducted by

ST JOHN'S MEDICAL COLLEGE, BANGALORE

Through its

ROSS INSTITUTE UNIT OF OCCUPATIONAL HEALTH

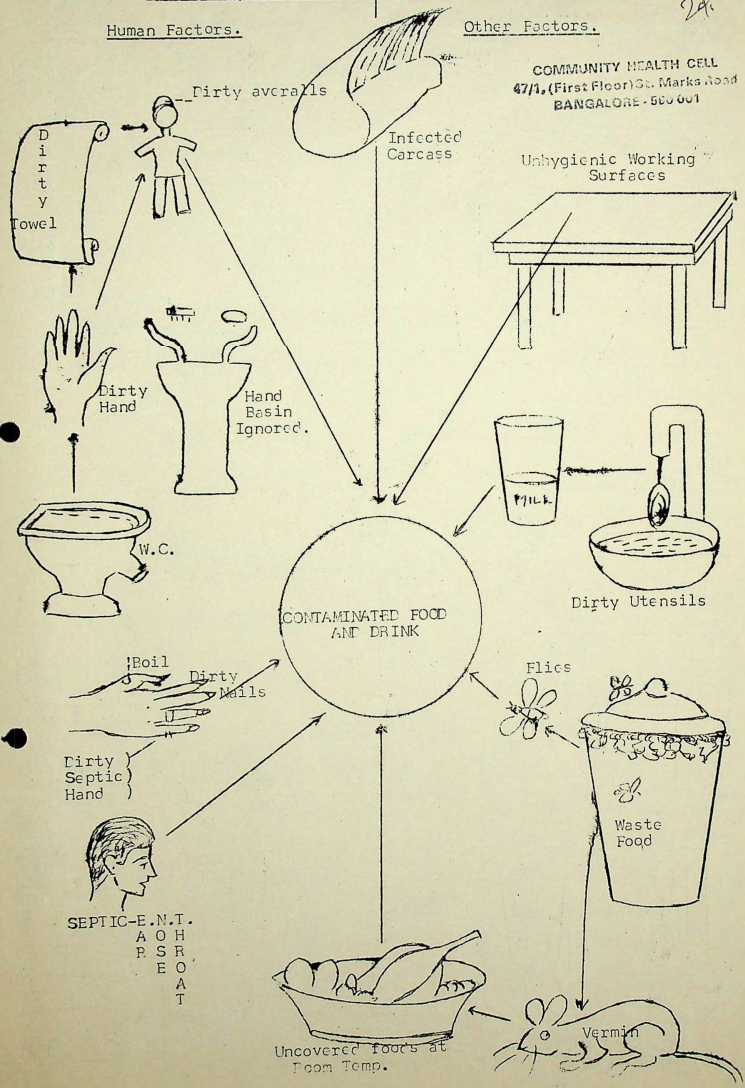
CONTENTS

FACTORS WHICH ENCOURAGE THE SPREAD OF FOOD POISONING

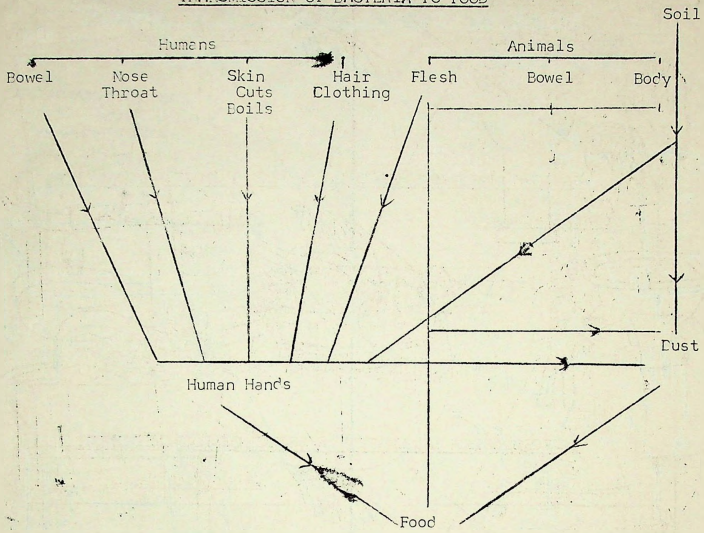
COMMUNITY HEALTH CELL
47/1, (First Floor) St. Marks Road
BANGALORE - 560 001

Human Factors.

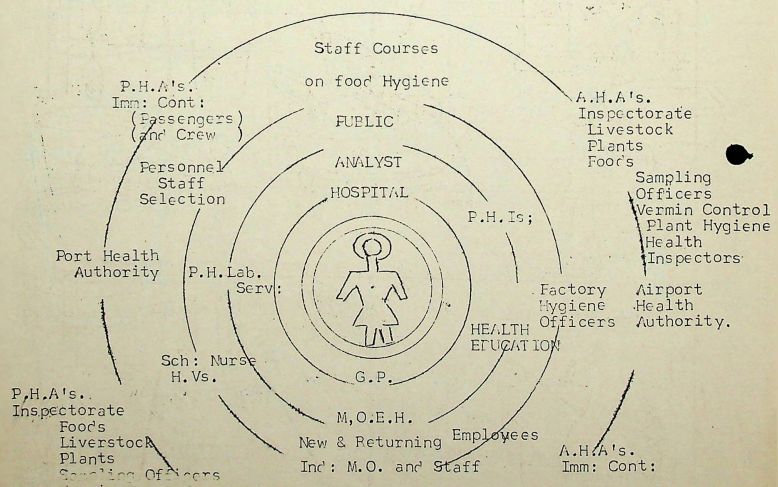
Other Factors.



TRANSMISSION OF BACTERIA TO FOOD



INTER-RELATED AGENCIES CONCERNED WITH THE CONTROL OF CONTROL OF FOOD



DIGESTION AND THE DIGESTIVE SYSTEM

The life of man can be regarded as a continual production of energy by oxidation or burning of the food he consumes. Oxygen in the inspired air frees the potential energy of foodstuffs by oxidizing them in the cells of the body to form CO_2 and water, and liberates heat and energy. The heat maintains the body temperature and the energy is expended in movement. The whole cycle of activity is known as Metabolism. The build up or repair of body tissues is called Anabolism, while the break down of the tissues with the liberation of energy and the excretion of wastes is called Katabolism. The waste products are excreted by the kidneys, bowel, lungs and skin and consist largely of water, CO_2 and nitrogenous breakdown products of protein such as urea, mostly found in the urine but also in the faeces.

Digestion converts the complex insoluble constituents of the food into simple and absorbable substances which diffuse through the lining of the intestine to enter the blood or lymph to be dealt with by the tissues.

Food consists of carbohydrate, protein and fat together with small quantities of vitamins and minerals, all of which should be present in a balanced diet. Water, which constitutes about 70% of the body weight, is essential to life.

Carbohydrates are sugars and starches, which provide energy and are broken down to sugar by the body. Rice, Wheat and Ragi are probably the carbohydrates most commonly and extensively eaten in this country.

Proteins are obtained from lean meats, fish, eggs, peas, beans, nuts and milk. Protein is required for the growth and repair of the body tissues.

Fats, which may be either animal or vegetable as also are the proteins, are valuable energy producing foods and are stored in the body as energy reservoirs. They are also useful vehicles of vitamins A & D
Ex: Animal fats - Codliver oil, Shark liver oil
Vegetable fats - Ground nut oil, Coconut oil, Mustard oil.

The most important minerals in the diet are calcium, iron, phosphorus and iodine.

Carbohydrates are reduced to monosaccharides such as glucose, and disaccharides such as maltose and lactose. All are absorbed as monosaccharides after digestion.

Proteins are reduced to amino-acids and fats to fatty acids. Digestion is accomplished by the enzymes contained in the digestive juices formed by the various glands found along the length of the digestive system.

The process of chewing, hunger, the smell of a well cooked meal or even the anticipation of appetising food promotes the flow of saliva from the salivary glands situated in the mouth and the saliva thus secreted aids the process of mastication by softening and diluting the food introduced into the mouth. The saliva comes from the Parotid, Submaxillary and Sublingual Glands and contains Mucin and Ptyalin Enzymes the first to soften the food and the second to start the digestion of starch to maltose.

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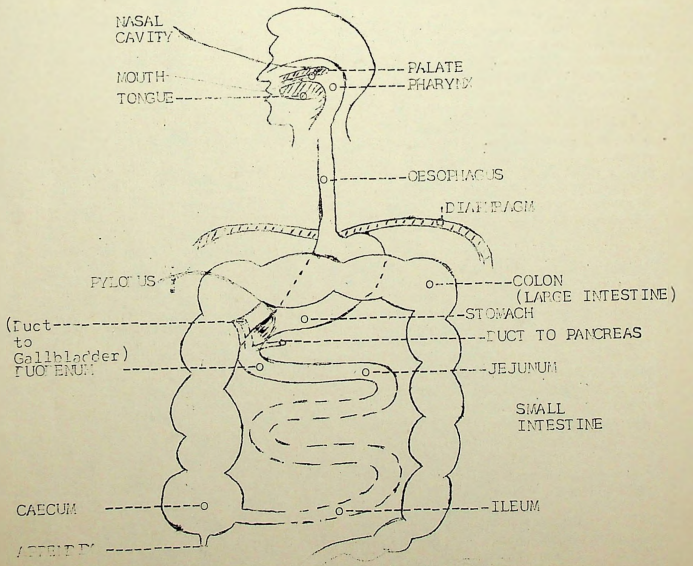
When the masticated bolus of food is ready to be swallowed it passes into the Pharynx where a reflex mechanism prevents its passage into the Larynx or windpipe by means of the Epiglottis, which seals off the entry, while the soft palate is raised and closes the nasal passages. The food is thus carried into the Oesophagus, a long thin muscular tube leading from the pharynx to the Stomach.

The Stomach (Gaster) is a hollow muscular organ whose walls, when it is empty, lie close together but can separate and dilate to accommodate the food which enters. Waves of muscular contractions start in the upper part of the stomach, occuring 3-4 times every minute and they sweep down to the pylorus or exit of the stomach. They thus both mix the food with the gastric juices and provide the force to drive the gastric contents out through the pylorus in small jets. These waves are called Peristaltic waves and in front of each wave the pylorus, which is a muscular ring, relaxes to allow a small part of the stomach contents to be ejected into the Duodenum.

The stomach acts as a reservoir, a temperature regulator and also begins the digestion of proteins through the action of its glands which secrete hydrochloric acid and pepsin. Pepsin acts upon the proteins, reducing them to peptones. A further function that the stomach performs is a protective one, as its highly acid contents exert an antimicrobial action. Gastric digestion lasts 3-4 hours.

The first part of the small intestine is known as the Duodenum into which flow bile from the Liver and pancreatic juice from the Pancreas, an organ lying close to the spine with its head enclosed by the duodenum. Both the bile and the pancreatic juices are alkaline in reaction and so the acidity of the chyme entering the duodenum from the pylorus is quickly reduced.



The pancreatic juice contains three powerful enzymes:

Trypsin - Completes the digestion of proteins to their constituent amino-acids.
Amylase - Break down starch and other carbohydrates to glucose.
Linase - Break up fats into fatty acids and glycerol.

Bile is secreted by the liver and is stored in the gall bladder which is attached to the under-surface of the liver. When food enters the duodenum the gall bladder contracts and empels bile into the duodenum. Bile is a viscid green fluid, the colour being due to the bile pigments and these with the food give the faeces their characteristic colour. It also contains salts which emulsify fats, thus facilitating their digestion by the pancreatic linase.

On leaving the duodenum, the food enters the Jejunum, which secretes two enzymes - Enterokinase, which helps to produce aminoacids, and Sucrase, which helps to produce glucose. This part of the intestine also contributes a large amount of water to facilitate the solution and absorption of the digested food.

On the whole the jejunum is chiefly occupied with secretion and digestion while the lower part of the small intestine or Ileum is largely concerned with absorption, but both processes can proceed simultaneously to some extent. The increasingly digested food is passed along the 20 feet of small intestine by peristaltic waves occuring approximately 11 times per mi

Absorption in the ileum is carried out by minute hair-like projections into the gut, called Villi. Each villus is richly supplied with blood vessels and a central lymphatic channel called a Lacteal for carrying digested fat globules to the main lymphatic channel of the body. The amino-acids, the monosaccharides and the water are absorbed into the blood vessels of the Villi and then distributed to liver and the tissues.

The small intestine also contains many bacteria which assist in the process of digestion and produce a slightly acid environment, this helping to inhibit the production of toxic materials.

The last part of the small intestine which is the ileum empties its contents into the Caecum. This is the first part of the large intestine, which is approximately 6 feet in length. The time taken for food to reach the caecum varies greatly in time. Food takes about two or three days to traverse the whole intestinal tract.

The Caecum, to which is attached that vestigial organ, the Vermiform Appendix, leads into the Ascending, Transverse and Descending Colon and this finally empties into the Rectum. The Anus is the tight muscular ring which guards the exit to the Rectum.

The importance of the large bowel, especially the caecum and ascending colon, is in the conversion of the fluid ileal contents into a formed stool. This is done by the absorption of the fluid elements of the contents as a result of which a semi-solid mass of faeces is formed. Faeces are principally composed of bacteria, secretions and undigested food residues. Peristaltic action continues slowly to move the faecal mass along the colon until the rectum is full and defaecation takes place. The bacteria normally found in the colon will produce gases from food residue not completely broken down in the small intestine.

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MAKING FOOD SAFE

The problem of making food safe is clearly a vast one, for it involves an understanding of all the hazards to which the whole variety of foods (and drinks) are exposed; and the ways in which such hazards can be minimized, if not completely removed. Because of the size of the subject, the format of the notes for this lecture differs from those elsewhere in this booklet and does in fact conform more to true note form, than do the papers on other topics. Under the various sub-headings, some brief implications are mentioned, but neither the headings themselves, nor the additional remarks, are in any way exhaustive. It is hoped, however, that they provide a framework of ideas which readers can enlarge upon, and add to, in the light of their own experience, for one of the problems facing us in deciding the content of this brief course, is that those taking it, come from a variety of jobs and industries, and the only thing which many have in common, is a shared responsibility for food which others eat.

The order of the topics here, is not necessarily the only one possible, based as it is on the history of various food items from their source to their consumption, and clearly some workers will have no control at all over some aspects of the food with which they deal at different stages in this chain. Lastly, some hazards will clearly appear more than once in the chain, e.g. the danger of Salmonella from duck eggs.

THE NATURAL HISTORY OF FOOD:

A SOURCE

Degree of control available.

1. MEAT Inspection of slaughter-houses, sampling of imported meat.
2. POULTRY Control of rearing conditions.
3. EGGS Control of import of dried eggs. Note danger of Salmonella from duck eggs.
4. MILK Brucellosis-free herds.
   Tuberculin-tested (attested) herds.
5. VEGETABLES Avoid excessive soil contamination-B. Cereus. Possibility of danger from pesticide spraying. Possible danger of intestinal infections if faecally contaminated vegetables, e.g. salads, are consumed raw.
6. WATER Dangers of intestinal infections, e.g. Cholera, Typhoid Fever, Dysentery from faecal contamination, if untreated.

B. TRANSPORT

1. Danger of cross-infection of animals; increase in Salmonella before slaughter if crowded or too long in transport.
2. Cross contamination of food from animal excreta.
3. If meat, danger of spoilage and bacterial multiplication unless refrigerated.

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C THE TREATMENT OF FOOD

A wide variety of methods are designed to preserve food, and to prevent bacterial and other contamination.

1. HYGIENIC SLAUGHTERING (See B (1) above).
2. CANNING - to a temperature sufficient to kill all pathogens, e.g. a "Botulinum Cook". Ensure proper sealing of tin-cf. contamination of corned beef in the Aberdeen Typhoid outbreak.
3. FREEZING Rapidity is an important factor for quality. Does not kill all pathogens.
4. ACCELERATED FREEZE DRYING
5. DEHYDRATION
6. SMOKING AND CURING.
7. SALTING AND PICKLING, e.g. the salt beef of Nelson's Navy.
8. PASTEURISATION, e.g. milk, canned ham. Kills pathogens - but spoilage organisms may survive.
9. STERILISATION, e.g. milk-kills all germs.
10. ULTRA HEAT TREATMENT-as for sterilization.
11. ADDITION OF PRESERVATIVES, e.g. Sulphur Dioxide to sausages, etc. Only a short-term effect.

D STORAGE

1. REFRIGERATION-Temperature control vital.
2. (a) Deep freezers.
   (b) Frozen food cabinets-watch the load line.
   (c) Domestic type refrigerators-avoid overloading and introducing hot food-
2. PEST CONTROL Rodents, insect pests, especially flies.
3. STOCK ROTATION- consider implications of date stamping.

E PREPARATION

1. Consider construction and use of premises.
2. CONSIDER FOOD HANDLERS ("Man in his own worst enemy").
   Clothing.
   Cleanliness.
   Absence of infection in throat, nose, on skin, in bowels.
   Hygienic practices.
3. STORAGE AFTER PREPARATION Avoid bacterial growth. Avoid contamination.
4. DISCARD THE DOUBTFUL FOOD.

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F SERVING FOOD

1. Cleanliness of handlers.

2. Cleanliness of utensils-washing methods.

G DISPOSAL OF WASTE FOOD

1. Dustbins-refuse collection.

2. Drains.

3. Flies, vermin, other pests.

H MONITORING

1. From within, by regular supervision-and irregular checks.

2. From without by the Food Inspectors of the Local Authority.

I THE AIM-is to break the chain.

1. Not to allow food to become contaminated.

2. To prevent bacterial growth.

J THE FINAL ANSWER IS HEALTH EDUCATION.

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INTRODUCTION TO BACTERIOLOGY

Bacteria, sometimes referred to as micro-organisms or, more simply, as germs, are minute living creatures. They are composed of Protoplasm, a protein substance rather like raw white of egg but considerably more complex since it is composed of living matter. They are found everywhere, in soil, in the air, in natural waters, in plants and in animals.

Compared with other living creatures, bacteria are simple in their structure and many require very little for satisfactory growth and reproduction, relative warmth, a little water and a few simple substances being sufficient. Others, particularly those which cause disease, are more finicky, and require complex proteins, vitamins etc., for their growth. Different bacteria, under natural conditions, live at different temperatures, and those temperatures are approximately those at which they grow best. Thus soil bacteria live at and prefer relatively low temperatures. The bacteria of hot springs prefer high temperatures and are said to be thermophilic. Generally speaking, soil bacteria and thermophilic bacteria do not cause disease, and are said to be saprophytes. Disease-producing bacteria are known as pathogens and they live and multiply best at the temperature of the human body (37°C. 98.6°F). Their growth is inhibited at refrigeration temperatures and this is used to control their numbers, in food for example.

Bacteria are very small, frequently about 1 to 3 microns in diameter, or 1/25,000 to 3/25,000 of an inch. Thus nearly a million bacteria would be required to cover an ordinary pinhead. When bacteria are grown in laboratories, they are often grown on the surface of solid jellies containing nutrient substances. Each bacterium multiplies rapidly under these circumstances, the number of bacteria doubling itself about every 20 munutes. Thus a single bacterium becomes eight in one hour, 64 in two hours and 512 in three hours. A simple calculation shows that each bacterium will have produced more than 250,000 descendants in six hours and more than 1,000 millions in ten hours. The bacteriologist usually examines his cultures after about 18 hours, by which time each bacterium has produced such a mass of descendants that the clumps are visible to the naked eye, scattered over the surface of the culture medium. Such visible clumps are known as bacterial colonies.

The colonies of different bacteria differ from one another in shape, size, colour, transparency and general appearance, and an experienced bacteriologist can often name a bacterium, or at least place it within its group, by merely inspecting its colonies.

Bacteria vary considerably in shape and size. Thus cocci are round or nearly so, while bacilli are elongated and rod-shaped. A common coccus is the staphylococcus, a cause of bacterial food poisoning. This is prefectly spherical and forms clusters which, under the microscope, resemble clusters of grapes. Some cocci form chains like strings of beads, and are known as streptococci (sing. streptococcus). Others form pairs and are known as diplococci. Examples are pneumococci which cause pneumonia, meningococci which cause meningitis and gonococci which cause gonorrhoea.

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Bacilli may occur singly or in chains. Examples of bacilli are the bacteria which cause tuberculosis and diphtheria. The Salmonellae, which are a common cause of food poisoning, are bacilli. Some bacilli undergo branching and are known as streptothrices. (sing. Streptothrix). An example is the bacterium which causes the disease known as actinomycosis. Bacilli may be curved. A bacillus with a single curve is a vibrio. An example is the bacterium which causes cholera. If it possesses a few loose curves the bacterium is a spirillum. An example is the bacterium of rat bite fever. Multiple curves converting the bacterium into a coiled spiral produces a spirochaete. An example is the bacterium of syphilis.

When conditions for growth are poor, some bacilli produce resistant forms known as spores. These are rounded bodies produced within the bacterial cells, the rest of which may finally disappear leaving the spores free. Spores are highly resistant to drying, heat and antiseptics, and will withstand such adverse circumstances to an extent not possible for non-sporing (vegetative) forms of bacteria. Bacilli which form spores include those responsible for tetanus, anthrax and gas gangrene, as well as certain forms of food poisoning (Botulism and Clostridium welchii food poisoning). Spores can survive for very long periods without food or water and "germinate" into bacilli again when favourable conditions return. They are found in many places including soil, dust and unsterilised cotton wool. They are difficult to destroy and articles possibly contaminated with them are sterilised by prolonged heating at high temperatures e.g. with high pressure steam.

The recovery and identification of bacteria from man

Bacteria can be recovered from the secretions and excretions of man as well as from many parts of his body. They can, for example, be recovered from the skin, nose and throat, from pus, sputum and faeces and, in the presence of disease, from such things as urine which are normally sterile (bacteria-free). Specimens for bacteriological examination are collected in a number of ways. Thus an infected throat, eye or wound may be touched with a sterile cotton wool swab on the end of a wooden stick to collect a little of the infected material, or urine, faeces or sputum may be collected into sterile glass or plastic containers.

In the laboratory the first step is to apply a little of the infected material to a strip of glass known as a microscope slide, and spread it into a thin film. The slide is heated to kill any bacteria present and to fix the film firmly to the glass so that it will not wash off during subsequent treatment. A variety of stains are then applied, chosen to demonstrate the features of interest to the bacteriologist. The film is then washed, dried and examined under the microscope.

Bacteria are so small that very high magnifications such as 1,000 diameters (one million areas) are employed. The lenses used for such magnifications are complex and will not give clear pictures unless the area to be examined is covered with an oil of the same light transmission properties as glass and the lens focussed down into this oil so that there is no air space between the lens and the film. Such lenses are, understandably, called oil immersion lenses.

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The bacteriologis examines the film and determines whether bacteria are present and their number, shape, size and staining reactions. Different bacteria may stain differently and this is of value in diagnosis.

The second step in diagnosis is to grow the bacteria in synthetic culture media. These consist of solutions of nutrient substances, vitamins and minerals, sterilised by heating. They may be used as liquids but often incorporate gelatin or agar (an extract of seaweed) to set them into a jelly. The latter allow surfaces growths in the form of visible colonies to occur and this allows easy separation of the different types of bacteria in a mixed culture. Culture media frequently incorporate specific substances for the identification of certain bacteria. Thus they may include certain sugars and indicators which change colour in the presence of acid. Fermentation of the sugar present will produce acid and change the colour of the medium. Thus Salmonellae do not ferment the sugars lactose or sucrose, while many other bacteria in faeces do.

Some culture media contain blood. This is destryed (haemolysed) by certain bacteria and this also is of value in diagnosis. Some media contain substances which inhibit some bacteria but allow others to grow. This is useful in the isolation of the latter when the former may be present in such vast numbers as to overgrow them.

The method of culture is to transfer a little of the infected material to the chosen culture media and, in the case of solid media, to spread it over the surface w-ith a sterile wire loop. The media are sealed and placed in an incubator overnight. Next day they are examined, films (of suitable colonies in the case of solid media) are prepared, stained and examined, and subcultures prepared to further media of help in diagnosis. Subsequently serological tests may be carried out to define the nature of specific components of the bacterial cell, but these need not be discussed here. A diagnosis is finally reached by a knowledge of the appearances of the bacterium under the microscope, the nature of its colonies on solid media, the sugars it ferments, and so on. It is then exposed to a variety of antibiotics (penicillin, tetracycline, sulphonamides, etc.) to determine which do and which do not prevent its growth, for such information is of value in the treatment of the patient.

The harmful effects to man of bacteria are due to their production of poisonous substances known as toxins. Toxins are of two types, exotoxins and endotoxins. Exotoxins are produced by and released from the bacterial body during its life. Frequently such toxins tend to be resistant to destruction by heat. Examples in the field of food poisoning are the toxins responsible for staphylococcal food poisoning and for botulism. Endotoxins are released from bacteria only after they die. They tend to be sensitive to destruction by heat. Examples are the toxins responsible for the symptoms of salmonella food poisoning.

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Bacteria are normally present on the skin and hair and in body passages connected with the exterior, and each area tends to be contaminated with bacteria specific to itself. Thus the common bacteria on the skin are staphylococci, while the mouth, nose and throat harbour staphylococci, streptococci, micrococci resembling meningocci, and bacilli resembling the diphtheria bacillus. The colon (large bowel), rectum and anus and the skin around the anus, harbour bacteria normally present in the faeces. These are most commonly bacillary forms known as coliform bacilli, and certain streptococci. In the female the vagina (birth canal) harbours few bacilli because the little fluid present inhibits their growth. No bacteria are normally present in the uterus (womb) or urinary bladder.

These bacteria do not usually cause disease of the sites they inhabit, and are spoken of as commensals. While many are entirely non-pathogenic saprophytes, some are potential pathogens capable of causing disease. This they do when, because of injury or lowered resistance on the part of the subject, they enter areas not accustomed to their presence. Thus such bacteria which escape from the surface of the skin into its depths cause pimples, boils and carbuncles. Bacteria which enter the tissues of the mouth, nose and throat cause inflammation of the gums (gingivitis), inflammation of the tonsils (tonsillitis) and so on. Faecal bacteria from the perineum (skin between the legs around the anus) can cause inflammation of the bladder (cystitis) and this may spread up to the kidneys (pyelitis), etc. Bacteria entering other normally sterile organs and tissues will cause other inflammations which are given other names according to the areas infected. Thus inflammation of the lungs is pneumonia, and inflammation of the membranes covering the brain is meningitis.

Certain bacteria nearly always cause disease, the few exceptions being in the case of persons (carriers) who have learned to live with them. Such bacteria include staphylococci and the typhoid bacillus.

The transmission of infections to man

The sources of infection will determine the frequency with which infection of man will occur, the numbers and type of persons infected, and the parts of the body infected. Thus malaria is transmitted by mosquitoes and will occur only in mosquito-infected areas. Rat-bite fever is commonest in sewer workers. Urinary infections are most commonly due to faecal organisms because of the close proximity of the urinary tract exit to the anus. And so on.

Sources of infection:

1. Diseased patients. Patients with active bacterial diseases may transmit these to other people. Such diseases include tuberculosis, the veneral diseases, smallpox, typhoid fever, influenza, etc.

2. Carriers. These are people who do not have the disease but harbour and spread the causative organism. Carriers are of two types:

   (a) Convalescent carriers, who have recently had the disease and have recovered but still harbour the bacteria.

   (b) Healthy carriers, who have not apparently had the disease, but nevertheless harbour the causative organism.

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The latter group are particularly dangerous since they are often unsuspected. Epidemics may result because of them. Diseases spread by carriers include Scarlet Fever, Meningitis, Typhoid Fever, Dysentery, Poliomyelitis, Staphylococcal food poisoning and Salmonella food poisoning.

3. Animals. These also may be diseased or merely carriers. Many animals transmit disease to man, including cats and dogs, cattle, pigs and rodents. Among the diseases they transmit are:-

Tuberculosis.....cows, from milk,

Brucellosis.....ditto.

Rabies.....dogs.

Salmonella infections.....rodents, birds and fowl, cattle (beef) etc.

Plague.....rats

Leptospiral jaundice.....rats.

4. Soil. Soil commonly harbours disease-producing bacteria. In particular the contamination of wounds with soil may result in tetanus or gas gangrene.

5. The patient himself. Bacteria which act as harmless commensals in one situation may cause disease when they enter another, Examples are:-

(a) Cystitis caused by faecal organisms entering the bladder.

(b) Boils caused by staphylococci normally present in the nose or on the surface of the skin, entering the depths of the skin.

Such auto-infections are known as endogeneous infections.

The spread of infection

The ways in which infections are spread are best discussed by the types of infection which occur.

1. Infections of the gut, including food poisoning.

Frequently these occur because the subject consumes traces of faecal matter in his food or drink. Thus his food may have been contaminated with traces of faeces from the hands of the person who prepared or served it, or handles the crockery, cutlery, etc. Meat may have become infected, during butchering, with the faeces of the slaughtered animal. Flies, contaminated with the faeces of one meal may transfer traces of the stuff to their next. Staphylococci from the nose or skin infections of a cook may find their way into a meal. Faecal material may contaminate river water, which may be consumed or used for watering crops. Infected giblets may form part of the food served to animals and fowl, to be eaten later by man.

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2, Respiratory infections.

These are infections of the nose and throat, the air passages and the lungs. They include the common cold, influenza, bronchitis and pneumonia. Transmission from one person to another may occur by:

(a) Direct contact, e.g. handshaking, kissing, etc.

(b) Indirect contact through articles handled by the infected person, e.g. handkerchiefs, cutlery and crockery, bedding, clothing, etc.

(c) Inhalation of dust in the air, contaminated by bacteria from the infected person.

(d) Inhalation of droplet spray from the infected person speaking, coughing or sneezing.

3. Skin, wound and burn infections, by contact with contaminated hands, clothing, airborne dust or droplet spray.

4. Venereal diseases, by sexual contact with an infected person.

5. Insect-borne infections. These are largely confined to the tropics nowadays and include:

Malaria.....transmitted by mosquitoes.

Plague.....transmitted by fleas from rats.

Typhus.....transmitted by lice.

Sleeping sickness.....transmitted by testse flies.

Such diseases are rarely transmitted by other means. Other diseases may be transmitted by insects in a less specific way.

6. Laboratory infections. These occur in persons working with infected materials such as bacterial cultures, post-mortem tissues and infected experimental animals.

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Source: Royal Institute of Public Health & Hygiene - London.

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FOOD POISONING

Food poisoning is a general term applied to certain illnesses, frequently of sudden onset, brought about through the consumption of food. They usually affect the gastro-intestinal tract, although in some cases other systems may be mainly affected. A notable example of the latter is Botulism in which the major symptoms are related to damage to the nervous system. Food poisoning can be chemical, vegetable or bacterial in origin, and, when the gastro-intestinal tract is mainly affected, it is associated with nausea, abdominal pain, vomiting and diarrhoea, occurring soon after the responsible food has been taken. In such cases the time of onset of symptoms varies from 10 minutes to 48 hours after the food has been consumed, according to the nature of the poisonous substance ingested.

TYPES

Incidents are divided into three categories:-

(1) General outbreaks - Two or more cases in different families.

(2) Family outbreaks - Two or more cases in the same family.

(3) Sporadic cases - Single cases which are isolated occurences, having no connection with other cases or carriers.

With certain uncommon exeeptions the mortality is low and it is virtually confined to the very young and very old. The term "food poisoning" is nowadays applied more and more to those outbreaks caused by germs, as these are the commonest cause.

Chemical Poisoning:

Chemical poisoning by metals is comparatively rare these days as the manufacturers of canned goods take stringent precautions to obviate the contamination of their products by metallic salts.

Lead poisoning due to the absorption of lead (from pipes and storage tanks) caused by soft water, acid in reaction, is now a thing of the past, while the use of arsenic as a preservative is strictly controlled by law. The spraying of fruits and vegetables with poisonous insecticides has in recent times attracted considerable attention. A recent statement from the U.S.A. suggests that people who use a lot of spray insecticide such as D.D.T. in the home, have a correspondingly high concentration of residue in their bodies. Furthermore, investigations by W.H.O. and the Food & Agricultural Organization of the United Nations, indicate that there may be a link between pesticides, insecticides and liver damage. These sprays are used all over the world and can contaminate food.

The chief substances implicated are Aldrin, Dieldrin, Endrin, Rothane and Endosulfan.

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Although chemical food poisoning is uncommon nowadays dramatic incidents do occur occasionally, as for example in 1965 when 84 people became ill through eating bread made from flour which had been contaminated by a chemical hardener for epoxy resin. The latter had been carried in the same lorry as the sacks of flour and spillage of the chemical had occurred. This incident also illustrates the fact that very rarely are chemical poisons destroyed by cooking.

Most cases of chemical food poisoning fall within the province of home or industrial safety, being caused by carelessly stored pesticides, paraffin, detergents or sterilising agents leading to spillage or leakage or by these substances being placed in unmarked old food containers. It is particularly important, therefore, when such stores are bought in bulk and subsequently broken down for convenient use that the smaller containers are clearly labelled and kept well away from all food stuffs and out of the reach of children.

In recent years it has been shown that pollution of estuary waters by factory waste can cause disturbingly high concentrations of mercury compounds in the flesh of in-shore fish. This has led to strenuous efforts being made to control such pollution.

Vegetable Poisoning:

Certain plants when consumed are poisonous to human beings. Such poisoning is generally accidental, the plant, fruit or berry being mistaken for an edible variety. Examples are Hemlock, Aconite, Datura and Deadly Nightshade, while the commonest cause is the Toadstool. With regard to Mushrooms, the only safe procedure is to learn to identify certain well-known species by their botanical features and to avoid fungi growing under trees and those which are brightly coloured.

Bacterial Poisoning:

Food poisoning caused by micro-organisms is almost invariably due to infected solid food, as to-day water and milk supplies are treated so effectively as to render them comparatively uncommon as vehicles of infection.

Bacteria or germs are extremely small. Approximately a million can be accommodated on a pin's head. They are living organisms which produce themselves by simple division which takes place every 20-30 minutes. Thus one germ alone could in 12 hours produce between 500 and 1,000 million offsp-ring.

In order to grow and multiply a germ needs:-

(1) Warmth — Blood heat is the most favourable temperature for growth.

(2) Time — Although germs multiply rapidly, a certain time is required before there is sufficient growth to cause illness.

(3) Moisture — Like all living organisms, germs require water.

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(4) Food — Unfortunately in the case of organisms which cause food poisoning the foods they thrive on best are those most palatable to human beings, e.g. meat and poultry, milk and cream.

How food Poisoning Germs Cause Illness:

Harmful germs are capable of producing poisons known as toxins, which cause illness in human beings. These toxins may be produced in one of two ways. Some germs produce the toxin outside their own bodies (exotoxin) so that it mixes freely with their surroundings. Others produce toxins inside their bodies (endotoxin) and these are not released until the organism dies.

These two forms of toxin produce different kinds of illness. If germs growing in food produce exotoxin then the food itself becomes poisonous and when taken will give rise to symptoms shortly afterwards. If, on the other hand, the germs growing in food are ones which produce endotoxin, then symptoms of food poisoning will necessarily be delayed until the germs have entered and established themselves in the bowel, and their numbers are such that the amount of toxin released from dying organisms is sufficient to cause illness.

An important fact in this connection is that exotoxin produced by the food poisoning staphylococcus is resistant to heat and may not be destroyed even by boiling for a short time. Thus stews and gravies, for example, in which this form of toxin has been produced, may still cause illness even if heated to boiling point before serving.

The commonest organisms responsible for food poisoning are the Salmonellae, Clostridium Welchii, Staphylococcus Aureus, and very rarely in this country Cl. Botulinum.

Agent	Time of Onset	Symptoms
Salmonellae	12-48 hours	Abdominal pain, diarrheoa, vomiting, fever.
Cl. welchii	8-24 hours	Abdominal pain, diarrhoea and often mild vertigo.
Staph. aureus	1-6 hours	Salivation, nausea, vomiting, abdominal pain, prostration and sub-normal temperature.
Cl. Botulinum	12-36 hours	Change of voice, double vision, paralysis of cranial nerves, obstinate constipation.

Method of Spread:

If we know where the different organisms live we can trace their method of spread and so take steps to prevent it.

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Salmonellae:

Salmonellae are sometimes carried in the human bowel and in the bowels of cats, dogs, rats and mice, cattle and pigs. Toilet paper is porous and it follows that after defaecation all adults and children should immediately scrub their hands with soap and hot water, otherwise the organism can be transferred from the fingers to food stuffs. The lavatory chain, lavatory seat and door handle should receive frequent cleaning. Towels, especially roller towels can spread infection.

Flies can also spread infection as they will feed on animal deposits out of doors and then enter a kitchen or alight on uncovered food stuffs. Domestic pets can be a danger in the kitchen. Another source of danger is the lidless dust-bin or swill-tub which attracts flies.

In the past, imported bulked egg products, both frozen and dried, have been a source of food poisoning, but the treatment of shelled egg products is now established. The Liquid Egg (Pasteurisation) Regulations, 1963 ensure that liquid egg is heat treated before use and this measure has been very successful.

Salmonella organisms can infect the duck and infected ducks can lay eggs which are infected even before the shell is formed. Alternatively, an uninfected egg may become infected through having been laid in a dirty environment as the infection can penetrate the porous shell. Cakes made with duck eggs are safe to eat because the high temperature at which cakes are baked ensures that they are sterile when leaving the oven. On the other hand, lemon meringue pies with the meringue made from duck egg whites can be unsafe because temperature and time of cooking of the meringue is below the thermal death point of the organism. If duck eggs are eaten whole they should be hard boiled for approximately eight minutes.

Salmonellae in animal feeding stuffs can introduce infection into farm stock. Spread depends on factors in the farm, in transit and in the slaughterhouse. Strain, cold, wet, deprivation of food and drink, can spread the infection within the animal body. Long transport, long waits and high killing rates increase the excretion of Salmonella organisms. Cattle and pigs are important foci of infection and poor hygiene in slaughter-houses can lead to contaminated carcases and then to contaminated manufactured products, e.g. sausages.

Infection in the raw meat of cows and pigs in butchers' shop can be transmitted to cooked meats by the practice of using the same knife to cut both raw and cooked meats. Pet food can be heavily contaminated by Salmonella organisms and in the home great care should be taken that cross-infection to food for human consumption does not take place. Desiccated coconut used to be a frequent source of Salmonella infection but legislation introduced by the Ceylon Government reduced the incidence of infection considerably. Many of our own bakers and confectioners sterilise raw coconut by steam treatment.

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In many parts of the world, including the United Kingdom, antibiotics are incorporated into animal feeding stuffs to promote rapid growth and fatening (presumably by keeping down bacteria in the animal body and so minimising the production of toxic substances which slow the animal's growth). Antibiotics are also used in the treatment of animal infections. Infecting organisms therefore tend to become antibiotic resistant and such resistant bacteria may infect man by contact with the animal or by the ingestion of infected food of animal origin. An important point which has only recently been discovered and is the subject of much investigation at present, is that in the human gut such antibiotic resistance is transferrable from one species of bacterium to another. The importance of this in the spread of cross-infection with antibiotic-resistant bacteria is obvious.

Clostridium Welchii:

Clostridium welchii is an organism that develops spres which are hardy and capable of living through adverse physical conditions such as high temperatures and dehydration. They can survive for long periods of time in dust and dirt and may be present in food after cooking. Raw meat and poultry are common sources of these organisms but they have been found in up to 25% of human and animal stools and also in the soil. The majority of outbreaks of Cl. welchii food poisoning occurred in canteens, hospitals, schools and hotels, and the foods responsible were chiefly meat and poultry products where the meat was pre-cooked and reheated.

Meals which include cooked meat eaten cold or reheated and meat pies have frequently caused Clostridium welchii food poisoning. In large canteen kitchens meat is frequently cooked, allowed to cool slowly at atmospheric temperature and stored in a cool or cold room overnight. The following day it is served cold, warmed up, sliced in hot gravy or made into pies or meat puddings. This practice is dangerous, as in meats cooked at a temperature not higher than 212°F(100°C) spores of Cl. welchii may survive cooking and in slowly cooling meat germinate into large numbers of actively multiplying bacteria able to cause food poisoning. Big cuts of meat are particularly dangerous because heat penetrates very slowly into meat. Meat thus reheated is responsible for the majority of cases of Cl. welchii poisoning.

Bacillus cereus:

This is a sporing bacillus which occurs in soil. It is a common contaminant of cereals. Food poisoning by this organism is being more frequently reported in the last two or three years, particularly as a result of eating infected rice in Chinese restaurants. The spores resist the initial cooking (boiling) of the rice. This is often done in the evening and the boiled rice left overnight on a table. The spores germinate and the vegetative forms multiply rapidly. Next day the rice is served after a rapid process of re-heating, insufficient to kill off the vegetative bacteria. The problem is therefore essentially similar to that of Cl. Welchii food poisoning, except that rice takes the place of meat. The cure in each case is the same. If re-heating must be used, the food should be refrigerated as soon as possible after cooking and re-heating should be adequate. In both cases cross-contamination via infected surfaces and equipment is possible.

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Staphylococci:

Food poisoning due to staphylococci depends largely upon the presence of sufficient exotoxin in the food, and the susceptibility of the individual. The predominant human sources are the nose, throat, skin and septic lesions. Thus, the personal hygiene of the food handler is of the utmost importance in preventing the growth of staphylococci in foods. Furthermore, the appropriate use of the refrigerator is of the utmost value. The majority of outbreaks are caused by the direct contamination of cooked foodstuffs by hands soiled with the secretion from the nose, mouth and skin lesions. Frequently the cooked food has been handled while warm and subsequent storage conditions have encouraged the staphylococci to grow and form toxin. Staphylococcal enterotoxin is heat resistant and this is of importance because, even if the food is thoroughly heated and all the staphylococci destroyed, the enterotoxin may well persist, so causing food poisoning of this type. Staphylococci have been found in 38% of raw meat samples and, as with Salmonellae, cross contamination can occur from raw to cooked meats.

Cheese prepared from raw or inadequately treated milk can present a problem.

The increasing veterinary use of antibiotics in the treatment of disease-especially staphylococcal mastitis in cows has resulted in the development of antibiotic resistance by the responsible organisms. These may therefore persist, be present in raw milk and in products manufactured from raw milk, and, flourishing under poor storage conditions be responsible for outbreaks of food poisoning. If only pasteurised milk is used in cheese making, such outbreaks can be avoided. Reports have also been received of Brucellosis being caused by cheese made from untreated milk.

Cl. Botulinum:

The toxin of the Cl. Botulinum is a highly poisonous substance which affects the Nervous System, and can be fatal. Cases rarely occur in Great Britain but are reported from other countries such as Canada, the U.S.A. and Japan. They have been attributed to uncooked, under-cooked or stale fish. Smoked fish and canned tuna fish have given rise to occasional outbreaks in various countries in recent years and the use of home preserved foods, such as meat and vegetables, have also been associated with outbreaks. The famous Loch Maree incident in 1922, when eight people died, was attributed to duck paste sandwiches. The last incident in Britain some nine years ago was due to pickled fish privately imported.

Prevention:

Food poisoning can be avoided by:-

(a) Preventing germs getting into the food, or if this fails,
(b) storing the food so that any germs present do not multiply, and
(c) ensuring that food is so well cooked that all germs in it are destroyed.

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Of these three, the safe storage of food is perhaps the most important. During this period, everything possible must be done to rob the germ of the things it needs to grow and multiply.

(i) Warmth

Food poisoning germs do not multiply in cold conditions. Storage in a refrigerator or cool larder will retard their growth. Deep freezing will stop their growth. No form of cold will kill germs and they will start growing as soon as the food is warmed up again.

(ii) Time

Germs are like seeds. The more that are planted, the more likely it is that there will be a successful crop, or in the case of germs, a successful "infection". Germs need time to multiply. Therefore, if food is eaten shortly after it is prepared, the risk of food poisoning is considerably reduced.

(iii) Moisture:

Germs do not multiply in dry products, e.g. dried egg and dried milk, but when these are mixed with water the germs can multiply freely. Such food should always be used shortly after mixing.

(iv) Food:

Stored food must be adequately protected from all forms of contamination.

(v) The Human Factor:

When it is known how human beings can spread the organisms of food poisoning it becomes obvious that the maintenance of strict personal hygiene is of paramount importance.

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Source: Royal Institute of Public Health & Hygiene - London

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INCIDENCE OF FOOD POISONING AND FOOD HYGIENE LEGISLATION:

The primary aim of food hygiene is to prevent food poisoning and, other food borne diseases. Statistics available in our country on the incidence of these diseases is unfortunately meagre, although the morbidity due to the same is high, Further,

Food Hygiene Legislation in most States is inadequate, except for the Prevention of Food Adulteration Act of 1976.

Accurate data of such outbreaks including Food Hygiene Legislation in the United Kingdom, are available, which are shown below, to serve as a guide.

Synopsis;

(a) The incidence of Food Poisoning in the population
(b) The investigation of an outbreak of Food poisoning.
(c) The change in eating habits of the population.
(d) A brief history of Food Hygiene legislation (see the Appendix).

A. THE INCIDENCE OF FOOD POISONING:

The size of the problem

It has been estimated that disease of all types in the United Kingdom may account for an average loss of up to two weeks work per person per year. This does not include illnesses which result from industrial accidents or industrial disease.

The incidence of most types of infectious disease has shown a marked decrease in recent years. There are, however, two notable exceptions; one is bronchitis and the other is various forms of food poisoning.

Outbreaks of Food Poisoning:

It will be seen (Table A) that there was a fall in incidents of food poisoning in England and Wales between 1970 and 1972, and then a steady increase until 1975.

TABLE A

OUTBREAKS OF FOOD POISONING

Year	General Outbreaks Incidents	Family Outbreaks Incidents	Sporadic Cases	Total Cases
1970	175	708	3,358	8,088
1971	164	671	2,977	6,910
1972	138	510	2,483	5,958
1973	147	576	2,918	6,763
1974	184	517	2,963	7,295
1975	230	765	4,144	10,936

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CAUSATIVE ORGANISMS RESPONSIBLE FOR OUTBREAKS OF FOOD POISONING:

The causative organisms responsible for outbreaks of food poisoning during 1975 are set out in Table B below. The previous year's figures (for 1974) are shown in brackets.

TABLE -- B (FOOD POISONING IN ENGLAND-1975)

Causative Agent	General Incidents	Outbreaks cases	Family Incidents	Outbreaks Cases	Sporadic Cases	Total Incidents Sporadic Cases	Total Cases
Salmonella	42	594	229	589	1107	1378	2290
Typhimurium	(40)	(292)	(142)	(411)	(787)	(969)	(1490)
Other	97	1910	397	1067	2262	2756	5239
Salmonella	(55)	(860)	(210)	(534)	(1192)	(1457)	(2586)
Clostridium	41	1441	11	95	35	87	1571
Welchii	(30)	(890)	(10)	(36)	(19)	(59)	(945)
Staphylococcus	17	256	4	9	35	56	300
Aureus	(6)	(86)	(4)	(14)	(31)	(41)	(131)
Other Causes	7	41	16	39	63	86	143
	(11)	(298)	(13)	(69)	(102)	(126)	(469)
Causes unknown	26	453	108	293	642	776	1393
	(42)	(421)	(138)	(421)	(832)	(1012)	(1874)
Totals	230	4695	765	2097	4144	5139	10,936
	(184)	(2847)	(517)	(1485)	(2963)	(3664)	(7295)

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B. INVESTIGATION OF AN OUTBREAKS OF FOOD POISONING:

During an outbreak of food poisoning all persons suffering from diarrhoea and vomiting are traced and questioned about food they have recently eaten. Particular attention is paid to any food substance which has been eaten by the majority of the sufferers within the preceding 12 to 48 hours. The remains of any suspected food are recovered if possible, and they are subjected to bacteriological examination. Experience has shown that certain "high risk" foods always warrant special attention; these include processed meats, egg and milk products. Where possible faecal (stool) specimens obtained from everyone who has symptoms of food poisoning are also bacteriologically examined. The bacteriological analysis of both the food substance and the stool specimens are compared. The type of the bacteria and their possible source is noted. When the organism in the food and the stools is the same, stool specimens should be obtained from all the persons who have helped to prepare the particular food substance contaminated. The investigation involves the bacteriological examination of the premises as well as the staff, canteens, food shops and food preparation areas. Anyone suffering from diarrhoea or vomiting may be excluded from work as a food handler until the local Medical Officer for Environmental Health considers it is safe to allow him to resume. Investigation of an outbreak of food poisoning is carried out by local authority Public Health Officers. These officers study the hygienic techniques employed by the food handlers, methods of food storage, methods of washing up, methods of disposal of waste food, the method employed to prevent food substances from becoming contaminated by vermin and flies, as well as the general state of repair and cleanliness of the food premises. Failure to find a bacteriological basis for an outbreak of food poisoning focuses the need to evaluate possible chemical causes arising from production techniques.

C. THE CHANGE IN EATING HABITS OF THE POPULATION:

Formerly general outbreaks of food poisoning tended to occur in institutions. Since the first and second World Wars, however, there has been an increase in communal feeding in Europe, and at the same time there has been a considerable increase in the bulk manufacture of food. Food hygiene education has resulted in a much increased appreciation and awareness of the need to prevent the bacterial contamination of food substances. Detailed and far reaching legislation has been introduced to provide suitable safeguards in the preparation and storage of food. Today, ...ment at the weekends, fewer people eat their mid-day meal at home. ...ing the week, mid-day meals are often eaten in canteens, restaurants, shops, ... public houses, ...

Many meals are now prepared at local central depots for the Armed Services, hospitals, the School Meals Service, the Welfare Service (i.e. "Meals on Wheels" for the elderly), etc. The cook-freeze operation in mass catering is now widespread.

The large-scale movement of holiday populations during the summer months imposes an extra strain on catering services in restaurants, in railway stations, coach stations, airports and aboard ships, so that good hygiene may be prejudiced. During the summer there is an increased tendency to use pre-packed food substances. Many of these are eaten by customers who may be caravanning or picnicking. In such circumstances the consumer usually gives very little thought to the safe storage of the food which may be left too long in warm, moist conditions, ideal for the multiplication of food poisoning bacteria.

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The sale of pre-packed food substances from shops and supermarkets calls for a high degree of quality control at every stage of production, from the food factory to the consumer.

Finally, casual labour is often employed in the food industry during the summer holidays. Such unskilled and untrained staff require very close supervision when engaged in food preparation since they do not normally know the basic principles of food hygiene.

Table C shows the probable location and type of organism causing general outbreaks of food poisoning in England and Wales in 1966. The micro-organisms most frequently found were salmonellae, Cl. welchii and staphylococci. Although these figures are somewhat old, the distribution details are still relevant.

TABLE-C

GENERAL OUTBREAKS OF FOOD POISONING

	Salmonellae	Staphylococci	Cl. Welchii	Chemical	Not discovered	All Agents
Hospitals ..	64	-	2	-	-	[illegible]
Restaurants, Clubs, Hotels, Holiday Camps	14	4	6	-	12	36
Canteens	-	-	18	1	7	26
Institutions	11	3	6	-	5	25
Schools	3	-	8	-	10	21
Shops:						
Butchers	3	2	-	-	-	
Chicken Barbeque	5	-	-	-	-	
Fish	-	-	-	-	1	14
Others	2	1	-	-	-	
Farms	11	-	-	-	-	[illegible]
Dinners, Dances Receptions	2	1	-	-	5	8
Infected Abroad	3	-	-	-	1	4
Others and Not Stated	19	3	3	1	8	34
All Places	137	14	43	2	49	245

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Vernon, Enid (1970) Public Health 84:239

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APPENDIX

BRIEF HISTORY OF THE LAW RELATING TO FOOD HYGIENE

Public Health Act 1848 and 1875.

The Industrial Revolution resulted in large numbers of people moving from rural communities into towns. Living conditions deteriorated and disease of all types was rife. Parliament set up several Royal Commissions to report on "The Sanitary Conditions of the Labouring Population of Great Britain" in 1842-45. The reports revealed extremely poor sanitary conditions which prevailed in most main cities.

The report of these Commissions resulted in the appointment of the first Medical Officer of Health in 1847, followed by the Public Health Act of 1848. This dealt with certain Public Health measures related to the sale of food.

1. Public Health Act, 1875. This dealt with various nuisances and their batement, some of which were indirectly concerned with the production and control of food substances.

2. The Food and Drugs Act, 1938. Section 13 of this Act referred to the standard of cleanliness to be maintained in food premises. The Act was subsequently repealed by the Food and Drugs Act of 1955.

3. The Public Health Act, 1936. Under this Act additional powers were granted to Local Authorities relating to the supervision of food premises.

4. The Food and Drugs Act, 1955. Various Food Hygiene Regulations were made in connection with this Act. Local Authorities were empowered to make certain bye-laws regarding the handling, wrapping and delivery of food substances. The scope of these Regulations made under this Act were briefly as follows:-

General Requirements:

(a) Regulations concerning the cleanliness of equipment

(b) Regulations relating to persons engaged in food handling, i.e. personal cleanliness, the carriage of food, the notification of certain infectious diseases occurring in food handling staff by an employer, to their Local Medical Officer for Environmental Health.

The Medical Officer for Environmental Health was empowered to decide whether such affected persons should be excluded from food handling duties under the Public Health (Infectious Diseases) Regulations 1968.

(c) Regulations relating to premises, i.e. details of water supply, hand washing facilities, lighting, ventilation, the state of cleanliness of premises and the accumulation of refuse, etc.

(d) Regulations relating to the sale of food substances.

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(e) Regulations relating to the transport of meat.

(f) Regulations relating to premises used for the manufacture of "at risk foods", i.e. ice cream, sausages, pickled meats, etc.

Such premises must be registered by the Local Authority under Section 16 of the 1955 Act.

5. The milk and Dairies Regulations, 1959. These Regulations make it obligatory for Dairies, Dairymen, and Milk Distributors to be registered. The Local Authority is empowered to grant licences to persons who sell designated milk (i.e. pasteurised, sterilised, untreated and ultra heat treated).

6. The Food Hygiene (General) Regulations, 1970. Extended the powers given to Local Authorities under the Food and Drugs Act, 1955 with particular reference to the preparation of food as well as the supervision of food handlers and the hygienic transport of meat. Requirements were also incorporated with regard to the preparation of food on ships working in coastal waters.

7. The Food and Drugs (Control of Food Premises) Act, 1976. This gives local authorities powers to take action leading to the closure of food premises where conditions are such as to be dangerous to health.

8. The Food Hygiene (Market Stalls and Delivery Vehicles Regulations, 1966). Under the provisions of the above Regulations, special problems relating to market stalls and delivery vehicles were dealt with. It was considered desirable to separate particular functions from the Provisions in The General Regulations.

9. The Health Services and Public Health Act, 1963. Part III of this Act deals with the notifiable diseases and food poisoning. Every outbreak of food poisoning is now subject to detailed investigation and is fully reported to the D.H.S.S. The Provisions relating to notification procedures for both notifiable disease and food poisoning had previously been set out in the Public Health Act, 1936, and also the Food and Drugs Act, 1955. The 1968 Act repealed the method of notification and set out a new unified procedure for both. It included provision regarding the medical examination of a person suffering from (or believed to be the cause of) a notifiable disease. Part III of this Act(and also Sections 69 and 70 and Part V of the Act together), was brought into force on 1st October 1968, together with a Statutory Instrument consolidating and bringing up to date in one document, existing Statutory Instruments relating to infectious diseases.
The D.H.S.S. sent Local Authorities a comprehensive circular explaining the effects of the provision in this part of the Act. The Circular included a single, complete list of all diseases which are notifiable, either under the Act or under the above mentioned Statutory Instrument.

10. There are certain regulations applied to the import of food substances and the sale of shell fish. There are further regulations relating to the standard of hygiene that is to be maintained in slaughter houses.

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The following Regulations deal with the hygiene standards which are to be observed in the treatment and handling of specific food substances:

(a) Ice Cream (Heat Treatment) Regulations, 1959 and 1963.

(b) Liquid Egg (Pasteurisation) Regulations, 1963.

(c) Imported Food Regulations, 1968.

(d) Meat (Sterilisation) Regulations, 1969.

FUTURE DEVELOPMENTS:

Britain's entry to the E.E.C. has brought major implications in the field of food legislation, both as regards food, subject to intra-Community and Domestic Trade. E.E.C. Directives relating to such foods as poultry meat, meat products, preserved milk and fruit juices cover hygienic and quality standards requiring new legislation in Britain.

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Source: ROYAL INSTITUTE OF PUBLIC HEALTH & HYGIENE
- LONDON.

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EXAMPLES OF OUTBREAKS OF FOOD POISONING
AND FOOD BORNE ILLNESS

The Principal features of Bacterial Food Poisoning.

For practical purposes there are three main types of bacterial food poisoning; salmonellae, staphylococci and clostridium welchii. The onset of symptoms are : Salmonella (12-24 hours), clostridium welchii (8-22 hours) and staphylococci (1-6 hours). Table B provides a detailed breakdown of incidents of each in 1974.1975,

Method of Spread of the Bacterial Food Poison:

Food can become contaminated due to the poor hygiene practised by a food handler who may be a symptomless excreter, by vermin, flies, or during the slaughter of an animal. If the bowel of a slaughtered beast is cut during preparation, the contents of the gut will spill into the carcass and contaminate the muscle tissue. Food may often be cross-contaminated if prepared on an infected work surface or by addition to an already infected food substance, such as meat or gravy.

EXAMPLES OF OUTBREAKS OF SALMONELLA POISONING

1. Salmonella typhimurium: Three members of a family became ill after eating a chocolate mousse prepared with uncooked white of an egg. Salmonella typhimurium was isolated from the faeces (stools) of all three cases. The eggs used were laid by the family's hens. Salmonella typhimurium were isolated from the hens' eggs and their droppings. The same type was identified from the patients' stools and the eggs.

2. Salmonella dublin: 249 cases of Salmonella dublin food poisoning occurred in 90 households. 85 out of 89 households investigated had a common milk supply. Salmonella dublin was isolated from the milk supply and from a number of cows and calf on a farm supplying this particular dairy. It was also found that several of the farm workers were symptomless excreters of the germ.

3. Salmonella virchow: 50 people out of 120 who had attended a club dinner subsequently developed both diarrhoea and vomiting. Salmonella virchow was found to be the causative organism. Unfortunately samples of the food served were not available for bacteriological examination during the course of the investigation.

The meal had included spit-roasted chicken portions prepared and packed by a catering firm. Samples of spit-roasted chicken grew salmonella virchow. The source of supply was traced back through the caterer's usual supplier to a processing plant and from there to individual farms. From the investigation carried out it did not appear that the chicken had been the cause of the outbreak of food poisoning.

The catering firm's procedure had been store the chickens overnight in a dee-freeze. The following morning the chickens were left at room temperature to unfreeze for two hours and then cooked on a spit roaster for about one-and-a-half hours. They were then allowed to cool for an hour before they were quartered. The portions were packed into boxes and sent to the club where they arrived during the mid-morning still warm. The working space at the catering establishment was reported to be unhygienic. Thawing out after freezing and the subsequent cooling after cooking were done on the same restricted surface. The cleanliness of the spits and ovens was also criticised. Eight of the 11 persons employed on the premises were found to be carriers of the organism Salmonella virchow.

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When the warm chicken portions were received at the club they remained in their boxes, unopened, on a very hot afternoon from mid-morning until 4.30 pm. when about 100 portions were served. The remainder of the portions were eaten at about 9.30 p.m.

N.B. There were 45 deaths reported in 1975 in which Salmonellae organisms were isolated either ante or post mortem.

STAPHYLOCOCCI.

Illustrative Examples

1. Eight explosive outbreaks of food poisoning, totalling some 1,190 cases, occured as a result of food contaminated by Staphylococci which was served in a school canteen. The incriminated food substance was spray-dried skim milk. In each incident the food prepared from this was artificial cream made from the skim milk that had not been heat-treated. It was consumed within 3-4 hours after preparation. The milk powder was found to contain very large numbers of staphylococci. In one instance it was found that a cook had a septic finger. Staphylococci of an identical type were isolated from the finger. Staphylococci of an identical type were isolated from the finger and the unopened tins of milk powder. It was concluded from this that the milk powder had infected the cook, rather than the reverse. The factory which had prepared the milk powder was then investigated. This showed that some batches of dried milk grew 20,000,000 and 9,000,000 staphylococci bacteria per gram on two separate occasions. These counts included 500,000 and 2,750,000 staphylococci per gram.

2. Sixty-one out of 110 people on a coach party developed food poisoning two hours after eating cold ham at a cafe. Staphylococci were isolated from some of the patients stools, and vomit. These types were identified with those isolated from the ham slicer and the chef's hands as well as from other food in that cafe.

3. Six out of eight people who ate home-made "veal and ham" pie later developed food poisoning. Staphylococci were isolated from the six patients. The bacteria were similar to those isolated from the nose of the person who had made the pie.

CLOSTRIDIA

(a) Clostridium welchii.
(b) Clostridium botulinum.

Illustrative Examples

(a) Clostridium welchii

1. Twenty-five out of 30 people who ate a Lancashire "hot-pot" served in an office canteen became ill between eight to twelve hours later. Clostridium welchii organisms were isolated from 12 of the patients tested and from the "hot-pot", which had been cooked two days previously and had been re-cooked twice subsequently.

2. Thirty-one out of 63 people who ate a turkey Christmas lunch in a canteen became ill between 9 to 15 hours later. Clostridium welchii was isolated from 9 of the patients, from 11 of the food handlers and from the table on which the turkey had been carved.

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(b) Clostridium botulinum

An outbreak may result from badly prepared food contaminated by the organism. This particular type of food poisoning is now very uncommon in England and Wales. Incidents have occurred in North America which were attributed to the home-canning of vegetables. Clostridium botulinum causes a food poisoning called botulism. The organisms produce a strong poison (toxin) which almost invariably results in death. The poison has a specific effect on the central nervous system causing paralysis of the muscles.

BACILLI

B. CEREUS

Illustrative Examples

1. Two persons who ate a meal from a Chinese take-away restaurant developed vomiting 3 hours later. One also had diarrhoea. The meal included curried prawns, curried chicken and fried rice. B. cereus was isolated from the one patient who submitted a specimen of faeces. 200 million bacilli (B.cereus) per gram were isolated from fried rice. B. cereus was also isolated from freshly boiled rice and from curry.

2. An outbreak of food poisoning affecting two groups of people occurred after a meal in a Chinese restaurant. Six young men in one party, and another two people, all of whom had the "meal of the day" were taken ill with vomiting 1½ to 2 hours later. The meal consisted of soup, rice, prawns, beanshoots and finished up with ice cream.

B. cereus was isolated from the seven affected patients who submitted specimens of faeces, the count in one instance being 2½ million per gram of faeces! None of the suspect rice was available but subsequent samples prepared as usual yielded over 30 million B. cereus per gram.

FOOD BORNE ILLNESSES

Food borne illnesses (unlike food poisoning caused by Salmonellae, Staphylococci or Clostridia) have a longer incubation period. The diseases normally run a different course. The food borne illnesses include:

(a) Certain bacteria, e.g. typhoid fever, para-typhoid fever (i.e. enteric fever), undulant fever, tuberculosis and some-dysentery, and

(b) Some types of food borne parasites (i.e. worms such as Cysticercus bovis and Trichinella spiralis).

EXAMPLES OF FOOD BORNE ILLNESSES AND INFESTATION

Enteric Fever: Enteric fever includes typhoid fever and para-typhoid fever. Typhoid fever is caused by the organism Salmonella typhi. The incubation period for typhoid fever is between 5 and 25 days (usually 21 days). Para-typhoid fever is usually caused by Salmonella para-typhoid B. The incubation period is 7-10 days.

Sources of germs: Both typhoid and para-typhoid organisms are excreted in the faeces and urine of patients suffering from the disease or in the excreta of convalescent or symptomless carriers.

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Method of spread: Outbreaks of both diseases have occurred through water contaminated by sewage. Similarly, milk supplies, cream or ice cream have sometimes been infected by the contaminated hands of food handlers who were convalescent or healthy carriers of the organism. Less often, outbreaks of enteric fever have been caused by eating shell fish taken from sewage contaminated sea-water or water cress which has been grown in sewage contaminated water. Enteric fever is accompanied by generalised fever (pyrexia), weakness, severe diarrhoea and prostration. It can still cause death in severe or untreated cases. The intestinal symptoms do not usually predominate until the second or third week when severe diarrhoea may occur.

Illustrative Examples

(a) Typhoid fever

1. Two large outbreaks of typhoid fever occurred in 1946 and 1964. In 1946 nearly 200 persons developed typhoid fever after eating contaminated ice cream in Aberystwyth, North Wales. The epidemic was explosive in character, 97 cases occurred in the Borough itself, 30 other cases occurred in neighbouring rural districts. The remainder occurred elsewhere in the country and was thought to be attributable to visitors who had been on holiday in the town. Four of the 97 local cases died as a result of the illness. The ice cream was manufactured under the supervision of the local authority and was considered to be satisfactory. The manufacturer had been registered as an authorised ice cream vendor. One of his staff was found to be a healthy "carrier".

2. A more recent epidemic of typhoid fever was reported in Zermatt (Switzerland) in 1964. Approximately 437 cases occurred inand around Zermatt. As a result of this outbreak some 260 cases of typhoid fever were subsequently discovered in the United Kingdom and America. For some years prior to 1964 it had been found that the water supplies at Zermatt were inadequate to cope with the extra demands made on them by the tourists visiting the area. To meet this demand, the local authorities had given their approval for water to be taken from certain streams. This water was used for human consumption after treatment. Unfortunately, some of the water in a storage tank became contaminated by a sewage effluent.

(b) Para-typhoid fever

This disease is similar to typhoid fever but the symptoms are generally less severe. The incubation period is between 7-10 days. The illness arises most frequently in the summer months. Sometimes para-typhoid fever presents the same characteristics as Salmonellosis but more often resembles a prolonged mild form of typhoid. Outbreaks of para-typhoid fever have been and are occasionally associated with food substances containing artificial or synthetic creams which have become contaminated by the organism Salmonella paratyphi B.

Para-typhoid organisms are thought to be responsible for about 400 cases of paratyphoid (enteric) fever each year. It has a low death rate. Para-typhoid fever is an illness which is commonest in the age group 15-30 years old. Apart from human contamination typhoid and para-typhoid germs may be conveyed to uncovered food substances by flies or vermin which may have previously been in contact with infected excreta. Clearly great care must always be taken to ensure that food substances are always adequately protected, from both flies and vermin. Hand washing after using the toilet is essential as part of the prevention of the spread of both diseases.

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BRUCELLOSIS (Undulant or Abortus Fever)

The causative germ is called Brucella abortus. The infection has a variable incubation period of 1-4 weeks.

Source of germs is from infected cattle, goats or pigs.

Method of Spread is either by drinking raw contaminated, untreated milk (or milk products such as cheese), or as a result of coming into physical contact with animals which are infected by the organism Brucella abortus. The illness is characterized by the gradual onset of recurrent fever, sweating, pain in the joints and in the muscles. The disease gives rise to prolonged ill health.

Illustrative Examples

Illustrative examples of recent outbreaks are difficult to find, since in most instances the signs and symptoms are transient and relatively mild. The diagnosis, therefore, may sometimes be confused between enteric fever (more especially para-typhoid fever) aor influenza. The diagnosis is confirmed both bacteriologically and by means of certain blood tests. The majority of cases of Brucellosis are thought to result from physical contact with infected animals or infected carcasses. The transmission of Brucellosis to man from contaminated cows' milk is now rare in this country. All milk sold for human consumption should be pasteurised. This kills the brucella abortus "germ". For many years past it has become possible to immunize herds of cattle against Brucellosis by means of vaccination. The immunity given to calves lasts about seven years. Pregnant cows suffering from Brucellosis tend to abort, hence the second name Abortus Fever. The by means of the vaccination process previously described.

Two other strains of the Brucella organism have been described. One affects goats and may be transmitted to man by drinking contaminated unpasteurized goats' milk. The other is a strain which sometimes affects pigs. Some decades ago Brucellosis was endemic on the island of Malta.

TUBERCULOSIS

Drinking unpasteurized tuberculous contaminated milk (obtained from a diseased cow) may cause bovine tuberculosis in man. The illness causes chronic ill health, until detected. Advances in modern drug therapy have greatly helped to combat the disease. Tuberculosis-free herds have been built up in this country to a point at which bovine tuberculosis is rare. Even so, this is no justification in abandoning the heat-treatment of milk (pasteurization).

DYSENTERY

There are two types of dysentery:

(1) Amoebic dysentery caused by a unicellular organism in tropical and sub-tropical countries. This is rare in Europe.

(2) Bacillary dysentery (the commonest form of dysentery in Europe), is caused by a bacillus. The incubation period for the disease may be from two to four days.

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Outbreaks of bacillary dysentery occur most often in institutions and schools. Cross-infection plays a considerable part in the spread of the disease but this can be greatly reduced by hand washing after using toilets. There are almost 25,000 cases of dysentery reported in this country each year. Most of these cases occur during the months of January and June.

FOOD-BORNE PARASITIC WORMS

(a) Tapeworms

These are flat worms consisting of a head and a chain of flat oblong segments arising from the head-piece. The two tapeworms of most importance in man are the beef tapeworm (Taenia saginata) and the pork tapeworm (Taenia solium).

Both of these parasites have a two-stage life cycle, a larval stage which occurs in the intermediate host, and an adult stage which occurs in man. In the case of the beef tapeworm, the intermediate host is a member of the ox family which becomes infected by eating the eggs of the adult worm, passed in his faeces by an infected human. In the ox the eggs liberate their embryos which invade the tissues of the jaw, tongue, shoulder, heart and other muscles of the beast, producing oval cysts in these areas. This stage in the life cooked are [illegible] known as cysticercus bovis and the disease in cattle which is [illegible]cosis. If infected meat is inadequately adult tapeworm T. saginata. [illegible] intestines, in his gut, into the

While meat inspectors may not infrequently find [illegible] worm is nevertheless uncommon among the native population of this [illegible] suggesting a high standard of meat inspection, and adequate standards of cooking, infection of home grown beef is uncommon because hygiene facilities are such that investion by cattle of the eggs shed by humans must be rare.

The pork tapeworm (T.solium) has a similar double life cycle, the intermediate host being the pig. However, this worm does not occur in the United Kingdom, and need not be discussed further, except to point out that in this case the condition of cysticercosis can also occur in man.

b) The Trichina Worm

This is a roundworm and is not segmented. It infests the small intestine of its hosts, man, pig, rat, etc, The female is fertilized within the gut, burrows its way into the gut wall and there lays its larvae, the fertilized eggs hatching within the womb of the worm. The larvae are carried throughout the body of the host and undergo further development within its muscles. In man, this is the end of their life cycle, but in rare cases, migration may occur into the brain and cause neurological symptoms, including unexplained epilepsy. In the case of the pig, the infected flesh, if inadequately cooked and consumed by man, will cause infection of the human, this infection being known as Trichiniasis. The larvae in the consumed meat develop into adults in the subject's gut and the life cycle is repeated.

Source : Royal Institute of Public Health & Hygiene, London

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THE PROTECTION OF FOOD

The main object of food hygiene is to prevent food poisoning and in order to do so it is necessary to protect the food against contamination. Generally speaking, food poisoning is caused by bacteria or their products and it is therefore against this form of contamination that we must take preventive measures.

Bacterial food poisoning originates in human beings, animals and the soil.

So far as human beings are concerned the principal sources of infection are the bowel, the nose and throat, the skin, cuts and boils, septic spots and the hair and clothing.

Animals may cause food poisoning due to the fact that the flesh itself contains beacteria, or due to their activities whilst alive in carrying bacteria on their bodies and feet. The soil is a prolific source of the Clostridia particularly welchii and botulinum, and of Bacillus cereus.

Infection is spread by human beings either through the hands or through coughs and sneezes. The hands receive infection from the bowel after visiting the lavatory, from cuts and septic spots by the act of touching, from the hair, from the nose, and from the throat by handling of those infected parts either consciously or unconsciously. The hands may also be a vehicle of cross-contamination by handling infected raw food and subsequently touching cooked meat. Utensils used for raw food may contaminate cooked food if not sterilized between operations. Smoking normally contaminates hands either by direct contact with lips in the act of smoking a cigarette or by indirect contact with the lips through touching the stem of a pipe. It is for this reason that smoking is prohibited in food premises. The risk of contamination by ash or cigarette ends are relatively minor factors although of course any form of contamination is important.

PERSONAL HYGIENE:

The principal method of preventing the spread of infection from human beings is by means of personal hygiene and this may be considered under five main headings.

(a) Hand washing-is of primary importance and should be carried out in the basin which is required by law to be provided in every food. In addition to a hand basin supplied with hot and cold running water and suitable drainage, there should also be a towel, or means of hand drying, soap or detergent and a nail brush. This hand basin is one of the essential breaks in the food poisoning chain and must be reserved exclusively for the purpose for which it is provided. It is the duty of management to ensure that under no circumstances are these hand basins misused for such purposes as washing small pieces of equipment, lettuce heads, etc. The hand basin should be used not only after visiting the lavatory but also after smoking, after coughing or sneezing, after using a handkerchief, after touching any raw food, and before handling any form of cooked food.

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(b) Coughs and sneezes-spread bacteria, particularly staphylococci and streptococci into the atmosphere and on to food or working surfaces. Great care must therefore be taken to avoid coughing and sneezing wherever open food is handled. Smoking encourages coughing and the use of snuff encourages sneezing so it is for this reason that these habits are prohibited in food premises.

(c) Outdoor clothing-is frequently contaminated by staphylococci and streptococci from the atmosphere. This contamination is particularly heavy in congested areas such as public transport, so lockers for outdoor clothing should be located outside of food rooms. Usually these lockers are situated in changing rooms where the outdoor clothing can be removed and clean protective clothing put on. Where protective clothing is worn it is a statutory requirement that this shall be clean and it should also cover those parts of the body liable to contaminate the food. Protective head gear should be designed so as to retain the hair in position since bacteria and dandruff from the hair are a potential source of contamination.

(d) Cuts, boils, whitlows, septic spots-frequently harbour staphylococci and the law requires that these should be covered with a waterproof dressing whenever food is handled. Most large firms today carry this one stage further and insist upon coloured waterproof dressings so that should these fall off due to the action of grease the coloured dressing will be seen before the food is made up. Where coloured waterproof dressings are provided it is essential that they be used in all cases.
It is very easy for a member of staff to use a domestic transparent type of dressing on a cut and for this to come off and pass undetected into the food.

(e) The law also requires that any person engaged in the handling of food who is suffering from food poisoning or is a carrier of food poisoning bacteria, any bowel infection, any staphylococcal infection or any serious skin infection should notify his employer immediately. The employer is required to notify the local Public Health Department. The Medical Officer for Environmental Health may well require that the employee concerned be restrained from handling food until such time as he is certified free from infection.

Foreign bodies in food may come under the category of failures in personal hygiene if those foreign bodies are parts of personal jewellery, worn by employees. There is always a risk that earrings, tiepins, cufflinks, beads and stones from dress rings, etc., could fall off and become mixed up with food under preparation. For this reason no personal jewellery other than wedding rings should be worn by any food handler.

Apart from this, foreign bodies occur in food often as a result of failure to clean up adequately after machinery or premises have been repaired. No matter how minor the repair may be, even the fitting of a small wire fuse, it is essential that great care be taken to ensure that every scrap of material is removed before the area is re-used for food preparation. Small pieces of concrete, wire, nails, washers, nuts, bolts, screws, etc., have all been found in food, in many instances in areas where some work had been carried out recently.

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Cross Contamination:

Approximately 25 per cent of the raw meat supplied to customers in this country contains live food poisoning organisms. This is due to a variety of causes including poor meat handling, the feeding of animals with infected foodstuffs and incorrect storage of the meat. This infected meat may cause illness either directly if the meat is consumed without adequate cooking, or indirectly if the meat is sliced upon a working surface which is subsequently used for cooked food without adequate sterilization. This is one of the many forms of cross contamination which can occur between raw and cooked food. Others include the location of raw food above cooked food in refrigerators allowing blood and moisture to drip on to the cooked food, the use of the same equipment (e.g. knives) for raw and cooked food without adequate sterilization between, the handling of raw food by an individual followed by the handling of cooked food without adequate handwashing and the use of swabs first to wipe down an infected surface and then to wipe some equipment used for cooked food.

The main key to the prevention of cross contamination is as far as possible to use separate storage areas, separate equipment and separate working surfaces for cooked and raw foods. As this is not always practicable great care must be taken not only to clean but also to sterilize equipment after it has been used for raw food and prior to its use for cooked food.

Another frequent source of cross contamination is the swab used universally for wiping down. Wherever possible these should be of disposable material and thrown away after being used only once. If this is totally impracticable the swab should be made of short-lived material and when not in actual use should be kept in a bowl of hypochlorite or other strong sterilizing solution. Once it has been used it should be washed, rinsed and placed back in the bowl of sterilant. The sterilant should be changed frequently and certainly be discarded at the end of the day.

CLEANING OF SURFACES AND EQUIPMENT:

The normal procedure for cleaning equipment is to wash it in a detergent or cleaning agent and this definition includes soap, although, because of the problems related to hard water, soap is not now used as frequently as synthetic detergents. A detergent must primarily be a good wetting agent, i.e. it must break down the surface tension of the water so as to allow the whole surface of the article to be wetted instead of the water forming droplets on the top. It should also emulsify grease and hold dirt in suspension so that the grease and dirt once removed do not float to the surface as a scum to be redeposited on other articles. Detergents should be chemically stable, non-toxic, soluble in water and easily rinsed off. A detergent is normally used in warm water at a temperature of about, but not exceeding, 62.7°C.(145°G.). This should succeed in removing most of the grease and dirt, whereas the use of a higher temperature will tend to bake on certain protein products. The physical removal of this grease and dirt will in effect reduce the bacterial count considerably since the dirt contains a high proportion of germs. However, this process will not render the article totally free from germs as a detergent does not normally have any specific germ killing properties. The object of sterilization is to kill any remaining germs. In practice, this can be carried out in two ways, either by heat or by chemicals. In washing up by hand, two sinks are usually used, the first containing the detergent solution at the temperature of

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approximately 60-62.7°V.(140-145°F.)and the second being either a boiling sink where the water is literally at or near boiling point or a very hot sink with the water at a temperature of at least 77°C. (170°F.). After the articles have been washed in the first sink they are placed in a basket and immersed in the second sink for a period varying with the timperature-between half a minute and 2 minutes. After this they are taken out and allowed to dry in the air. This second sink serves three purposes: the first is to rinse off any traces of detergent; the second, to kill off any bacteria which may have remained (using the heat of the water); the third, to heat the article to a sufficiently high temperature to allow it to air dry without the necessity of wiping it with a cloth.

This procedure is closely followed in most mechanical dish-washing operations. The number of washing and rinsing cycles may vary from machine to machine, but in principle, apart from any initial pre-wash or pre-rinse, the main washing operation is carried out in a tank at a temperature of approximately 62.7°C. (145°G.), the water containing a detergent with or without a bleaching agent, the main purpose of the latter being to ensure effective stain removal. The second stage is rinsing with water at a temperature of approximately 77°C. (170°F), sprayed on to the crockery from various rinse arms. Frequently a rinse additive is placed in this water but its function is not so much to sterilize as to act as a wetting agent so that the highly concentrated detergent found in the first stage is removed completely.

In washing up by hand, where it is impracticable to use boiling or very hot water, chemicals (frequently hypochlorites) are often added to the second sink. These are quite effective germs killers providing that sufficient contact time is allowed. In some instances it may not be possible to sterilize metallic objects in this way because of the risk of corrosion. After sterilizing in a chemical it is often desirable to rinse the article in some clean hot water to remove any residue, after which they are dried and put away. Wherever possible air drying should be used, but if it is necessary to wipe or polish any article a disposable towel should always be employed. Whether washing up is done mechanically or by hand it is still essential to ensure that all machinery and equipment used in the process is kept thoroughly clean and in good order. This applies particularly to dish-washing and glass-washing machines which, unless they are cleaned and maintained regularly, can frequently produce unsatisfactory bacterial counts on the crockery.

So far as crockery and cutlery are concerned, these can be dealt with by washing up either by hand or by machine in the two-stage process mentioned, but this procedure is not always practicable for the large equipment to be found in food premises. Working surfaces must be cleaned and sterilized at least daily and often more frequently. Where sufficient labour is available a two-stage process is ideal, i.e. washing down with a suitable detergent to be followed by rinsing thoroughly with a suitable chemical sterilant. How-ever as time and labour are frequently at a premium it is often only practicable to carry out a single operation. In this case it is necessary to use a combined detergent-sterilizer. Various combinations of chemicals are available on the market but many detergent-sterilizers today fall into the group of chemicals called quarternary ammonium compounds. These may not be as effective cleaning agents as detergents or even as effective sterilizing agents as pure sterilants but, if properly used, they can, under normal circumstances, provide an adequate cleaning and sterilizing process in one operation. Their detergent properties tend to be inversely proportional to their sterilizing power. It is common practice therefore to combine a

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quaternary ammonium compound of high sterilizing power with a suitable (non-ionic) detergent. Detergent-sterilizers are used frequently for such equipment as milk machines, ice-cream machines, the insides of refrigerators, meat slicers, mixing machines and working-surface tops.

After equipment has been cleaned and sterilized, it is essential that it be put away properly in a suitable clean store, and not left lying around in the kitchen to become recontaminated.

THE DESIGN OF EQUIPMENT AND PREMISES:

The law requires that equipment used for the handling of food should not only be efficient but shall also be made of material which is impervious, easily cleansed and non-reactive to food ingredients. The actual materials used in the construction of a piece of food machinery or of a working surface must depend upon the particular operation involved and it is only possible to lay down very general guide lines. Nowadays, galvanized material is rarely used, because it is difficult to clean and the galvanizing ultimately corrodes. Stainless steel is obviously the most popular material, but in some cases it is precluded because of expense. However, wherever possible, this or one of the harder plastics is the most suitable material; the one surface which should not appear in any food premises is soft wood. Even now, soft wood shelving is frequently found in stores and if there is no means of avoiding this (as, for example, in existing premises) these shelves should be covered with an imprevious surface, even if this is only a hard, polyurathane paint. It is almost impossible to avoid spills and leakages from bottles and cans, and therefore untreated wood surfaces rapidly become contaminated and impossible to clean. Cutting boards can be obtained in various plastic materials, and on the whole they have proved quite satisfactory, provided they are not subjected to too much heat in the process of washing, when they tend to warp. The only wood surface which should be allowed to come into contact with food, is a hard, wood chopping block.

All equipment, particularly bins and containers should have rounded corners to facilitate cleaning, as food particles left in odd corners will not only harbour bacteria and mould spores, but may provide a breeding ground for various forms of vermin, including cockroaches, mites, weevils, etc.

So far as possible, the premises themselves should be so designed that they can be easily kept clean. The actual lay-out of the food room will depend upon the particular business being conducted on the premises, but it is essential that it be lighted adequately and ventilated properly. The walls, ceiling and floors, too, should be made of an impervious material, which can also be easily cleansed.

In the past, tiling has often been used to cover walls, and whilst there are many points in its favour, there are distinct disadvantages. Tiles are not hard-wearing and get damaged in areas such as corners and behind pan wash sinks. They also tend to come away from a wall subjected to intense heat-for example, behind grills and ovens. In these areas, a better proposition is to instal a metal lining to the wall, properly sealing it to prevent vermin from nesting behind the metal. At higher levels, a good hard plaster finished with a high-gloss paint, would usually be easier to keep clean than a tiled surface with its inevitable grooves between tiles.

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In so far as floor covering is concerned, it is imperative that the junction between the wall and floor be covered by a large radius the, Even in those areas where coved tiles are used, there is a tendency to employ a tile with a radius of approximately only half an inch. This type of corner is extremely difficult to clean, as grease and food particles tend to accumulate there, particularly behind pieces of equipment which provide an ideal breeding ground for vermin. Quarry tiles have been popular for many years as a floor covering, but where these are used, care should be taken to ensure that the tiles are laid as close together as practicable. Wide joints between tiles will absorb grease, and although floor cleaning machines may be employed satisfactorily to clean the tile surface, the brushes on these machines cannot reach the junction between the tiles where grease builds up. In the larger organizations experiments are being conducted with epoxy resin and various other forms of continuous flooring which can be laid in a single surface from wall to wall (and even up the walls to a certain extent) and this will probably be the answer to cleaning problems. On the other hand, some of these floor surfaces can become very slippery when in contact with water or grease and care must therefore be taken in the selection of these materials to ensure that the surface is both safe and can be easily cleaned.

Ventilation is very important, not only from the point of view of keeping the kitchen cool, but also in preventing fat and grease contaminating the walls in the cooking process. Hoods connected to a suitable extract system should be fitted with easily accessible filters and grease drip-trays. These must be cleaned very regularly as choked filters not only prevent the effective operation of the ventilating system, but are also a real fire hazard should the grease tray over-flow on to a hot surface. All fittings and equipment should be as simple in design as is possible, free from corners where dirt can accumulate. Shelves should be slatted in to allow any spillage to fall through and the bottom shelf should be at least 12 inches from the ground to facilitate cleaning. Similarly, work tables and other pieces of equipment should, wherever possible, be movable. Where this cannot be arranged, equipment should either be built-in, so as to prevent one continuous surface with the wall, without joints in which grease and dirt can lodge, or located far enough from the wall for the area behind to be easily cleaned. Free standing equipment should be sufficiently high from the floor to allow the area beneath to be properly cleaned. Particular attention should be paid to the supply pipes leading to such equipment, e.g. gas pipes, electricity cables and water pipes, which are often too close to the floor and where grease and dirt get trapped. Window sills and unnecessary leges should either be removed or made to slope steeply to prevent dust, dirt and rubbish accumulating.

THE PREVENTION OF INFESTATIONS BY RODENTS AND OTHER PESTS:

Rats and mice are liable to harbour food-poisoning organisms in their bowels and carry many forms of contamination on their fur and feet. The main danger from infestations lies in the unknown quantity of food which may have been contaminated either by their droppings or their physical contact when running around the premises, and not in the relatively small amount of food which is damaged. A careful watch must, therefore, be kept for signs of gnawings, grease marks, holes, droppings and damage to packages. If an infestation is suspected, expert advice should be sought from a specialist disinfestation firm or from the local Health Department.

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The main preventive action so far as infestations are concerned, may be defined in the two words-"Good Housekeeping". No crumbs or particles of food should be left around. All stock should be kept off the ground and used in rotation to deny harbourage for breeding purposes. Dust-bins should always be fitted with lids and care must be taken to ensure the lids are properly in place, particularly at the end of the working day. Used plastic or paper sacks should be properly secured before being deposited in the bin area. Too often these sacks are left open and if knocked over and spilled, the contents will attract the attentions of vermin and other animals.

The building should be examined frequently with a view to detecting failures in vermin proffing. Pipe runs should be sealed at the entrance to buildings and where pipes pass from room to room. Ventilators should be covered with fine gauze to prevent flying insects gaining access. The bottoms of doors should be fixed with kick-plates to prevent vermin easily gnawing through any damaged parts.

Insecticides, particularly slow acting ones such as DDT, should only be used in dust-bins, stores and passages, etc., and not where there is food exposed. In kitchens and food preparation areas where it is inevitable that a certain amount of food is exposed, electrically operated fly-killers should be employed. These consist of a blue light bulb or tube which, when switched on, attracts flies to an electrically charged metal grid. As the flies touch the grid they are electrocuted and their bodies fall into the collecting tray under-neath. While this method does involve a certain amount of capital outlay, it does preclude the risk of bodies of dead flies appearing in food.

THE DESTRUCTION OF GERMS IN THE FOOD ITSELF:

In practice, the only real method of destroying germs is by heat. There are three main categories of heat-treatment: pasteurization, sterilization and cooking.

The aim of pasteurization is to destroy the pathogens without necessarily killing all bacteria. At the same time, by reducing the temperature and time for which food has to be heated, changes in flavour and appearance of the food itself are minimized. This applies to milk, ice-cream, cream, liquid eggs and certain cooked meats which, for commercial reasons it may be impossible or impracticable to sterilize.

There are two methods of milk pasteurization: the holder or batch method and the continuous or high temperature short time method (HTST). In the case of the former, a batch of milk is heated to between 62.7°C.(145°F) and 65°C.(150°F), retained at that temperature for 30 minutes then cooled to 10°C.(50°F.) before being bottled. This is a relatively slow process and is, therefore, only used in very small dairies. The high temperature short-time method is used in larger establishments and is a continuous flow system by means of which milk is pumped steadily around the plant from the supply tanks at one end to the bottling machine at the other, and filtered. The milk is then warmed by heat exchangers to 71.3°C.(161°F), retained at that temperature for 15 seconds, during which time it flows through an insulated pipe to be cooled to 10°C.(50°F.) at the other end of the machine. It is required by law that indicating and recording thermometers be provided so that inspectors can see that each batch has been correctly treated. The flow diversion valve fitted at the output end of the holding tube, returns to the beginning of the process any milk which is not at the correct temperature.

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Ice-cream mix must be either pasteurized or sterilized. In the case of pasteurization, a number of different combinations of time and temperature may be used. These vary according to the size of the establishment and both batch and continuous flow methods are used.

Liquid eggs used for baking or for the manufacture of dried egg must be pasteurized at a temperature of 64.9°C.(148°F.) for 2½ minutes.

Most canned meats are sterilized, but in some instances it is impracticable to guarantee that the entire mass of the meat is heated to a sufficiently high temperature to destory all bacteria without damaging the outside of the meat in the process. In this case, a lower temperature is used so that only the pathogens are destoryed and the can is then labelled- "To be Kept Under Refrigeration". It is very important that these instructions be carried out in the case of pasteurized meats.

The aim of sterilization is to kill all bacteria. This is applied mainly to canned goods, milk, and to certain ice-cream dried mixes. The time and temperature combination for the sterilization of canned foods depends to a very large extent upon the nature of the food itself, the type of pack and the size of the pack. The principle behind the process is to ensure that the entire mass of the meat reaches a temperature above boiling point. The main organism with which canners are concerned is clostridium botulinum. For this reason most canned foods are heated to temperatures around the 115.5°C.(240°F.) mark for a period of several minutes, but it is not possible to generalize on this subject.

So far as milk is concerned, this may be sterilized either in batches or by the continuous flow method. Again, there are variations of time and temperature, no statutory figures having been laid down, but in the batch method the milk is heated to approximately 115.5°C.(240°F.) for 20 minutes in bottles that have already been sealed. It is then cooled and despatched. Since the souring organisms as well as the pathogens have been destroyed, this milk will keep for long periods without refrigeration, but unfortunately the milk sugars are caramelized and the milk, therefore, has a characteristic flavour. However, if the bottle has been opened the milk turns sour relatively quickly-as will fresh milk. Before milk can be legally described as "sterilized" it must pass a test known as the "Turbidity Test".

To obviate the unpleasant flavour of sterilized milk, a new method, known as Ultra Heat Treatment, has been devised. This is a continuous flow process similar to the high temperature short time method of pasteurization, but in this case the milk is heated to 132°C. (270°F.) for one second before being poured, under aseptic conditions, into sterile containers which are then sealed. This milk is often known as Long Life milk. Although for technical reasons it will not pass the turbidity test, and cannot legally be sold as "sterilized milk", for all practical purposes it is free from bacteria and will keep for as long as the conventional sterilized milk.

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Ice-cream is sterilized in a similar manner at a temperature of approximately 149°C. (300°F.) for 2 seconds, after which it is dried and packed into sealed containers for use by those manufacturers who do not have the facilities for heat-treatment (e.g. soft ice-cream sales from mobile vans).

The method most commonly employed in the kitchen for killing bacteria in food, is cooking. To be effective, the entire mass of the food must be exposed to the heat and, therefore, small joints of meat are much better than large ones. Minced meat should be spread out on shallow trays.

Unless the meat is to be served immediately, it should, after cooking, be cooled very rapidly and refrigerated as soon as possible to reduce to a minimum the development of bacteria from any spores which may have survived the cooking. Slow cooling of food followed by re-heating is a frequent cause of food-poisoning, particularly by organisms of the welchii group. In general, meat food should not be re-heated, but if this is unavoidable, then thorough re-heating is essential. The warming up of these dishes has caused many food poisoning outbreaks. The law requires that when food is needed for immediate consumption, it must be kept hot, i.e. at a temperature above 62.7°C. (145°F.), or cooled rapidly to below 10°C. (50°F.), until it is to be actually served for immediate consumption.

THE PREVENTION OF GERMS FROM MULTIPLYING:

The foods in which bacteria multiply most rapidly are: meat and meat products; milk and milk products; egg and egg products. One way of controlling the rate of multiplication is to remove the free moisture either by dehydration or the action of salt or sugar. With certain foods, the creation of an acid environment by the addition of vinegar or benzoic acid will prevent germs from multiplying, but in many cases, the nature of the food is altered and in others, the law limits the quantity of acid which may be added.

The most practical method of controlling bacterial multiplication is by regulating the temperature, normally by refrigeration. There are three main types of refrigeration in general use.

The dairy or domestic type of refrigerator operates at a temperature between 1°C. (34°F.) and 4°C.(40°F.) and is used for the short-term storage of various foods. Since most pathogenic bacteria do not multiply appreciably at temperatures below 10°C. (50°F.), food kept in these refrigerators is reasonably safe. However, there are many spoilage organisms which will continue to grow at a temperature of around 4°C. (40°F.) and, therefore, spoilage can occur even within the refrigerator to slightly above freezing point, is to prevent the formation of large ice crystals. Where any food containing moisture is cooled slowly, there is a tendency for large ice crystals to form within the cells of the food. In the latter stages of thawing, these ice crystals rupture the cell-walls so that valuable salts and products contained in the food-cell are lost as the water is drained away. On the other hand,

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this is not the case with food that is frozen by the "quick-freeze" process, as only small ice crystals are formed within the cells which do not rupture the cell-walls. It is, therefore, possible to reconstitute quick-frozen food with the minimum loss of nutritional value.

As the function of a refrigerator is to circulate cool air it is essential that it should not be over-loaded, for unless the air is freely circulating round the food, that food will not be cooled. As refrigeration space is relatively expensive, the most effective use must be made of the refrigerator and, therefore, canned goods, acid foods, raw fruit, raw vegetables, dried goods, etc., should not be placed inside the refrigerator. It should be reserved for the high protein wet foods, such as meat and meat products, milk and milk products, and egg and egg products. Because of air circulation, strong smelling foods such as fish should not be placed in the refrigerator with other foods unless the pungent food is put into an air-tight container first.

Another type of refrigeration frequently found in food premises, is the deep-freeze cabinet. This should be kept at a temperature of - 25°C. to - 19°C. (-5°F. to +5°F.). It should be used solely for the storage of food which has already been frozen and, therefore, it is not quite so essential to allow air space around the various items stored there. On the other hand, should the deep-freeze unit fail and any quick frozen food commence to thaw, it must not be re-frozen even in the deep-freeze unit itself. The temperature of this unit is insufficient to ensure the formation of the small ice crystals and any food re-frozen would suffer damage due to the formation of large ice-crystals. If such a problem arises the options open to a food handler are:-

(a) to destroy the food: (b) to use the food immediately; (c) to use as much food as possible immediately and store the remainder in a dairy refrigerator for a period not exceeding 48 hours, or (d) cook the food, cool it rapidly and store it in a dairy refrigerator for immediate use, again within two or three days.

The last type of refrigeration is the ice-cream conservator. This operates at a temperature of around -7°C. to -4°C. (20°F. to 25°F.). It is intended for the storage of ice-cream which the law requires to be kept at a temperature not exceeding - 2°C. (28°F.). It is, therefore, not suitable for the long-term storage of quick-frozern foods, although there is a tendency among certain caterers to use it for this purpose. Little bacterial growth will take place within frozen foods kept in these cabinets but flavour changes may well take place due to enzymic action which is not stopped completely at these temperatures.

Since the efficient operation of a refrigerator depends upon the cooling effect of air circulating outside as well as inside the cabinet, care must be taken in every instance to ensure that the ventilation grilles leading to the motor unit are kept clean and free from obstruction.

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Source: Royal Institute of Public Health & Hygiene
- London

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ST. JOHN'S MEDICAL COLLEGE & HOSPITAL

DIRECTOR OF RURAL HEALTH SERVICES & TRAINING PROGRAMME

MATERIALS USED IN CONSTRUCTION OF FOOD PREMISES:

All materials used in the construction of food premises should be such as will, of themselves, assist in the task of maintaining the premises in a proper state of cleanliness. For example:

Outer yards should be paved with-

(a) Hard-rolled tar macadam.
(b) Hard-surfaced concrete.
(c) Concrete-based cement-rendered surfaces.
(d) Tiles (earthenware) set to tight joints.
(e) Stone setts with flush joints, set in cement.
(f) Flagstones with good hard cement.

Interior work floored should be-

(a) Granolithic.
(b) Terrazo.
(c) Quarry tiles.
(d) Quarry tiles incorporating non-slip elements.
(e) Specialized plasticized floor tiles.
(f) Hard cork lino over flush-fitted wood.
(g) Surfaced-tight jointed hardwoods.
(h) Oiled and sealed hardwoods.
(i) Oil-dressed cement floors treated with silicate of alumina when laid.

Interior room floors where no heavy work is carried out and where the public are allowed for service or shopping should be-

(a) Specialized plasticized floor tiles.
(b) Hard cork lino over flush-fitted wood.
(c) Surfaced-tight jointed hardwood.
(d) Oiled and sealed hardwoods.
(e) Where the sales action demands rugs or carpeting these should be of a quality that will withstand regular daily vacuum cleaning or surface cleaning.

Walls of food rooms should be-

(a) Plastered and painted, two or three coats lead-free paint.
(b) Tiled (ceramics or earthenware).
(c) Sheeted with plastic laminate.
(d) Sheeted with metal sheet (not glavanized).
(e) Tiled with plasticized polyurethane tiles or the like.

Celings should be-

(a) Plastered but not painted. They are designed when plastered to act as a heat-absorbing area, and painting of this plaster leads to increased problems of condensation in rooms where steam rises

Woodwork where wood has to be used, should be-

(a) Hard-wood.
(b) Other woods given added protective surfacing such as two or three coats of lead-free paint.

Brickwork-

All brickwork of food premises (excluding outside walls) should be finished with flat face. That is, without uneven mortar joints.

CODE OF PRACTICE (EXAMPLE)

It is now practicable to set down an example of a code of practice which will equally apply to the construction and conduct of all food premises. In setting down the paragraphs it is inevitable that some of the items specified will also be the subject of food-control law. The agreed construction principles are, however, good sense in any food-handling circumstances.

1. The walls of food rooms made from permanent materials should be smooth and impervious.

2. Walls should be in good repair and be finished in a light colour.

3. Flaking paints and non-washable powder paint colours (distempers) should not be used.

4. Tiles are advantageous, and there should be rounded angles at floor level.

5. Ceilings should be in good repair, of even surface, and either porous or specifically insulated according to the process carried out.

6. Ventilation canopies should be fitted wherever excess steam is generated.

7. Such canopies should be of rust-proof materials.

8. Floors should be even, surfaced, and impervious to moisture.

9. Where frequent washing down is needed the floor should gently slope to a drain.

10. Pipes coming through walls, floors, or ceilings should be fitted in a manner that prevents ingress of insects through gaps.

11. All floors should be cleaned at least once a day.

12. Internal woodwork should be reduced to a minimum and should be of a design that makes cleaning easy. Wood should not (with the possible exception of butchers' blocks and special food-cutting surfaces) be used for food work surfaces.

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13. Doors should be fitted so as to prevent insects and rodents gaining access.

14. Windows should be of plain glass, and the window-sills sloped so as to stop them being used as 'unofficial' shelves. Where cooked meat and processed made-up foods are displayed the windows should be refrigerated.

15. All lights should be placed to give good illustrated pattern to fit the work process. The scale of lighting should never fall below 25 lumens per ft.^{2} (formerly [illegible] foot-candles or lamberts) at any work surface.

16. Ventilation must be worked out to suit the process, but some degree of mechanical ventilation is needed in most food rooms. [illegible]

17. Ventilation should aim at minimum of 20 changes of air per hour.

18. The heating systems needs to be planned to fit the process and the ventilation system, and must have relationship to the needed relative humidity.

19. Any outdoor yards or paving used in connexion with the food business should be of an even impervious good-condition surface.

20. Separate tools should be used for cutting raw foods, especially meats and cooked foods.

21. Where wooden work surfaces have to be used they should be cleaned to a special routine, and will best be sterilized by washing with sodium hypochlorite in a correct solution that will be advised by the makers.

22. Degreasing is as important as sterilizing, and correct detergents should be selected and properly used.

23. Premises should be inspected regularly for the presence of rodents and insects, and domestic animals should be banished from food rooms.

24. Adequate storage for food and all utensils should be provided and kept in a good state of repair to prevent accidental contamination or contamination by insects, rodents, etc.

25. Refuse should be moved regularly and completely from food rooms and stored under cover and kept dry as possible until final removal from the premises.

26. Refrigerators should be purpose built and correctly used. Full regard must be to aid the food and the special needs of that food when correctly kept.

27. Meat should be hung or placed in containers or on special cleanable pallets.

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28. Products should be kept at their correct temperatures and not indiscriminately taken into and out of that temperature ambient.

29. Refrigerators should be defrosted and cleaned regularly.

30. Food should not be placed on sale display in the direct rays of the sun or where any atmospheric contamination may occur or where persons may contaminate it.

31. Hands should be kept off food as far as possible, and where the trade-need's make handling necessary, then the hands should, indeed must, be clean.

32. Dressing poultry, and the like should never be carried out on the same surface as other food preparation, and the hands should be washed between every such operation.

33. Food for animals and pets should be handled absolutely separately from human food.

34. Delicatessen and meat products should be very carefully displayed and screened from contamination at all times.

35. All meat and meat products should be kept at below 10°C. until cooked.

36. Gelatines and gravies should not be kept in a ready-to-serve or use state from one day to the next.

37. All equipment should be purpose designed, and so should all utensils. Only correct utensils and equipment should be used, and they should be of correct materials and shape to make maintenance and cleaning easy.

38. All machine and container doors should be tightly fitting, and panels intended to be removed for cleaning or maintenance access should be gasketed to keep out insects and to prevent other forms of possible contamination of contents.

39. There should be a minimum of inaccessible internal surface that can be reached for cleaning. All the materials used should be non-toxic.

40. All machines or equipment delivery tubes, pipes, and chutes should be subject to a reasoned-out in situ chemical sterilization routine.

41. All liquid container machines and equipment should be fitted with anti-overflow devices.

42. Equipment designed to achive set temperatures should have indicator thermometers to show their working efficiency.

43. Light should be arranged so that all working parts of any machine or equipment can be examined for cleanliness.

44. Precise cleaning instructions should be worked out and known to all operatives for all machines, equipments, and utensils.

MGW/ms*/24/1/80/

THE LOCATION AND DESIGN OF PREMISES, EQUIPMENT, AND UTENSILS

Premises:

There are basic similarities in the construction of all premises where food is handled. These are found whether the premises be a small home kitchen, a small food shop, or a huge food factory. The use of good construction principles, and of materials that assist the maintenance of cleaning routines, thus become major factors in obtaining practical food hygiene.

Before the 'Example' code is read it is necessary to indicate some general principles in regard to the siting and location of food premises and the correct allocation of working space for food handlers. Badly located sites hinder the proper observance of basic food-hygiene ideals, and as such they should, in theory, be avoided. Where it is not possible to obey this precept, all cleaning and food-handling routines should be carefully worked out to compensate for site and location difficulties. Adequate water supplies, lighting services, and ventilation must always be available. The immediate surroundings should be examined for the presence of noxious trades and practices. An unpleasant smell is not so important as whether the air is charged with smoke or other dirty particles, or whether the surroundings contain potential or actual breeding-grounds for rats or harmful insects.

If prospective premises form part of a large building the location of the water supply and other common services should be examined; and it should be ascertained whether the sanitary conveniences and wash basins to be used by the staff are conveniently sited and adequate in number. Attention should be given to the facilities for handling and storing foodstuffs and to the routes by which the foods reach the establishment and the refuse is removed. The inward route, at least, should be under the trader's own control; dark and potentially dirty passages and alleyways should never be used as food rooms.

Underground food rooms present special difficulties. It is important that their windows should not open on to areas or forecourts so narrow that dirt of noxious matter can be kicked, thrown, dropped, or blown into uncleanable recesses or even on to the food. Underground premises may be liable to flooding and drainage backflow, and they also need special ventilation and lighting. Premises where food is stored need to be cool and dry.

All food-handling or service premises should be extensive enough to allow all work chores to be carried out without congestion on the lines of work flow. Food handlers should never be crowded at work-tables or have to queue for the use of food-cleaning or washing facilities or facilities for personal hygiene. At the same time the premises should not be so large as to entail unnecessary walking about by workers. Food handlers have been observed to neglect hygienic practices if they involve additional walking, waiting, or working uncomfortably close to a colleague. There must be sufficient table and shelf space to alllow used and unused utensils to be kept apart from each other and from food in course of preparation.

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Food-preparation and washing-up rooms or zones should occupy a space equal to approximately half the sales area, but rather more than this is necessary in very small establishments. Every food establishment should contain a room used solely as a food work room not less than 8ft. (2.43 m.) in height and with a minimum floor area of 100ft.^{2} (9.3 m.2) clear of furniture, fittings, and stored goods. If more than three people are employed in the room there should be an additional 33ft.^{2} (3 m.^{2}) of floor area similarly clear for each person above three in number.

The greater the distance over which food has to be carried, and the more often it has to be handled, the greater the chance of its becoming contaminated. Therefore, the ideal to aim at is to have everything moving forward in orderly progression- from delivery area to sales area.

Temperature and Relative Humidity. As this section proceeds the terms 'cool' and 'dry' will increasingly occur, and it is therefore useful to explain those terms.

Cool is actually coupled with the idea of hot food being piping hot. At first glance that may seem a contradiction in terms, but it is understandable when it is made clear that the object is to keep foods outside the danger range of temperatures 10°-63°C. There is a range of food, such as bread, pastries, etc., that may be within this range with safety. There are other foods which need to be always in sub-zero conditions, such as frozen foods and ice-creams. One of the greatest problems facing the food-hygiene worker is the ready plated meal held until the consumer arrives and kept for this purpose in so-called 'hot' cupboards, which are usually found to operate around 37°C. Plated food so held for 30 minutes has almost become the equivalent of a laboratory culture plate if there is original bacterial contamination of the plated meal. The aim must therefore be to keep food cool or piping hot, in hot cupboards above 63°C.

Relative humidity is the degree of available moisture in the air at any given temperature, and it is evaluated by taking contrasting readings of two thermometers, one kept dry and the other with its bulb covered by a wick immersed in water.

Lay-out. The lay-out should be planned with a clear idea of the purpose of every part of the food premises. A goods entrance, separate from the customer's entrance, is essential for hygienic planning. The most convenient arrangement is for this goods entrance to open from a yard so situated that delivery vans can pull right up to the door of the building. The yard should have an impervious and even surface, a water standpipe, tap and washing-down hose, raised and covered accommodation for refuse bins and swill bins, and adequate drainage. If solid fuel is used the store should be in the yard, and bulk oil fuel should be kept completely separate from any food or utensil store.

Vegetable and Root-crop Storage. If root crops and un-cleaned farm produce are being handled on any food premises they should be stored in a purpose-designed room which should be near the goods delivery point and is cool, dry, well ventilated, and large enough to allow for orderly storage. It is convenient in this room to arrange that water used for washing down drains to a gulley. Thus the room is best planned with and entrance direct from the yard-which will keep some dirt off the rest of the premises. Vegetables require ventilation.

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They should be stored on racks-preferably wire or metal- so arranged that air can circulate freely under and around them. The racks should be high enough off the ground so as not to be readily accessible to vermin. Potatoes and root vegetables should normally be stored in sacks as delivered; but if they have been bagged in wet weather they may be subject to disease, and they should be turned out, aired, and examined. The defective ones should be removed at once. Other fresh vegetables should be used the day they are received. If this is impossible they should be emptied out on to the racks, but new deliveries should not be emptied on top of older ones. Stored vegetables should be inspected frequently and premises should come the dry food store, which should be flyproofed by fixing removable screens over windows and door openings; in addition, the walls should be treated with residual insecticides. The room should be dry, well lit and ventilated, and at least 7 ft. 6 in. (2.3m.) high. This room should be used exclusively as a store, and therefore an internal water supply is not essential, but water for cleaning should be close at hand. Prepacked deep-frozen vegetables received into stock mean that sub-zero holding cabinets must be available. These cabinets should be such as allow for rotation of stock, and have a plainly marked effective loading line above which stock should not be placed. Rooms where food is 'worked' should never be used as thoroughfares to other parts of any building, and it is an advantage to study the processes and 'zone' the areas of floor space allocated to each. This,as a reduction of cleaning problems, is to be preferred against a multiplicity of small work-rooms. Full advantage should always be taken of natural lighting and existing mains services supplies, and the real aim should be to achieve cleanliness and supervision rather than pure design symmetry.

Siting of Equipment. All food equipment should be so placed as to allow room for cleaning around and behind, as well as in front. Where equipment and cupboards and store places are 'built in' the object must be to have them free of un-necessary ornamentation and finished to an even surface with surrounding wall surfaces or floor surfaces to obviate uncleanable ledges and areas.

Personal Hygiene Facilities. Sanitary accommodation must be provided for the staff, and should also be provided for customers. It is usually inconvenient for the same accommodation to be used both by staff and customers, except in quite small establishments. In larger establishments it is more satisfactory to combine the staff conveniences in a group with the staff washrooms and cloakrooms. It is important that the sanitary accommodation available to workers should be readily accessible. Although no general rule can be laid down, no worker should have to go more than thirty steps from the room where he is working to reach sanitary accommodation. The compartment containing the sanitary convenience should be separated from any working room and from the dining-room by an intervening ventilated space and should be wellllit; this point is most important, as otherwise it may not be properly cleaned. There should be separate sanitary accommodation for each sex, with separate approaches.

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There should be fully equipped wash-hand basins within any compartment containing sanitary conveniences or close to them, for example, in the intervening space referred to above.

The basic requirements of sanitary accommodation-ready accessibility, good light, and proximity to washing facilities-can be fulfilled in many different ways; only after consideration of all the circumstances can a decision be made on whether the provision in a particular instance is suitable and sufficient.

Where there is no water supply or when a water-carriage sewage-disposal system cannot be used for other reasons-for example at fair-grounds or at remote tourist centres-some form of chemical closet is needed. Whichever type is used should be fitted with a cover or otherwise constructed so that the contents are protected from flies. Care must be exercised to see that the equipment is kept as clean as possible. It should be situated as far from the food room as reasonable, and it should have hand-washing facilities adjacent.

It is never impossible to provide hot water, soap, nail brushes, and towels. Wall-cabinet roller towels which present each user with a fresh surface or, alternatively, paper towels for single use are preferable. Electric hot-air hand driers are also available.

Water Supply and Hot-water Apparatus. Ample and immediately available supplies of both hot and cold running water are essential. Where the food establishment occupies part of a building, it is desirable for it to have its own independent hot-water supply. All water used for food preparation and cooking, for drinking, for washing-up, and for cleaning utensils and surfaces with which food or utensils may come in contact should be public-supply-main water or of equivalent quality. Rain-water, river water, well water, and water from other non-purified sources should be used only for such outdoor purposes as washing down yards and swilling out dust-bins, except on the advice of the local health department.

It is not advisable to economize over water taps and piping. All sinks, wash-hand basins, and other fixed receptacles should receive their water supplies direct from taps appropriately placed. For internal piping copper is best; and where the course of the piping is not dictated either by the existing mains and tanks or by the siting of sinks and other appliances, it is worth while to give some thought to its arrangements. Pipes tend to collect dust, and horizonatal or sloping overhead pipes are not only difficult to clean but may also accumulate moisture, which drips on to the food.

Whenever possible, pipes should either be run outside the kitchen (for example, under the floor or above the ceiling) or else they should be sunk into the wall. When they must come into the open they should for preference run vertically rather than horizontally, bringing the water straight down to the tap from the overhead pipes or straight up from the supply beneath the floor. In any case, they should be held at least 2 or 3 in. (5-8 cm.) away from the wall by pipe clips, so that they can be cleaned all round and do not create crevices in which insects or vermin may breed. If cold service pipes have to be run at high level they should be lagged to prevent condensation and the dripping which results.

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Hot-water pipes should be lagged to conserve heat and so reduce the consumption of fuel. The methods of lagging pipes and storage tanks is important, as cases have occurred of mice burrowing into soft lagging and nesting in it. Pipes should be protected with a fine wire mesh to prevent this, and the lagging round tanks should be enclosed with materials which cannot be gnawed.

Hot Water. Many water-heating systems produce water which, although hotter than the 43.5°C., which is about the most that normal human hands can stand, is never as hot as the 77°C. necessary for the proper sterilizing rinse of cockery, cutlery, and utensils. Such systems are satisfactory enough in smaller establishments which can carry out the sterilizing by steam or by water heated as required for sterilization purposes. Larger establishments which have a constant demand for washing-up water at 77°C. should be careful to ensure that their systems can provide water at 77°C.

Wash Basins. Workers should be encouraged to wash their hands both after visiting the sanitary convenience and whenever necessary during the course of work. They should not use the wash-up sinks for this purpose, as this may infect the sinks with germs which can later find their way on to food. Moreover, the sinks will usually not be free at the time when hands need to be washed. Accordingly, wash-hand basins with hot and cold water laid on, and with good lighting overhead, should be provided in or adjoining the food room and also in immediate proximity to the sanitary conveniences.

Sinks. Sinks and draining boards should have a smooth, hard, even surface, and are best constructed of porcelain-finished fireclay, non-corrosive metal (for example stainless steel), virteous enamel or plastic, with one-piece tops welded to the sinks and draining boards harbour germs in the cracks and joints. Aluminium sinks scratch easily, are not robust, and are difficult to keep clean.

Sinks used for washing up should be small enough to ensure frequent replenishing with hot water but large enough to take the largest dishes comfortably. For washing pots and pans galvanized-iron sinks are suitable, as they are robust and withstand heavy cleaning.

It is desirable to have the sink fitted with a spray hose for washing down the sink and draining boards, and with a removable strainer in the waste pipe for trapping crumbs, tea-leaves, etc. A built-in, but removable refuse container is also an advantage.

The number of sinks required will necessarily depend largely on the trade. In general, it may be said that fish should never be washed in the same sink as vegetables, and a separate sink should therefore be reserved for fish. The meat-preparation room also needs a separate sink. All these sinks should have hot and cold water laid on.

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Drains: Drains should be adequate to remove all waste water without risk of flooding. Normal-sized drains are 4 in. (10.2 cm.) in diameter. These are large enough to deal with a considerable flow of drainage, and may be suitable for some food establishments; but many establishments will need 6-in. (12.7 cm.) drain pipes. Grease traps are valuable because they prevent grease from congealing in the drain pipes. The grease tray should be removed regularly and washed out.

Many establishments have channelling covered with steel grids round the grease-producing areas. The tops of these grids and the channels themselves are likely to become dirt-traps unless they are very regularly cleaned. They are difficult to clean. Drainage should be adequate to remove all waste water without risk of 'pooling' at gully traps.

Source: The Theory & Practice of Public Health

By

W. Hobson

ms*/29/1/80/

CLEANING ROUTINES

All merchandising techniques produce the need for specialized designed cleaning techniques to fit the trade or selling circumstances. Here is an example of such a routine. This is designed for the bakery trade, but all other trades can be studied and routines of similar calibre designed.

ROUTINE CLEANING CHART

Equipment or area	Routine to follow	Frequency of cleaning
GENERAL GOODS STORE		
Walls and shelves	Sweep and/or vacuum clean.	Frequently and regularly
	Wash down with hot water containing detergent.	At least once a week
Floors	Sweep and/or vacuum clean.	Frequently and regularly
	Wash down with hot water containing detergent.	Daily
ISSUING STORES		
General	Sweep and/or vacuum clean. Wash any surface that comes into contract with food with hot water containing detergent.	Daily
Walls and shelves	Wash down with hot water containing detergent. Walls can be hosed with 'live steam' if facilities exist.	Frequently and regularly
Floors	Wash down with hot water containing detergent or hose with 'live steam' if facilities available.	Daily
EQUIPMENT		
Utensils and supply vessels	Wash with hot water containing detergent, rinse and dry or wash out with 'live steam' if facilities available. If the utensils, etc., are used for meat, cream, imitation cream, or egg the hot water should contain detergent with sterilant.	At least once a day, more frequently if the process requires

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Equipment or area	Routine to follow	Frequency of cleaning
Measures and pans	Clean thoroughly, wash with hot water containing detergent, rinse, and dry. If the measures and skips are used with meat, cream, imitation cream, or egg the hot water should contain detergent with sterilant.	Frequently and regularly
Ventilation ducts and fans	Brush and/or vacuum clean outside surfaces of ducts and metal fitments.	When cleaning the walls of the appropriate store
	Wash down with hot water containing detergent.	Regularly in other parts of the premises.
	Clean inlet screens and filters in the same way.	At least once a week
Storage tanks (not completely sealed)	Drain tank. Wash interior with hot water containing detergent. Rinse thoroughly and run off. When refilling first run off sufficient water to dispose of any residues.	At least once every 6 months
Brining tanks	Scrape, scrub, and wash with hot water containing detergent. Rinse thoroughly. Alternatively, wash out with 'live steam' if facilities available.	Before refilling
Bulk egg-storage tanks	Wash out with cold water to remove residues. Wash with hot water containing detergent with sterilant. Rinse thoroughly with cold water.	Before refilling
Blocking, forming, and stamping machines.	Dismantle, degrease, and clean thoroughly, Immerse dismantled parts in boiling water or swab thoroughly with warm water containing detergent. Rinse, dry, and reassemble.	Frequently and regularly.
Homogenizers	Dismantle, was working parts in warm water and detergent. Rinse with sterilant, rinse with clean water, reassemble.	At the close of every working period

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Equipment or area	Routine to follow	Frequency of cleaning
Whisks and cooling utensils	Clean thoroughly and scrub in water at 43.5° C. or above, immerse in warm water containing detergent with sterilant. Scour, rinse, and dry.	After every period of use
Conveyor belts	Clean off dropped materials.	Frequently and regularly during use
	Swab with warm water containing detergent.	At least once a day
	Clean surface of rollers.	At least once a day.
Proving and baking tins	Clean thoroughly.	When necessary
Proving trolleys	Wash with hot water containing detergent, rinse, and dry.	Frequently and regularly during use
Dough and pastry mixers	Remove spillage and extruded food.	Frequently and regularly during use
	Clean thoroughly and wash with warm water containing detergent. Rinse with cold water and dry.	At the close of every working period
Flavours, essences, and colour containers	Clean the outside of containers.	Each time they are used.
Pastry boards and icing tables	Keep clean during use. Remove all traces of flour or sugar deposit. Immerse boards in boiling water and scrub, or scrub with warm water containing detergent with sterilant. Always scrub wooden surfaces with the grain.	At the close of every working period.
Scale pans and measures	Remove deposit or spillage.	Frequently and regularly during use
	Wash with warm water containing detergent, rinse, and dry. If the pans and measures are used with meat, cream, or egg the water should contain detergent with sterilant.	At the close of every working period and at any change of trade operation.

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Equipment or Area	Routine to follow	Frequency of Cleaning
Knives, etc.	Wash in water at 43.5°C or above or in warm water containing detergent with sterilant. Rinse and dry. Replace in purpose-built racks (preferably metal) attached to fixed equipment.	After use
Wooden trays	Scrub with the grain in warm water containing detergent. Rinse and dry.	Frequently and regularly
	Wash with warm water containing detergent with sterilant. Rinse and dry. If the trays are used with meat, cream, imitation cream, or egg products the water should contain detergent with sterilant. Alternatively, wash by machine in hot water (above 43°C.).	Trays to be used must be clean or cleaned ready for the start of every working day.
Wiping materials and cloths	(a) Use expendable material.	(a) Discard into suitable containers conveniently placed
	OR	
	(b) Keep in suitable chemical sterilant between uses and boil after changing.	(b) Change several times a day.
Savoy bags (icing bags)	Turn inside out, wash away surplus cream. Scrub inside and out with warm water containing detergent with sterilant, rinse in hot water. Boil for 5 minutes if material is suitable. Scour and sterilize nozzles. Rinse and dry.	After use
EXTERIOR		
Drains	Remove grease-trap inserts and clean. Wash out body of trap with hot water containing detergent with sterilant. Renew filter material.	Frequently and regularly

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Equipment or Area	Routine to follow	Frequency of cleaning
Open drainage channels	Remove any surface grit and scrub grids channels with hot water containing detergent with sterilant.	At the close of every working day
Dustbins	Wash out with hot water and soda or a detergent solution and invert to dry. Alternatively, wash out with 'live steam' if facilities available.	After each emptying
VEHICLES		
Surfaces, receptacles, and equipment, or parts of equipment that touch food	Clear crumbs and spillage during use.	Frequently
	Clean thoroughly.	Every day
	Surfaces soiled only with flour dust or non-fatty crumbs can be brushed out.	
Remaining parts of the interior of the vehicle and interior equipment.	Wash with warm water containing detergent.	At least once a week.

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Source: The Theory & Practice of Public Health

By

W. Hobson

ms*/29/1/80/

ADULTRATION OF FOODS

Adulteration of foods consists of a large number of practices - mixing, substitution, abstraction, concealing the quality, putting up decomposed foods for sale, misbranding or giving false labels and addition of poisons. Some forms of adulteration are injurious to health, e.g. adulteration of mustard oil with argemone oil. But for the most part, food adulteration has an economic rather than a sanitary significance, e.g. addition of water to milk.

Food adulteration practices vary from one part of the country to another, and from time to time. Our knowledge about the current practices of food adulteration is meagre. The types of adulteration commonly found in various foodstuffs in India are as follows:

(1) Milk: Perhaps no other food is subjected to such frequent adulteration as milk. Addition of water, removal of cream, and addition of starch, paper pulp and skim-milk powder are the common types of milk adulteration

(2) Ghee: Ghee is adulterated with vanaspathi and animal fats such as pig's fat. In order to improve the flavour of adulterated ghee, tributyrin is added. The Government of India have not succeeded in enforcing the colouring of vegetable ghee.

(3) Cereals: Rice and wheat are mixed with stones, sand, grit and mud to increase bulk

(4) Flours: Wheat flour is mixed with soap stone (talc) powder and chalk powder. Bengal gram (Besan) flour is adulterated with lathyrus flour. Maida is adulterated with singhada flour.

(5) Pulses: Pulses are adulterated with lathyrus. Chemical substances such as metanil yellow are added to old stocks of pulses to improve the colour and appearance.

(6) Edible oils: Admixture of cheaper oils and mineral oils is commonly practised. Dyes are also added to improve the appearance. Argemone oil is another intentional adulterant. (

(7) Tea and Coffee: Tea leaves are adulterated with exhausted old tea leaves and dust, black gram husk, saw dust and cashew husk. Coffee powder is adulterated with roasted dates, tamarind seeds, husk powder, added colour and chicory without declaration.

(8) Honey: Honey is adulterated with sugar or jaggery and boiled with empty beehives. The list is endless

Food Standards:

(1) Codex Alimentarius: This is a collection of international food standards prepared by the Codex Alimentarius Commission, which is the principal organ of the Joint FAO/WHO Food Standards Programme. The food standards in India are based on the international codex alimentarius (2) PFA Standards: Under the prevention of Food Adulteration Act (1954) rules have been framed. These are revised from time to time by an expert body called the "Central Committee for Food Standards". Any food that does not confirm to the minimum standards is said to be adulterated.

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The purpose of the PFA standards is to obtain a minimum level of quality of foodstuffs attainable under Indian conditions. (3) The Agmark Standards: These standards are set by the Directorate of Marketting and Inspection of the Government of India. The Agmark gives the consumer an assurance of quality in accordance with the standards laid down. (4) ISI Standards: The ISI mark on any article of food is a guarantee of good quality in accordance with the standards prescribed by the Indian Standards Institution for that commodity. The Agmark and ISI standards are not mandatory; they are purely voluntary. The express degrees of excellence above the PFA Standards.

Prevention of Food Adulteration (Amendment) Act, 1976

The prevention of Food Adulteration Act was enacted by the Indian Parliament in 1954. Standards have been laid down under this Act for various foods, and these standards vary from State to State. Any food that does not confirm to the minimum standards is said to be adulterated. Although it is a Central Act, its implementation is largely carried out by the local bodies and the State Governments. In 1963 and 1969, the Act was amended in order to make it more stringent. The more recent Prevention of Food Adulteration (Amendment) Act came into force throughout the country on April 1, 1976. The new Act provides for summary trial and deterrent punishment including life imprisonment under certain circumstances. There is also a Central Committee for Food Standards. A chain of laboratories, including four regional appellate laboratories have been established. The purpose of the Prevention of Food Adulteration Act is to protect the health of the consumer and to assure foods of honest nutritive value.

FOOD ADDITIVES

The concept of adding 'non-food' substances to food products is not new. Pickling is an ancient culinary practice aimed at preserving food articles such as mango, lime and amla for fairly long periods by the addition of salt and spices. Modern science of food technology employs more than 3,000 substances- some natural (e.g. saffron, turmeric) and others artificial or synthetic (e.g. saccharin, sorbic acid) known as 'food additives'. Majority of the processed foods such as bread, biscuits, cakes, sweets, confectionary, jams, jellies, soft drinks, ketchup, all contain food additives.

Food additives are defined as non-nutritious substances which are added intentionally to food, generally in small quantity, to improve its appearance, flavour, texture or storage properties. The definition also includes animal feed adjuncts which may result in residues in human food and components of packing materials which may find their way into foods.

The food additives may be classified as colouring agents (e.g. saffron, turmeric), flavouring agents (e.g. vanilla essence), sweeteners (e.g. saccharin), preservatives (e.g. sorbic acid, sodium benzoate), bleaching agents (eg, chlorine) acidity imparting agents (eg, citric acid, acetic acid), etc. Uncontrolled or indiscriminate use of food additives may pose health hazards among consumers.

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The use of food additives is subjected to government regulation throughout the world. In India, two regulations, viz. the Prevention of Food Adulteration Act and the Fruit Products Order govern the rules and regulations of food additives. Any food that contains food additives that are not permitted is considered adulterated; if the permissible limit exceeds, then also the food is considered adulterated. The nature and quantity of the additive shall be clearly printed on the lable to be affixed to the container. Whenever, any extraneous colouring matter has been added to any article of food, the words 'Artificially Coloured' shall be written on the label. At the international level, food standards are fixed by the codex alimentarius commission.

FOOD FORTIFICATION

The 8th Joint FAO/WHO Expert Committee on Nutrition (1971) defined fortification as "the process whereby nutrients are added to foods to maintain or improve the quality of the diet of a group, a community or a population". On the other hand, the word enrichment is used to signify the addition of dietary essentials to a food to restore the total content of the former. The following are some examples: (1) Milk: Milk is fortified by the addition of vitamins A and D (2) Wheat flour: In February 1970, the Government of India launched a programme in Bombay for fortification of atta with vitamins and minerals, and for increasing the protein content by admixture with edible groundnut flour. This programme is planned to be extended to other cities at a later date. (3) Edible oils: Fortification of "vanaspathi" (hydrogenated fat) with vitamin A has been made compulsory (2,500 i.u. of vitamin A and 175 i.u. vitamin D per 100 g of vanaspathi) by the Government of India. (4) Common salt: Common salt is fortified with potassium iodate and supplied in areas where goitre is endemic. Fortification of common salt with calcium and iron is being considered to be taken up on a national scale in India. (5) Synthetic amino acids: Addition of synthetic amino acids to foods offers great possibilities for the future, e.g., lysine to wheat flour. (6) Sugar: fortified with vitamin A is being used in some countries for the prevention of nutritional blindness. Fortification and enrichment have made tremendous contributions to the public health in improving the nutritional standards of the people and in correcting specific deficiency states.

SOURCE: PREVENTIVE & SOCIAL MEDICINE

ms*/1/2/1980/

FOOD HANDLERS

Food sanitation rests directly upon the state of personal hygiene and habits of the personnel working in the food establishements. Proper handling of foods, utensils and dishes together with emphasis upon the necessity for good personal hygiene are of great importance. The infections which are likely to be transmitted by the food handlers are diarrhoeas, dysenteries, typhoid and para-typhoid fevers, entero-virus, viral hepatitis, protozoal cysts, eggs of helminths, strepto and staphylococcal infections, and salmonellosis.

The first essential is to have a complete medical examination carried out of all food handlers at the time of employment. Any person with a history of typhoid fever, diphtheria, chronic dysentery, tuberculosis or any other communicable disease should not be employed. Persons with wounds, otitis media or skin infections should not be permitted to handle food or utensils. The day to day health appraisal of the food handlers is also equally important; those who are ill should be excluded from food handling. Iti is also important that any illness which occurs in a food handler's family should at once be notified.

Education of food handlers in matters of personal hygiene, food handling, utensil, dish-washing, and insect and rodent control is the best means of promoting food hygiene. Many of the food handlers have little educational background, Certain aspects of personal hygiene are therefore required to be continually impressed upon them: (a) Hands: The hands should be clean at all times. Hands should be scrubbed and washed. with soap and water immediately after visiting a lavatory and as often as necessary at other times. Finger nails should be kept trimmed and free from dirt. (b) Hair: Head coverings should be provided, particularly in the case of females to prevent loose hairs obtaining entrance to food-stuffs. (c) Overalls: Clean white overalls should be worn by all food handlers. (d) Habits: Coughing and sneezing in the vicinity of food, licking the fingers/before picking up an article of food, smoking on food premises are to be avoided.

/ or scraching any part of the body

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SOURCE: PREVENTIVE AND SOCIAL MEDICINE

by

J.E. PARK

K. PARK

ms*/1/2/1980/

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THE PREVENTION OF FOOD ADULTERATION ACT, 1954

(Act 37 of 1954)

This Act to make provision for the prevention of adulteration of food was enacted by the Indian Parliament in 1954. It extends to the whole of India except the State of Jammu & Kashmir and supersedes all Food Laws that were passed by individual States in their own territories. It came into force in May, 1955.

An attempt has been made under this Act to make the provisions uniform, broadbased and more deterrant and to remove some of the lacunae that were found in the existing Food Laws and Bye-laws of the different States and local bodies.

Some of the important Sections are summarised below :

Section 2. Definitions

(1) "Adulterated"- an article of food shall be deemed to be adulterated -

(a) if the article sold by a vendor is not of the nature, substance or quality demanded by the purchaser and is to his prejudice, or is not of the nature, substance or quality which it purports or is represented to be;

(b) if the article contains any other substance which affects, or if the article is so processed as to affect injuriously the nature, substance or quality thereof;

(c) if any inferior or cheaper substance has been substituted wholly or in part for the article so as to affect injuriously the nature, substance or quality thereof;

(d) if any constituent of the article has been substituted wholly or in part abstracted so as to affect injuriously the nature, substance or quality thereof;

(e) if the article had been prepared, packed or kept under insanitary conditions whereby it has become contaminated or injurious to health;

(f) if the article consists wholly or in part of any filthy putrid, disgusting, rotten, decomposed or diseased animal or vegetable substance or is infested or is otherwise unfit for human consumption;

(g) if the article is obtained from a diseased animal;

(h) if the article contains any poisonous or other ingredient which renders it injurious to health;

(i) if the container of the article is composed, whether wholly or in part, of any poisonous or deleterious substance which renders its contents injurious to health;

(j) if any colouring matter other than that prescribed in respect thereof and in amounts not within the prescribed limits of variability is present in the article;

(k) if the article contains any prohibited preservative or permitted preservative in excess of the prescribed limits;

(l) if the quality or purity of the article falls below the prescribed standard or its constituents are present in quantities which are in excess of the prescribed limits of variability.

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(V) "Food" means any article used as food or drink for human consumption other than drugs and water and includes;

(a) any article which ordinarily enters into, or is used in the composition or preparation of human food, and

(b) any flavouring matter or condiments.

(IX) "Misbranded"- an article of food shall be deemed to be misbranded -

(a) if it is an imitation of, or is a substitute for, or resembles in a manner likely to deceive, another article of food under the name of which it is sold, and is not plainly and conspicuously labelled so as to indicate its true character;

(b) if it is falsely stated to be the product of any place or country;

(c) if it is sold by a name which belongs to another article of food;

(d) if it is so coloured, flavoured or coated, powdered or polished that the fact that the article is damaged is concealed or if the article is made to appear better or of greater value than it really is;

(e) ifalse claims are made for it upon the label or other;

(f) if, when sold in packages which have been sealed or prepared by or at the instance of the manufacturer or producer and which bear his name and address, the contents of each package are not conspicuously and correctly stated on the outside thereof within the limits of variability prescribed under this Act;

(g) if the package containing it, or the label on the package bears any statement, design or device regarding the ingredients or the substances contained therein, which is false or misleading in any material particular; or if the package is otherwise deceptive with respect to its contents;

(h) if the package containing it or the label on the package bear the name of a fictitious individual or company as the manufacturer or producer of the article;

(i) if it purports to be, or is represented as being, for special dietary uses, unless its label bears such information as may be prescribed concerning its vitamin, mineral, or other dietary properties in order sufficiently to inform its purchaser as to its value for such uses;

(j) if it contains any artificial flavouring, artificial colouring or chemical preservative, without a declaratory label stating that fact, or in contravention of the requirements of this Act or rules made thereunder.

(k) if it is not labelled in accordance with the requirements of this Act or rules made thereunder.

Section 3. The Central Govt. to constitute a Central Committee for Food Standards with D.G.H.S. ex-officio as Chairman and Director of Central Food Laboratory, ex-officio member and the following members nominated by the Central Government-two experts, one representative each of the Central Ministries of Food and Agriculture, Commerce and Industry, Railways and Defence, two representatives from Union Territories, two representatives of industry and commerce. Besides these, each State nominates one representative and the Indian Council of Medical Research nominates a representative of the medical profession.

Section 4. The Central Govt. to establish a Central Food Laboratory, and after consultation with the Central Committee make rules regarding the functions of the Central Food Laboratory. The object of these two sections is to bring about uniformity of Food Standards throughout the country and to maintain a satisfactory standard of laboratory practices in the different States.

Section 5. Prohibition of certain articles of food into India.

(i) any adulterated food ;
(ii) any misbranded food ;
(iii) any article of food for the import of which a licence is prescribed, except in accordance with the conditions of the licence; and
(iv) any article of food in contravention of any other provision of this Act or of any rule made thereunder.

Section 7. Prohibition of manufacture, sale, etc., of certain articles of food. No person shall himself or by any person on his behalf manufacture for sale, or store, sell or distribute -

(i) any adulterated food ;
(ii) any misbranded food ;
(iii) any article of food for the sale of which a licence is prescribed, except in accordance with the conditions of the licence ;
(iv) any article of food the sale of which is for the time being prohibited by the Food (Health) Authority in the interest of public health ; or
(v) any article of food in contravention of any other provision of this this Act or any rule made thereunder.

Section 8. The Central or State Govt. to appoint Public Analysis and define their jurisdiction.

Section 9. The Central or State Govt. to appoint Food Inspectors who shall be deemed to be public servants within the meaning of the section 21 I.P.C. thereby having definite rights and responsibilities.

Section 10. (1) A food inspector shall have power

(a) to take samples of any article of food.
(b) to send such sample for analysis to the public analysts.
(c) with the previous approval of the health officer having jurisdiction in the local area concerned, or with the previous approval of the Food (Health) Authority, to prohibit the sale of any article of food in the interest of public health.

(2) Any food inspector may enter and inspect any place where any article of food is manufactured, stored or exposed for sale and take samples of such articles of food for analysis.

(4) A food inspector may seize and carry away or keep in safe custody of the vendor with a bond, if any article intended for food appears to be adulterated or misbranded.

(6) Any material apparently of a kind which may be employed for purpose of adulteration may be seized by the food inspector and if necessary, a sample submitted for analysis to a public analyst.

(7) Where the food inspector takes any action under clause (a) of sub-section (1), sub-section (2), sub-section (4) or sub-section (6), he shall call one or more persons to be present at the time when such action is taken and take his or their signatures.

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Section 11. (1) When a food inspector takes a sample of food for analysis, he shall

(a) give notice in writing then and there of his intention to have it so analysed to the person from whom he has taken the sample :

(b) except in special cases provided by rules under this Act separate the sample then and there into three parts and mark and seal or fasten up each part in such a manner as its nature permits ; and

(c) (i) deliver one of the parts to the person from whom the sample was taken;
(ii) send another part for analysis to the public analyst; and
(iii) retain the third part for production in case any legal proceedings are taken or for analysis by the Director of the Central Food Laboratory under sub-section (2) of section 13, as the case may be.

Section 12. A purchaser may have food analysed by giving notice to the vendor of his intention to have the same analysed; if, on analysis, the article is found to be adulterated, the fee paid by him for analysis will be refunded to him and the vendor will be dealt with according to law.

Section 15. The Central Government or the State Govt. may, by notification in the Official Gazette, require medical practitioners carrying on their profession in any local area specified in the notification to report all occurences of food poisoning coming within their cognizance to such officer as may be specified in the notification.

Section 16 to 20. Penalties : If any person whether by himself or by any other person on his behalf (a) contravenes Sec. 5 or 7, or (b) prevents a food inspector from taking samples for analysis or (c) obstructs the food inspector in the discharge of his duties or (d) being a manufacturer has any material that can be used for adulteration in his possession or in one of his premises, or e) uses any report or certificate of a test issued by the Director of Central Food Laboratory for advertising or (f) gives a false warranty to the purchaser in, writing in respect of any food sold by him, he shall be punishable.

He shall, in addition to the penalty to which he may be liable under the provisions of section 6, be punishable with imprisonment for a term which shall not be less than six months but which may extend to six years, and with fine which shall not be less than one thousand rupees. There are other provisions also.

If any person convicted of an offence under this Act commits a like offence afterwards, it shall be lawful for the court before which the second or subsequent conviction takes place to cancel the licence and to cause the offender's name and place of residence, the offence and the penalty imposed to be published at the offender's expense in such newspapers or in such other manner as the court may direct. The expenses of such publication shall be deemed to be part of the cost attending the conviction and shall be recoverable on the same manner as a fine.

No court inferior to that of a Presidency Magistrate or a Magistrate of the first class shall try any offence under the Act.

Section 23. The Central Govt., may after consultation with the Committee and subject to the conditions of previous publication, make rules:

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(a) specifying the articles of food or classes of food for the import of which a licence is required and prescribing the form and conditions of such licence the authority empowered to issue the same and the fees payable therefor;

(b) defining the standards of quality for, and fixing the limits of variability permissible in respect of any article of food ;

(c) laying down special provision for imposing rigorous control over the production, distribution and sale of any article or class of articles of food and other rules for proper implementation of the Act.

Section 24. The State Government may also make rules in the same way as above in matters not falling within the purview of section 23.

3. THE PREVENTION OF FOOD ADULTERATION RULES, 1955

In exercise of the powers conferred under the Act, the Central Government after consultation with the Central Committee of the Food Standards have made the following rules.

These cover the definitions and standards of quality of various articles of food as also definite directives regarding the Central Food Laboratories, Public Analysts and Food Inspectors, packing, sealing and despatch of samples, conditions for sale and licence, colouring matter and preservatives, anti-oxidants, emulsifying, stabilising and flavouring agents.

Standards of Quality of food - The standards of some food items are given below:

A.08 Coffee -

A.0801 (1) Coffee (green, raw or unroasted) means the seed of coffea arabica, Coffea liberica or Coffea robusta, freed from all but a small portion of its spermoderm by decortication.

(2) Roasted Coffee means the properly cleaned green coffee which has been roasted to a brown colour and has developed its characteristic aroma.

(3) Ground coffee means the powdered product obtained from 'roasted coffee' only and shall be free from husk.

(4) Coffee (green, raw or unroasted), 'roasted coffee' and 'ground coffee' shall be free from any artificial colouring, flavouring, facing, extraneous matter or glazing substance and shall be in sound, dry and fresh condition free from rancid or obnoxious flavour.

(5) Coffee (green, raw or unroasted), 'roasted coffee' and 'ground coffee' shall conform to the following analytical standards -

(i) Total ash (determined on the sample dried to constant weight at 100°C), shall be feathery white or bluish white in colour and shall be not less than 3.5 per cent and not more than 5.0 per cent by weight of which not less than 65 per cent shall be soluble in boiling distilled water. The ash insoluble in hot dilute HCl shall be not more than 0.1 per cent.

(ii) The alkalinity of the soluble ash per gram, of dried coffee shall be equivalent to not less than 3.4 ml. and not more than 4.4 of N/10 acid.

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(iii) The caffeine content as obtained by standard methods, shall be not less than 1.0 per cent.

(iv) The aqueous extract determined by extraction of 2 grams of the sample direct to constant weight at 100°C with 100 ml. of boiling distilled water for one hour under reflux shall be not less than 25 per cent and not more than 32 per cent.

A.11 Milk and Milk Products.

A.11.01 Milk means the normal clean and fresh secretion obtained by complete milking of the udder of a healthy cow, buffalo, goat or sheep during the period following at least 72 hours after calving or until colostrum free whether such secretion has been processed or not.

The standards prescribed for milk shall apply for boiled milk also.

A.11.01.01 Cow milk shall contain not less than 3.5 per cent of milk fat, except in Orissa, where it shall be not less than 3 per cent and in Punjab and PEPSU where it shall be not less than 4.0 per cent. The milk solids other than milk fat, shall be not less than 8.5 per cent.

A.11.01.02 Buffalo milk shall contain not less than 5.0 per cent of milk fat except in Delhi, Punjab, PEPSU, Uttar Pradesh, Bihar, West Bengal, Assam, Bombay and Saurashtra where it shall not be less than 6 per cent. The milk solids other than milk fat, shall be not less than 9 per cent.

A.11.01.03 Goat or Sheep milk shall contain not less than 3.0 per cent of milk fat except in Madhya Pradesh, Punjab, PEPSU, Bombay, Uttar Pradesh, and Travancore-Cochin where it shall be not less than 3.5 per cent. The milk solids other than milk fat, shall be not less than 9 per cent.

Where milk, other than skimmed milk, is sold or offered for sale without any indication as to whether it is derived from cow, baffalo, goat, or sheep the standard prescribed for buffalo milk shall apply.

A.11.02 Skimmed milk, either fresh or reconstituted means milk from which all or most of the milk fat has been removed by mechanical or any other process and includes "separated milk" or "machine skimmed milk". The milk solids other than milk fat shall be not less than 8.5 per cent.

A.11.03 Butter-milk means the product obtained after removal of butter from curds by churning or otherwise.

A.11.04 Toned milk means the product prepared by blending milk with fresh separated milk or with separated milk reconstituted from spray dried skim milk powder or by partial abstraction of fat through skimming or separation of milk.

It shall contain not less than 3.0 per cent of milk fat and 8.5 percent of milk solids other than milk fat.

A.11.04.01 Double Toned Milk means the product prepared by blending milk with

(a) fresh separated milk ; or

(b) separated milk reconstituted from spray dried skim milk powder; or

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(c) by partial abstraction of fat through skimming or separation of milk; and containing not less than 1.5 per cent of milk fat and 10 per cent of milk solids other than milk fat.

A.11.06. Dahi or curd - (a) Whole milk dahi or curd means the product obtained from fresh whole milk either of cow or buffalo by souring. It shall not contain any ingredient not found in milk except sucrose and/or gur.

The standard of purity of dahi or curd shall be the same as prescribed for the milk from which it is derived.

A.11.11 Ice-cream shall contain not less than 36 per cent by weight of solids and 10 per cent by weight of milk fat except that when the ice-cream contains fruits or nuts or both, the content of milk fat may be proportionately reduced but not less than 8.0 per cent by weight. Ice-cream prepared from skimmed milk shall not contain less than 8.5 per cent of milk solids other than milk-fat.

Mixed Ice Cream should have the same fat content and total solid contents as prescribed for Ice cream.

A .11.14 Ghee means the pure clarified fat derived solely from milk or from curd or from deshi (cooking) butter or from cream to which no colouring matter or preservative has been added. The standard of quality of ghee produced in a State or Union territory shall conform to the standards as laid down for that area. Although the maximum limits of the percentage of (1) free fatty acid (as oleic acid) and (2) moistre have been uniformly specified, the standards for minimum Reichert value and Butyro-refractometer reading at 40°C varies from region to region.

A.14 Tea means tea derived exclusively from the leaves, buds and tender stems of plants of the Camellia genus and thea species. It shall conform to the following specifications:

(a) Total ash determined on tea dried to constant weight at 100°C - 5.0. to 8.0 per cent

(b) Total ash soluble in boiling Distilled Water - Not less than 40.0 per cent of total ash.

(c) Ash insoluble in HCl-Not more than 1.0 per cent.

(d) Extract obtained by boiling dry tea (dried at constant weight at 100°C) with 100 parts of distilled water for one hour under reflux - Not less than 1.3 per cent.

(e) Alkalinity of soluble ash - Not less than 1.3 per cent and not more than 2 per cent expressed as K_2O

(f) Crude fibre-Not more than 15 per cent. It shall not contain any added colouring matter.

A.17.06 Mustard oil (Sarson-ka-tel) means the oil expressed from clean and sound mustard seeds, belonging to the compestris, juncea or napus varieties of Brassica. It shall be clear, free from rancidity, suspended or foreign matter, separated water, added colouring or flavouring substances or mineral oil. It shall conform to the following standards:

(a) Butyro-refactometer reading at 40°C -58.0 to 60.5

(b) Saponification value - 168 to 176

(c) Iodine value - 96 - 108

(d) Unsaponifiable matter - Not more than 1.2 per cent

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(e) Free fatty acid as Oleic acid - Not more than 3.0 per cent.

(f) Bellier (Turbidity test) by Ewer's method (Acetic Acid) - Not more than 26.5°C.

The test for argemone oil should be negative.

A.17.11 Til Oil (Gingelly or sesame oil) means the oil expressed from clean and sound seeds of Til (Sasamum indicum) black, brown, white, or mixed. It shall be clear, free from rancidity, suspended or other foreign matter, separated water, added colouring or flavouring substances, or mineral oil. It shall conform to the following standards:

(a) Butyro-refractometer reading at 40°C-58.0 to 61.0

(b) Saponification value-188 to 198

(c) Iodine value-105 to 115.

(d) Unsaponifiable matter - Not more than 1.5 per cent.

(e) Free fatty acid as Oleic acid-Not more than 3.0 per cent.

(f) Bellier Test (turbidity temperature - Acetic acid method) - Not more than 22°C.

A.19. Vanaspati means any refined edible vegetable oil or oils, subjected to a process of hydrogenation from groundnut oil, cotton seed oil and sesame oil or mixtures thereof or any other harmless vegetable oils allowed by the Government for the purpose. It shall conform to the standards specified below:

(i) It shall not contain any harmful colouring, flavouring or any other matter deleterious to health.

(ii) No colour shall be added to hydrogenated vegetable oil unless so authorised by Government, but in no event any colour resembling the colour of ghee shall be added.

(iii) If any flavour is used, it shall be distinct from that of ghee in accordance with a list of permissible flavours and in such quantities as may be prescribed by Government.

Provided that diacetyl to the extent of not more than 4.0 p.p.m. may be added to Vanaspati exclusively meant for consumption by the Armed Forces.

(iv) It shall not have moisture exceeding 0.25 per cent.

(v) The melting point as determined by the capillary slip method shall be from 31°C to 37°C both inclusive.

(vi) The Butyro-refractometer reading at 40°C, shall not be less than 48.

(vii) It shall not have unsaponifiable matter exceeding 1.25 per cent.

(viii) It shall not have free fatty acids (calculated as Oleic acid) exceeding 0.25 per cent.

(ix) The product on melting shall be clear in appearance and shall be free from staleness or rancidity, and pleasant to taste and smell.

(x) It shall contain raw or refined sesame (til) oil not less than 5 per cent by weight, but sufficient so that when the vanaspati is mixed with refined groundnut oil in the proportion of 20:80, the red colour produced by the Baudouin test shall not be lighter than 2.0 units in a 1 cm. cell on a lovibond scale.

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(xi) It shall contain not less than 25 I.U. of synthetic Vitamin 'A' per gram.

(xii) No anti-oxidant, synergist, emulsifier or any other such substance shall be added to it except with the prior sanction of the Government.

PART X

PRESERVATIVES

Preservative has been defined as a substance which when added to food, is capable of inhibiting, retarding or arresting the process of fermentation, acidification or other decomposition of food. Preservatives have been divided into two classes:

(i) Class I preservatives comprise of : Common Salt, Sugar, Dextrose, Glucose, Wood smoke, spices, Vinegar or acetic acid, Honey, Hops, Commercial salt petre, and Alcohol or potable spirits. Addition of Class I preservatives in any food in any proportion is not restricted.

(ii) Class II Preservatives are : Benzonic acid including salts thereof, Sulphurous acid including salts thereof, and Nitrites of Sodium or Potassium in respect of food like ham, pickled meat. Use of more than one Class II Preservative in or upon a food is prohibited. Their use has been restricted to the specified group of foods in concentration not exceeding the proportions fixed against each. These foods comprise of Sausage and Sausage meat, Fruits and fruit juices, Cooked picked meat, Alcoholic and non-alcoholic wines, Syrups, Sherbets, Dehydrated vegetables, etc.

PART XII

ANTI-OXIDANTS, EMULSIFYING AND STABILISING AGENTS

'Anti-oxidant' means a substance which when added to food retards or prevent oxidative deterioration of food and does not include sugar, cereal oils, flours, herbs and spices. No anti-oxidant, other than lecithin, ascorbic acid and tocopherol shall be added to any food, but a number of anti-oxidants have been specified which may be added to edible oils and fats.

"Emulsifying agents" and "Stabilising agents" mean substances which when added to food are capable of facilitating a uniform dispersion of oils and fats in aqueous media, vice versa, and or stabilising such emulsions and do not include the following, namely -

Agar, alginic acid, calcium and sodium alginates, carrageen, edible gums, dextrin, sorbitol, pectin, sodium and calcium pectate, sodium citrate, sodium phosphate, sodium tartrate, calcium lactate, lecithin, gelatin, quillaia, modified starches and hydrolysed protein.

Except in milk and cream, a number of specified emulsifying or stabilising agents are permitted to be used in foods.

Container of an article of food to which any emulsifying and stabilising agent has been added shall bear a statement of the chemical nature of such emulsifying and stabilising agents in addition to any trade name.

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PART XIII

FLAVOURING AGENTS

The use of coumarin and dihydrocoumarin as flavouring agents in any article of food is prohibited. Use of Diethylene Glycol monoethyl ether as a solvent in flavours has been prohibited.

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Source – Hygiene and Public health
By – DR. B. N. Ghosh.

ST JOHN'S MEDICAL COLLEGE, BANGALORE

Directorate of Rural Health Services &
Training Programmes

First Certificate Course in Food Hygiene &
Handling of Food(21st Jan to 4th Feb 1980)

Final Evaluation

(Please give your frank views in the matter to enable the college faculty to undertake modifications and improvements in this course)

1. What were the objectives/aims of this Course?

2. In your opinion has the overall course content helped to achieve the above objectives? If yes, to what extent? If not, then why not?

3. The duration of course was:

a) too long b) too short c) adequate

4. The syllabus covered by the training course was:

a) inadequate b) inadequate to c) not relevant
(If inadequate or not relevant state specific topics concerned)

5. Different teaching methods were used in the course. Tick off your opinion of each method:

Method	Very useful	Useful	Not useful
Lectures			
Slide shows			
Film shows			
Laboratory Demonstrations			
Brain's Trust			

6. Do you think that visits to a few Restaurants/Hotels, to see their actual working, would have been an effective teaching method? If yes, how? If not, why not?

7. The following topics were covered during the teaching session. Use the following code to denote your assessment.

(0) - Not useful at all (1) - of some use (2) - Very useful

(3) - Essential

A. Problems of making food safe?

B. Germs - their habits and life requirements

C. Transmission of infection

D. Food borne diseases

E. Food poisoning

F. Food adulteration

G. Requirements of Food establishment and Eating houses

H. Food handlers

I. Food legislation(including Prevention of Food Adulteration Act)

J. Organising a food hygiene programme

K. Investigation of an outbreak of food poisoning(an exercise)

L. Brain's trust

8. Was the course of practical value to you in improving your efficiency as Manager/Supervisor of Restaurant/Hotel/Hospital Kitchen(If yes - to what extent? If not - why not?)

9. How the course in any way, fallen short of your expectations? If yes, to what extent?

10. Give any suggestion you have to improve the utility of this course for participants of your category?

THE ROYAL INSTITUTE OF PUBLIC HEALTH AND HYGIENE, LONDON

CERTIFICATE EXAMINATION IN FOOD HYGIENE AND THE HANDLING OF FOOD

CONDUCTED BY

ST JOHN'S MEDICAL COLLEGE, BANGALORE, THROUGH ITS ROSS INSTITUTE UNIT OF OCCUPATIONAL HEALTH

11 FEBRUARY 1980

TIME ALLOWED: TWO HOURS 1.00 pm to 3.00 pm

Five questions only to be answered

1. List the hygiene rules that you consider all food handlers should be obliged to observe, giving your reasons why they are important.

2. What types of foods are most frequently involved in food poisoning? How is this danger transmitted? Describe the methods of cleaning and sterilising equipment used in relation to food.

3. Write short notes on four of the following:

   a. Convalescent carrier

   b. Importance of food

   c. Cocci

   d. Bacillus Cereus

   e. Cross contamination

4. It is well known that refrigeration plays an important part in the prevention of food poisoning. Explain fully why this should be so.

5. Give reasons for the following statements:

   a. Smoking should not be allowed in food preparation rooms

   b. "Coughs and sneezes spread diseases"

   c. Cuts and abrasions must always be covered with suitable water-proof dressings

6. What qualities are desirable in the kitchen floor of a catering establishment? Name three materials which might be recommended for the construction of such a floor. In working out the size of a kitchen and dining hall what are the principles to be followed?

p.t.o.

7. You are asked to give a talk to the food handlers of a restaurant on the importance of food hygiene. List the points which you would emphasise in your lecture.

8. What is meant by

   a. Food which is unfit for human consumption; and

   b. Food which is not of the nature, substance or quality demanded?

   How would you decide which category a complaint fell into and what action would you take? Where could you get advice?

.....

Rs 20.00

INDIA TODAY

JUNE 15, 1989

SHARAD PAWAR

LANDING IN TROUBLE

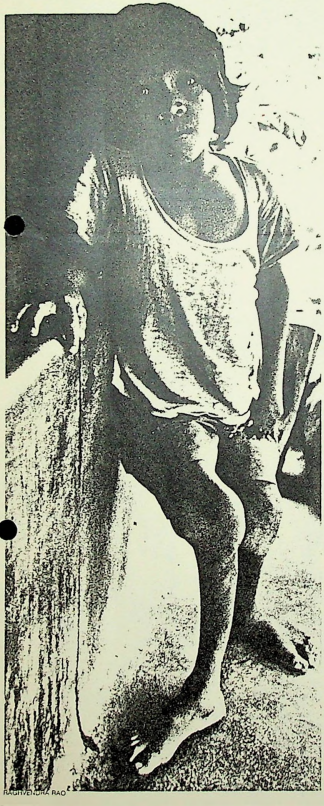
PAWAN HANS: OPERATION DISASTER

HILL STATIONS: HOLIDAY RUINED

POISON IN YOUR FOOD

Rampant misuse and poor checks have seen toxic pesticide residue in Indian food reach one of the highest levels in the world. It now poses a serious health threat.

IN YOUR FOOD



would be starving," he says. In children, the disease, apart from crippling them, has inhibited their growth.

Initial studies indicated that these people, mostly farm labourers, had switched to eating crabs from nearby fields after their wages were cut. These fields were being sprayed with pesticides regularly. And in the classic food chain link (*see chart*), the villagers who ate the crabs are believed to have been poisoned too. Researchers now suspect that these people were genetically vulnerable to the disease and the high dose of pesticides acted as a catalyst. An indepth investigation by several institutions is now on to verify these findings.

AROUND the same time an epidemic of epilepsy broke out in Lakhimpur Kheri district in Uttar Pradesh. Around 250 people suffered from sudden convulsive seizures that wracked the body. They complained of whistling noises in the ears, saw flashes of coloured lights and suffered from giddiness and headache. Reason: farmers in this area had been ignorantly using BHC to preserve their foodgrain.

For the mass of Indians, however, the threat from imbibing small doses of pesticides in their daily bread is more difficult to quantify. The problem is that these pesticides poison the body slowly. Most of them are made by rearranging atoms of various elements like carbon, hydrogen and chlorine into toxic molecules. These usually attack the nervous systems of the pests, first paralysing and then killing them.

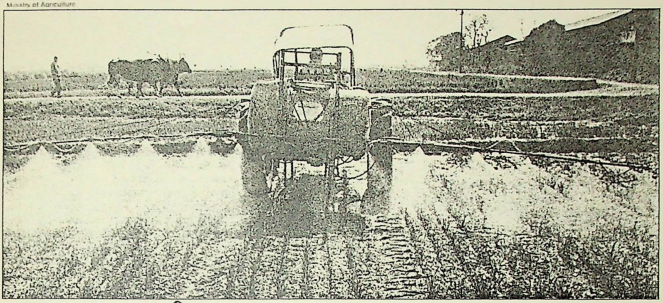
When humans swallow chemicals like DDT and BHC they are absorbed by the small intestine. These then adhere to the fatty tissues—the storehouses of energy that are distributed throughout the body and account for 10 per cent of its weight. The toxins usually pile up in the fatty tissues of such vital organs as the thyroid, heart, kidney, liver, the mammary glands and the testes. They can be transferred from the umbilical cord blood to the growing foetus. And through breast feeding to babies. Over the years, the body can store about 50 to 100 milligrams of a wide variety of these toxins.

The debilitating impact of such a heavy load of toxins came through when the King George Medical College (KGMC) and the Industrial Toxicology Research Centre (ITRC) in Lucknow did a series of tests on workers spraying DDT and malathion regularly. At least half of the workers developed psychological symptoms like anxiety, sleep disturbance and depression. Many complained of severe headaches. One out of five of them had impaired memory and performed simple drawing tests clumsily. Some of them even suffered from retinal damage, blurred vision and saw flashes of light and black dots in front of their eyes.

The difficulty lay in proving whether the general population, which is usually not exposed to such high doses of pesticides, would exhibit simi-

AN EXTREME CASE

Nagaraj, 10, is just one of the 300 people struck by a mysterious, crippling attack of arthritis in Karnataka's Shimoga district. The disease, which wastes away the joints and muscles, was first noticed in 1975. Initial studies indicate that these people, mainly farm labourers, switched to eating crabs from nearby fields after their wages were cut. With the fields being sprayed regularly by pesticides, the crabs ingested large doses of toxins. And the people eating them were poisoned by them as well.



A field being sprayed with pesticides: rampant misuse

lar symptoms. As Devika Nag, head of KGMC's Neurology Department who co-authored these studies, says: "It may take years for the build-up to act. Few doctors in general hospitals will link blurring of vision or a heart attack to signs of pesticide poisoning."

That link, however, is being found in several other studies. In Hyderabad, when researchers studied women having still-births they found a high amount of DDT and BHC pesticide residues in their blood. The chilling conclusion: these residues may inhibit normal pregnancy. More recently, an analysis of breast tumours by the Marathwada Agricultural University in Parbhani, Maharashtra showed that almost all of them contained a high content of DDT and BHC in the tissues. The worrying question: could these residues have been the carcinogen (cancer-inducing substance)?

"What we are seeing is the tip of the poisonous iceberg. And even that seems serious enough for us to sit up and take corrective action," says eminent toxicologist Dr C.R. Krishna Murti, chairman of the scientific commission probing the Bhopal gas tragedy. He points out that there are other contaminants that pose an equal threat to Indians, but fewer studies have been done on these.

Those colourful *jalebis, barfis* and *gulabjamuns*, for instance, are not as sweet as they look. Many of those brightly coloured dyes are made from harmful compounds that are known to cause kidney damage, eye defects and in some cases even affect the reproductive systems. A recent survey by the government-funded ITRC found a third of the samples analysed to be coloured with prohibited dyes. Among the most commonly misused dyes were orange, blue, bright green and red. And illegal dyes were even added to spices like turmeric and chilli powder.

Nor is the *sarson ka tel* (mustard oil), widely used for cooking, all that safe. An extensive survey in Uttar Pradesh recently found that in a fourth of the samples the oil had been adulterated with linseed and the highly toxic argemone oil. Argemone poisoning causes swelling of limbs, nerve damage, heart attacks and blindness. It's a common problem in West Bengal, Maharashtra, Andhra Pradesh and Uttar Pradesh.

If all this isn't enough a new danger to Indians comes from heavy metals like lead, cadmium, manganese and nickel. In March the results of an all-India survey found that the level of these metals in food samples had crossed the safety limits. And what's more, drinking water too was similarly contaminated.

Pesticides (some contain these metals) are only one of the suspects. Untreated industrial effluents being discharged indiscriminately into rivers and fields are a major culprit. The other, surprisingly, is the exhaust fumes spewed out by the surfeit of automobiles. These fumes are known to contain high amounts of lead and manganese. Apart from poisoning the air these settle on food and water sources. Each of these metals if consumed beyond tolerance levels can cause mental retardation in children, nerve damage, impotence, blindness and even death.

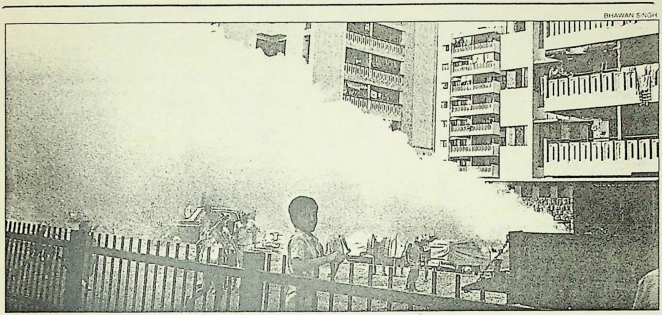
Other dangers remain areas of dark-

VEGETABLES

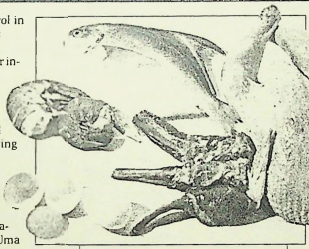
Malpractices abound. Farmers are known to spray methyl parathion on cauliflower to give it an extra white appearance. *Bhindi* (okra) is dipped in copper sulphate to make it look greener. And the norm that no spraying should be done a week before harvest is frequently violated. A thorough wash and a vinegar douse help to get rid of much of the toxins in vegetables.

People exposed to large doses of toxins developed impaired memories.

BHAWAN SINGH



Spraying for malarial control in Delhi: dubious benefits



MEAT, FISH & EGGS

Non-vegetarian food too is highly contaminated. Goats swallow pesticides when they graze near fields being sprayed with them. Hens do the same through the feed they eat, which is usually the husk of grain. And the residues seep into eggs as well. Fish too contain high amounts of DDT residues. In West Bengal, people illegally spray endosulfan on water to stun fish and catch them.

Women having still births have shown high serum levels of DDT and BHC.

ness. No one really knows, for instance, whether the widespread use of plastics to pack food products like milk is really safe. Or whether the host of preservatives and additives used in the growing instant food industry is harmful or not.

Most consumers in India too are casual about these threats. Asked what she thought about food contamination, Delhi housewife Uma Raghavan says: "I have been more worried about putting on weight." And Ajay Gupta, a businessman, added: "Food poisoning? I'll probably die in a road accident before that."

THE vast body of research on the menace of pesticides, however, will make anyone sit up and take note. Ironically, pesticides now play a vital role in checking the spread of malaria in the country and in boosting foodgrain production. For instance, DDT was so successful in curbing the mosquito menace that malarial cases dropped from 75 million a year in 1948 to barely 50,000 in 1961. However, with mosquitoes becoming increasingly resistant to it, malaria staged a come-back and now strikes around two million people yearly.

In agriculture, the chemical war began when high yielding variety crops were introduced in the '60s. These were more vulnerable to pest attacks. Currently pesticides protect around 80 million hectares of crops or half of the country's area under cultivation.

The result: pesticide consumption has risen tenfold in just three decades and is expected to cross 80,000 tonnes this year. India is now both the largest manufacturer as well as consumer of pesticides in South Asia. There are over 131 different types of pesticides marketed under 203 different formulations by over 350 companies in the country. And as Dr Mehrotra puts it: "The Government is the largest peddler of this dope." The public sector Hindustan Insecticides manufactures all the DDT the country uses. Along with another public sector company, Hindustan Organics, it also accounts for a sixth of the BHC production.

Despite the proliferation of pesticides, DDT and BHC still account for 50,000 tonnes or two-thirds of the total consumption in the country. That's because these are 10 times cheaper than most other pesticides, easy to handle and attack a wide range of pests. However, they cause multiple problems. Once sprayed they do not degrade easily and can persist in the environment for as long as 20 years. The soil then becomes a reservoir for these pesticides steadily transferring them to edible crops, polluting the groundwater, trees and wildlife.

It was not till the '80s that the insidious threat from the explosion of pesticides started coming home. In 1984, a multi-centre study sponsored by the UN Food and Agriculture Organisation (FAO), analysed as many as 1,500 samples of cereals, pulses, milk, oil and meat from different parts of the country. The finding:

nerve and brain damage. The findings on BHC were as devastating. Animal studies showed clear evidence of its being a carcinogen apart from causing spontaneous abortions and leading to severe liver and kidney damage. And these are just a few of its ill effects.

That kind of damning evidence saw seven countries including the USSR, the US and West Germany ban DDT in the '70s. And nine other countries put severe restrictions on its use. BHC too has been banned in nine countries in North America and Europe and its use severely restricted in 13 countries.

These countries have now switched to safer pesticides like synthetic pyrethroids. The newer pesticides degrade rapidly once sprayed, cause less harm to the body and selectively kill target pests. Combined with stricter regulation, they have resulted in a significant drop in residue levels in foodstuffs.

IN India, however, officials seem strangely unmoved by the results of a series of tests done on animals. At the ITRC rabbits fed with large doses of BHC and endosulfan, another widely used pesticide, suffered from high blood pressure, severe heart damage and in many cases blindness. And mancozeb, a widely used fungicide, caused tumours in mice. In Mysore, when researchers at the Central Food Technology Research Institute administered large doses of DDT to rats they found that it caused deformities in the skeletal structure.

Anywhere else such studies would have created instant uproar and caused regulatory authorities to call for a more detailed investigation. Here, not only are these warnings ignored, even the agriculture and health ministries insist that there are no visible threats.

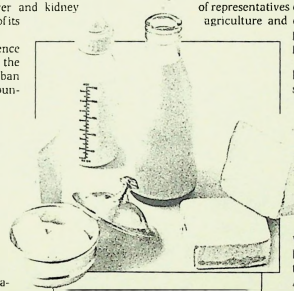
Other factors too are responsible for things coming to such a sorry pass. Regulation of the use of pesticides has been the weakest link in the chain. Only in 1968 did a comprehensive Insecticide Act come into force. Under it the Central Insecticide Board, which consists of representatives of several ministries including health, agriculture and chemicals, is in charge of screening pesticides and approving them for import or manufacture in the country.

The board, however, is severely handicapped. As one of its members said: "We are hamstrung both by the lack of facilities to test these pesticides and the inadequate data on their toxicology." That has resulted in an anomalous situation. Out of the 131 pesticides approved for use so far, only for 31 have tolerance levels been evolved. Worse, in the case of BHC, which has been so extensively used, so far no tolerance levels have been worked out.

As Kalra says: "This makes a mockery of our laws because how can you prosecute someone unless tolerance levels are fixed."

Most of the chemicals have been approved for use based on toxicology studies done abroad. Experts say that this is a dangerous practice. As Dr A.T. Dudani of the Voluntary Health Association of India points out: "Most Indians are undernourished, have poor hygiene and are susceptible to disease. So we don't know their threshold limits for such pesticides." And as studies have shown, DDT could combine with other pesticides like BHC in the body and become a more toxic cocktail.

Even more difficult is penalising offenders. The state health and food departments, under the Prevention of Food Adulteration Act, are to check food contamination by pesticides and prosecute offenders. But most of these departments have neither the specialised equipment to test residue levels nor the staff to carry out checks. As a result, hardly any cases are registered. And thanks to its anti-malarial campaign, the Health Min-



MILK & MILK PRODUCTS

Experts feel that the real threat comes from milk and its products like butter, ghee and cheese. Since pesticides adhere to fatty tissues in the body, milk, which has a high content of fat, is an ideal storehouse for toxins. In bovine milk, contamination comes through the cattle fodder which has a high level of toxins. When milk is processed into butter residue levels get magnified.

Ineffective controls and a lack of strict guidelines have worsened matters.

istry itself is indirectly one of the major offenders responsible for the high level of residues. As one expert remarks: "The ministry would really have to prosecute itself first."

PESTICIDE manufacturers, on the other hand, plead helplessness about curtailing production. Dr S.P. Dhua, chairman of the public sector Hindustan Insecticides, says: "We are at the captive end because we are really catering to the demand of the health or agriculture ministry." Most manufacturers, however, feel that the health hazards are exaggerated. They point out that in a tropical country like India, because of more sunlight, pesticides like DDT and BHC degrade faster than in temperate zones. That fact, however, is still to be convincingly established. About developing a new cheap and safer chemical, the manufacturers say that it would cost a phenomenal Rs 20 crore—an amount none of them would like to invest.

Much of the problem too has come about because of misuse of pesticides by farmers. Most don't even take elementary precautions for handling them. While gloves and face masks are a must, farmers use their bare hands to sprinkle pesticides.

Nor are farmers too conversant with pesticide use. A study done on Punjab cotton farmers, who are considered to be the most progressive in the country, found that only 11 per cent used the right pesticide in the right quantity to fight the bollworm, a major pest of the cotton crop. And another 20 per cent were using the wrong type of chemical.

In other states, several farmers violate the rule that no spraying should be done a week before harvest to prevent high pesticide residues in vegetables. That has seen residue levels shoot up to dangerous levels in such vegetables as okra, tomatoes, cabbage and cauliflower.

Apart from high buildup in food products, that kind of misuse has led to other problems. The most serious being the rising resistance among pests. For instance, the bollworm has developed resistance to several pesticides. Spraying has now gone up in many states from seven times a crop to over 30. And the widespread use of DDT by the Health Ministry has seen four species of mosquitoes develop resistance to the chemical.

Summing up the situation, Shekhar Singh of Kalpavriksh, a voluntary organisation working on the pesticide problem, says: "There seems to be everything going wrong at each stage. There is no proper regulation of pesticides, there is no check on the buildup of residues in our foodstuffs and I'm afraid there is absolutely no public consciousness at all."

Prodded by the growing evidence of the chemical menace, the Union Government in 1984 decided to appoint an expert committee to review usage of pesticides like BHC and DDT. After assessing a whole body of data on DDT the committee concluded in 1985 that it may continue to be used in the health programme but be banned in agriculture.

The guiding reason, however, was not safety but economics. Agriculture now relies more on BHC and uses barely 400 tonnes or 4 per cent of the country's DDT production. But the Health Ministry said it just could not afford to stop using DDT. It pointed out that the cost of covering a population of one million would shoot up from Rs 33 lakh to Rs 195 lakh if malathion, a relatively safer pesticide, was used instead of DDT.

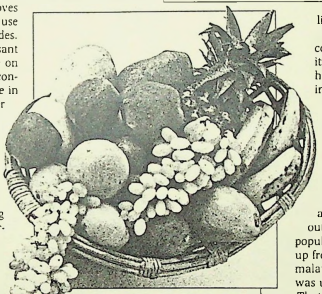
That meant that there was going to be no let-up on the poison explosion. The Health Ministry itself projects that by 1999 it needs 20,000 tonnes of DDT annually for its spraying programme. And with the Ministry continuing to spray DDT, residues will keep finding their way into the soil and edible crops. That fact came through when the Punjab Agriculture University recently proved that spraying of DDT around households resulted in residue levels shooting up in stored grain like wheat and rice.

Meanwhile, the Agriculture Ministry used the same economic argument to allow farmers to continue using BHC. The committee, which filed its report on BHC in 1986, made it clear that production of the pesticide should be frozen. It also wanted the Government to ban its spraying on vegetables, oilseed crops and in storage godowns. The Government has acted on these instructions though belatedly. BHC production was frozen at its current installed capacity of 41,900 tonnes last year. But farmers were only "advised" not to use it on vegetables and oilseeds. Orders

THE WAY OUT

- Regular 'market basket' surveys to warn people of dangerous buildup of toxins in food.

- Stepping up the integrated pest management programme to teach farmers to use pesticides judiciously.



FRUIT

Grapes are probably one of the most widely-sprayed fruits. Studies have shown that they contain a high residue level of several pesticides. A good wash with a dash of detergent or baking soda can knock out these toxins. In apples, the threat comes from the chemical daminozide, used as a growth regulator, and now suspected to be cancer-causing. Citrus fruit too contains toxic residues.

DDT and BHC, widely used in India, have been banned in at least 16 countries.

- Taking up on a war-footing the control of pests using their natural predators.
- Banning pesticides like DDT and BHC and replacing them by safer ones.
- Preventing industries from dumping poisonous effluents.
- Considering health costs while deciding pesticide policy.

for banning DDT's use in agriculture are to be issued only next fortnight—four years after the expert committee's recommendation.

The expert committee's recommendation in a way reflects the dilemma faced by the country in dealing with pesticides. In the West, after damaging studies on BHC and DDT led to the countries banning them, farmers switched to costlier but safer pesticides. In India, since pesticides account for 50 per cent of input costs in many crops, farmers are unlikely to use the expensive ones. And that could lead to a steep fall in foodgrain production.

So what is the way out? To the Government's credit, in the past few years it has been taking some positive steps. One was to encourage integrated pest management, a scheme that has led to a dramatic reduction in residue levels in the West.

ESSENTIALLY it's a programme which advocates the judicious use of pesticides and safer alternatives to fight pest attacks. One of the techniques is to teach farmers exactly when and in what quantities to use pesticides. For instance, farmers are advised not to begin spraying as soon as the brown plant hopper, that feeds on the rice crop, is noticed. Its predators, the spider and the mirid bug, could control the hopper population. Only if the population crosses certain limits are the farmers advised to spray.

Another technique is biological control of pesticides. Many of the pests have their natural biological enemies that if introduced could control their population without the use of these chemicals. Already the Government has introduced around eight such predators of common pests of sugarcane, rice and fruit such as apples. These have met with some success. Efforts to identify more such predators must be intensified. However, after releasing them, they have to be carefully monitored to ensure that they don't cause a new kind of pest attack. Both these programmes if taken up on a war-footing could drastically reduce the over-dependence on pesticides.

The Government has also been showing concern about the growing residue buildup in foods. In 1984, the Indian Council of Agricultural Research set up an all India coordinated research project on pesticide residues. While the project, involving 13 agricultural universities took three years to get cracking, some data has been compiled on residue levels in soils and certain food crops. And it is just completing another vital task: Fixing tolerance levels for daily intake of BHC.

However, even the Planning Commission admits that it can't do away with BHC and DDT till the much-vaunted 21st century. Most toxicology experts call for "a national pesticide management programme". Apart from more strictly regulating the manufacture of pesticides they want the monitoring system for pesticide residues to be beefed up. Laboratories to test residues need to be set up in each state. And they call for a regular 'market basket' survey, as done by several developed countries, to warn of dangerous buildups. Meanwhile the pesticide industry could join hands with the agricultural extension workers to train farmers on how to use smaller quantities of pesticides more effectively.

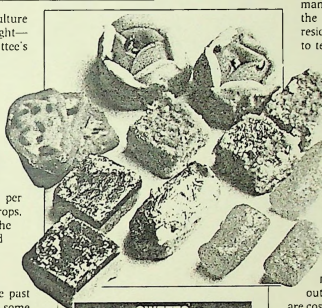
The Government needs to clean up its act too. Rather than just freezing production of the more persistent chemicals like DDT and BHC, these must be phased out rapidly. Even if the alternatives are costlier it is a lesser price to pay than the nation's health.

It also needs to chalk out a comprehensive policy on the types of pesticides to be used in the country. And while doing so, the health costs must be toted up. In other areas like heavy metal poisoning stricter control over industrial effluents and better exhaust cleaning devices could help considerably.

In all this speed is a must. For, as the late John F. Kennedy once said: "The loss of even one human life or the malfunction of even one baby—who may be born long after we are gone—should be of concern to us all. Our children and grandchildren are not merely statistics towards which we can be indifferent."

A poor country like India may find it difficult to uphold such high values. But it's about time we moved in that direction. After all neither we nor our children should be reduced to mere statistics, as is happening now.

—RAJ CHENGAPPA in Delhi, Lucknow & Ludhiana with CHIDANAND RAJGHATTA in Mysore



SWEETS

All those colourful *jalebis, barfis* and toffees are not as sweet as they look. A study in Uttar Pradesh found that in a third of the samples, the dyes used to colour the sweets were on the Government's prohibited list. Animal studies have shown that these illegal dyes damage the kidneys, spleen and liver and, in some cases, can harm even the reproductive system.

The dilemma: health of the individual versus boosting foodgrain production.

29.12

MAKING FOOD SAFE

The problem of making food safe is clearly a vast one, for it involves an understanding of all the hazards to which the whole variety of foods (and drinks) are exposed; and the ways in which such hazards can be minimized, if not completely removed. Because of the size of the subject, the format of the notes for this lecture differs from those elsewhere in this booklet and does in fact conform more to true note form, than do the papers on other topics. Under the various sub-headings, some brief implications are mentioned, but neither the headings themselves, nor the additional remarks, are in any way exhaustive. It is hoped, however, that they provide a framework of ideas which readers can enlarge upon, and add to, in the light of their own experience, for one of the problems facing us in deciding the content of this brief course, is that those taking it, come from a variety of jobs and industries, and the only thing which many have in common, is a shared responsibility for food which others eat.

The order of the topics here, is not necessarily the only one possible, based as it is on the history of various food items from their source to their consumption, and clearly some workers will have no control at all over some aspects of the food with which they deal at different stages in this chain. Lastly, some hazards will clearly appear more than once in the chain, e.g. the danger of Salmonella from duck eggs.

THE NATURAL HISTORY OF FOOD:

A SOURCE

Degree of control available.

1. MEAT Inspection of slaughter-houses, sampling of imported meat.
2. POULTRY Control of rearing conditions.
3. EGGS Control of import of dried eggs. Note danger of Salmonella from duck eggs.
4. MILK Brucellosis-free herds.
   Tuberculin-tested (attested) herds.
5. VEGETABLES Avoid excessive soil contamination-B. Cereus. Possibility of danger from pesticide spraying. Possible danger of intestinal infections if faecally contaminated vegetables, e.g. salads, are consumed raw.
6. WATER Dangers of intestinal infections, e.g. Cholera, Typhoid Fever, Dysentery from faecal contamination, if untreated.

B. TRANSPORT

1. Danger of cross-infection of animals; increase in Salmonella before slaughter if crowded or too long in transport.
2. Cross contamination of food from animal excreta.
3. If meat, danger of spoilage and bacterial multiplication unless refrigerated.

..2

C THE TREATMENT OF FOOD

A wide variety of methods are designed to preserve food, and to prevent bacterial and other contamination.

1. HYGIENIC SLAUGHTERING (See B (1) above).
2. CANNING - to a temperature sufficient to kill all pathogens, e.g. a "Botulinum Cook". Ensure proper sealing of tins. Contamination of corned beef in the Aberdeen Typhoid outbreak.
3. FREEZING Rapidity is an important factor for quality. Does not kill all pathogens.
4. ACCELERATED FREEZE DRYING
5. DEHYDRATION
6. SMOKING AND CURING.
7. SALTING AND PICKLING e.g. the salt beef of Nelson's Navy.
8. PASTEURISATION, e.g. milk, canned ham. Kills pathogens - but spoilage organisms may survive.
9. STERILISATION, e.g. milk-kills all germs.
10. ULTRA HEAT TREATMENT-as for sterilization.
11. ADDITION OF PRESERVATIVES, e.g. Sulphur Dioxide to sausages, etc. Only a short-term effect.

D STORAGE

1. REFRIGERATION-Temperature control vital.
2. (a) Deep freezers.
   (b) Frozen food cabinets-watch the load line.
   (c) Domestic type refrigerators-avoid overloading and introducing hot food-
2. PEST CONTROL Rodents, insect pests, especially flies.
3. STOCK ROTATION- consider implications of date stamping.

E PREPARATION

1. Consider construction and use of premises.
2. CONSIDER FOOD HANDLERS ("Man is his own worst enemy").
   Clothing.
   Cleanliness.
   Absence of infection in throat, nose, on skin, in bowels.
   Hygienic practices.
3. STORAGE AFTER PREPARATION Avoid bacterial growth. Avoid contamination.
4. DISCARD THE DOUBTFUL FOOD.

...3

F SERVING FOOD

1. Cleanliness of handlers.
2. Cleanliness of utensils-washing methods.

G DISPOSAL OF WASTE FOOD

1. Dustbins-refuse collection.
2. Drains.
3. Flies, vermin, other pests.

H MONITORING

1. From within, by regular supervision-and irregular checks.
2. From without by the Food Inspectors of the Local Authority.

I THE AIM-is to break the chain.

1. Not to allow food to become contaminated.
2. To prevent bacterial growth.

J THE FINAL ANSWER IS HEALTH EDUCATION.

1 of 23

TI: The DNA 'comet assay' as a rapid screening technique to control irradiated food.
AU: Cerda-H; Delincee-H; Haine-H; Rupp-H
AD: Department of Radioecology, Swedish University of Agricultural Sciences, Uppsala, Sweden.
SO: Mutat-Res. 1997 Apr 29; 375(2): 167-81
this source is not Available by this library
LA: ENGLISH
AB: The exposure of food to ionizing radiation is being progressively used in many countries to inactivate food pathogens, to eradicate pests, and to extend shelf-life, thereby contributing to a safer and more plentiful food supply. To ensure free consumer choice, irradiated food will be labelled as such, and to enforce labelling, analytical methods to detect the irradiation treatment in the food product itself are desirable. In particular, there is a need for simple and rapid screening methods for the control of irradiated food. The DNA comet assay offers great potential as a rapid tool to detect whether a wide variety of foodstuffs have been radiation processed. In order to simplify the test, the agarose single-layer set-up has been chosen, using a neutral protocol. Interlaboratory blind trials have been successfully carried out with a number of food products, both of animal and plant origin. This paper presents an overview of the hitherto obtained results and in addition the results of an intercomparison test with seeds, dried fruits and spices are described. In this intercomparison, an identification rate of 95% was achieved. Thus, using this novel technique, an effective screening of radiation-induced DNA fragmentation is obtained. Since other food treatments also may cause DNA fragmentation, samples with fragmented DNA suspected to have been irradiated should be analyzed by other validated methods for irradiated food, if such treatments which damage DNA cannot be excluded.

2 of 23

TI: Control of Yersinia enterocolitica in raw pork and pork products by gamma-irradiation.
AU: Kamat-AS; Khare-S; Doctor-T; Nair-PM
AD: Food Technology Division, Bhabha Atomic Research Centre, Trombay, India.
SO: Int-J-Food-Microbiol. 1997 Apr 29; 36(1): 69-76
this source is not Available by this library
LA: ENGLISH
AB: gamma-Radiation response of Y. enterocolitica 5692 and 152 was studied at 0 degrees C and at -40 degrees C in phosphate buffer (pH 7.00) as well as in 10% raw meat/salami homogenate. The strains investigated did not differ in their response and were found to be sensitive to gamma-radiation but exhibited a tailing phenomenon in the survival curve. The D10 in homogenate was 0.25 kGy at 0 degrees C. This response was not affected at -40 degrees C. Storage studies of packs, inoculated artificially with heavy inoculum of Y. enterocolitica (10(6) cfu/g) showed that while samples of salami and cooked ham could be decontaminated at doses of 4 and 3 kGy respectively; cells could not be eliminated from raw pork meat even at the higher dose of 6 kGy. The role of different treatments given prior to irradiation for revival of Y. enterocolitica after irradiation storage was studied. The dose of 1 kGy at -40 degrees C was efficient in eradicating low numbers (< 10(3)) of naturally occurring of Y. enterocolitica from raw pork meat without any revival during storage at refrigeration temperature.

TI: The effect of electron beam irradiation, combined with acetic acid, on the survival and recovery of Escherichia coli and Lactobacillus curvatus.
AU: Fielding-LM; Cook-PE; Grandison-AS
AD: Department of Food Science and Technology, University of Reading, Whiteknights, UK. l.fielding@uwic.ac.uk
SO: Int-J-Food-Microbiol. 1997 Apr 15; 35(3): 259-65
this source is not Available by this library
LA: ENGLISH
AB: The preservation of food by ionising radiation may lead to undesirable sensory changes within the food. These changes can be reduced by combining irradiation with other treatments, for example the addition of organic acids. Late exponential phase cultures of Escherichia coli and Lactobacillus curvatus were irradiated, in a liquid medium, at doses of 0-1.8 kilograys (kGy), in the presence of acetic acid (0-2%) at pH 4.6. A synergistic effect occurred when E. coli was irradiated in the presence of acetic acid (0.02-1.0%) at all doses used (0.145-1.1 kGy). There is evidence to suggest that membrane disruption occurred in the cells as a result of the combined treatments and this may account, to some extent, for the synergism observed. The addition of acetic acid up to a concentration of 2.0% had no effect upon the radiation survival or upon the subsequent growth of L. curvatus.

TI: Estimating the incidence of food-borne Salmonella and the effectiveness of alternative control measures using the Delphi method.
AU: Henson-S
AD: Department of Agricultural and Food Economics, University of Reading, UK. aeshensn@dg.ac.uk
SO: Int-J-Food-Microbiol. 1997 Apr 15; 35(3): 195-204
this source is not Available by this library
LA: ENGLISH
AB: The paper describes the use of the Delphi method to estimate the incidence of food-borne Salmonella in the UK and the effectiveness of alternative control measures. A panel of experts of food-borne Salmonella participated in the Delphi survey, which involved five rounds of questioning taking place in the period July 1993 to January 1994. Participants were asked to give initial estimates for a number of parameters and invited to revise these estimates through progressive rounds of the survey at which the group responses were reported back. This process resulted in a reduction in the variation between the estimates given by individual experts. The final estimated annual incidence of food-borne Salmonella in the UK was 537,000, although significant variation remained between individual estimates. The foods judged to be the most important modes of transmission were poultry and poultry products (50% of cases) and eggs and egg products (26% of cases). The panel was also requested to estimate the effectiveness of strategies available to reduce the incidence of food-borne Salmonella from all sources. The most effective methods were judged to be food irradiation and mandatory application of HACCP, although there were significant differences in the judged effectiveness of these technologies for individual respondents. The paper demonstrates the efficacy of the Delphi method as a mechanism for reconciling differences between expert judgements of the incidence of food-borne disease and the effectiveness of alternative control strategies.

TI: [Food irradiation with ionizing radiation; an overview]
AU: Nobitgedagt-AJ
SO: Tijdschr-Diergeneeskd. 1997 Mar 15; 122(6): 158-63
this source is not Available by this library
LA: DUTCH; NON-ENGLISH
AB: Irradiation of food in the Netherlands may only be performed by a company

'that works according to the (Dutch) law on nuclear energy. Irradiation is used to reduce the number of pathogenic and spoilage micro-organisms in food. Thus the use of preservatives can be diminished. The use of this technique for the decontamination of food is sustained by the FAO/WHO. Codex Alimentarius Committee and other organisations like the Dutch Public Health Council. It should be accepted world wide and used in every country. Irradiation of food is at the moment allowed in 38 countries and practically performed in 28 countries. Gamma radiation from the cobalt-60 isotope is the commonly used source of radiation. The treatment causes in most foodstuffs no organoleptic changes. On the other hand, organoleptic deteriorations provoked by micro-organisms rest unchanged by the treatment. An inferior lot can not be 'irradiated' into an impeccable food. In the Netherlands it is only allowed to irradiate foodstuffs mentioned in the (Dutch) Irradiated Food Products Act which-is part of the (Dutch) Food and Commodities Act.

6 of 23

TI: The influence of micronization, dehulling, and enzyme supplementation on the nutritional value of peas for laying hens.
AU: Igbasan-FA; Guenter-W
AD: Department of Animal Science, University of Manitoba, Winnipeg, Canada.
SO: Poult-Sci. 1997 Feb; 76(2): 331-7
this source is not Available by this library
LA: ENGLISH
AB: Two experiments were conducted to determine the effects of micronization (infrared heat treatment), dehulling, or enzyme supplementation on the nutritive value of three cultivars (Impala, Radley, and Sirius) of peas in laying hens. In Experiment 1, 280 White Leghorn hens were fed diets containing micronized and dehulled peas for a period of 12 wk. The dietary inclusion of peas was 600 g/kg (correction was made for the amounts of hulls in those diets that contained dehulled peas). Egg production ($P < or = 0.05$), feed conversion ($P > or = 0.05$), and egg mass output ($P < or = 0.05$) were lower for birds fed untreated peas. Daily feed intake, egg weight, and albumen quality were not affected. Egg production, feed conversion, and egg mass output were similar for layers fed diets containing micronized peas and those fed the wheat-soybean control diet. Except for daily feed intake, which was reduced ($P < or = 0.05$), dehulling did not affect ($P > or = 0.05$) the feeding value of peas. The efficacy of dietary inclusion of a crude enzyme (pectinase) was evaluated in another experiment (8 wk). Pectinase was included in the experimental diets at 0, 50, and 100 U/kg and fed to 252 layers. The inclusion level of peas in these diets was 650 g/kg. There was no effect ($P > or = 0.05$) of enzyme supplementation on all production traits. Egg production, feed conversion, and egg mass output were 81.9, 83.6, and 83.0%; 1.61, 1.59, and 1.59 and 50.0, 51.2, and 50.3 at 0, 50, and 100 U/kg levels, respectively. It can be concluded that of the treatments tested only micronization had a positive effect on the feeding value of peas for laying hens.

7 of 23

TI: Effect of gamma-irradiation on the natural occurrence of Fusarium mycotoxins in wheat, flour and bread.
AU: Aziz-NH; Attia-ES; Farag-SA
AD: National Center for Radiation Research and Technology, Cairo, Egypt.
SO: Nahrung. 1997 Feb; 41(1): 34-7
this source is not Available by this library
LA: ENGLISH
AB: A survey was carried out to obtain data on the occurrence of Fusarium mycotoxin in wheat and flour samples collected from local markets in Egypt and to study the influence of gamma-irradiation on controlling the occurrence of these mycotoxins in wheat, flour and bread. Deoxynivalenol (DON) was detected in five samples of wheat at levels ranging from 103 to 287 micrograms/kg and one sample each of flour and bread at concentrations 188 and 179 micrograms/kg. Zearalenone (ZEN) was detected in ten samples of wheat at levels from 28 to 42

micrograms/kg and four samples each of flour and bread at concentrations of 95 and 34 micrograms/kg, respectively. T-2 toxin was detected only in one sample each of wheat, flour and bread at concentrations of 2.9, 2.2 and 2.3 micrograms/kg, respectively. Gamma-irradiation at dose level of 6 kGy completely eliminated fungal flora in flour and wheat. DON, ZEN and T-2 toxin concentrations are reduced to 85, 20 and 2.0 micrograms/kg for wheat and to 125, 45 and 1.0 micrograms/kg for flour after 4 kGy exposure and a sharp drop in Fusarium toxin levels occurred at 6 kGy and as eliminated at 8 kGy. Bread prepared from 6 kGy was contaminated with Fusarium toxin at levels below 5 microgram/kg. It was noticed that gamma-irradiation reduce greatly the natural occurrence of Fusarium mycotoxins in bread.

8 of 23

TI: D values of Salmonella enteritidis isolates and quality attributes of shell eggs and liquid whole eggs treated with irradiation.
AU: Serrano-LE; Murano-EA; Shenoy-K; Olson-DG
AD: Department of Animal Science, Iowa State University, Ames 50011, USA.
SO: Poult-Sci. 1997 Jan; 76(1): 202-6
this source is not Available by this library
LA: ENGLISH
AB: Irradiation sensitivity of five Salmonella enteritidis isolates inoculated either on the surface or inside of whole shell eggs were determined. The shell eggs were irradiated at doses of 0, 0.5, 1.0, and 1.5 kGy. A minimal dose of 0.5 kGy was sufficient to eliminate all the isolates from the surface of whole eggs; however, the same isolates were more resistant to irradiation when present inside the eggs. The ATCC 13076 isolate was significantly more sensitive to irradiation, with a D value of 0.32 kGy, than the other four isolates from animal origin. Irradiation D values of the latter ranged from 0.39 to 0.41 kGy. Liquid whole eggs were also inoculated (2.4 x 10(6) cells per milliliter) with two S. enteritidis isolates and were heat-treated at 50 C for 0, 20, 40, or 60 min followed by irradiation at 0, 0.25, 0.5, 0.75, or 1.0 kGy. The results indicate that mild heating prior to irradiation was ineffective in reducing the irradiation D values. However, on the basis of the D values obtained, an irradiation dose of 1.5 kGy should be sufficient to reduce Salmonella counts by approximately 4 log10 in both whole shell and liquid eggs. Results also indicate that color and thermal characteristics of the whole or liquid eggs were unaffected by a 1.5-kGy dose of irradiation.

9 of 23

TI: Effect of irradiation dose, storage time and temperature on the ESR signal in irradiated oat, corn and wheat.
AU: Murrieta-H; Munoz-E; Adem-E; Burillo-G; Vazquez-M; Cabrera-E
AD: Instituto de Fisica, Universidad Nacional Autonoma de Mexico, Mexico, Mexico DF.
SO: Appl-Radiat-Isot. 1996 Nov-Dec; 47(11-12): 1657-61
this source is not Available by this library
LA: ENGLISH
AB: Results obtained for electron-irradiated oat, corn and wheat kernels are discussed. The applied irradiation doses were up to 160 kGy. For doses up to approx. 50 kGy the number of free radicals produced by the irradiation is linear with the absorbed dose; moreover, the decay at room temperature in the dark or in the presence of light is quite similar. These facts point to the possible use of these kernels as dosimeters. An analysis of the free radical decay as a function of time and temperature shows the contribution of at least three types of radicals, whose half-lifes, radiochemical yields and activation energies are given.

10 of 23

TI: Identification of irradiated mangoes by means of ESR spectroscopy.
AU: Bustos-MF; Romero-MF; Gutierrez-A; Azorin-J
AD: Instituto Nacional de Investigaciones Nucleares, Nex., Mexico.

SO: Appl-Radiat-Isot. 1996 Nov-Dec; 47(11-12): 1655-6
this source is not Available by this library
LA: ENGLISH
AB: Samples of mango varieties Tommy Atkins, Haiden and Ataulfo were irradiated with 60Co gamma radiation at doses in the range 0.15-1.0 kGy, and stored at room temperature for lapses of time up to 72 h. They were then studied by ESR spectrometry. Results show that the ESR signal of the irradiated samples is higher than that of the unirradiated samples, and this is found even at the minimum radiation dose of 0.15 kGy. The ESR signal remained stable during the storage time. The ESR signals obtained for hydroheated mangoes show insignificant differences with respect to the control samples.

11 of 23

TI: Influence of sample treatment on ESR signal of irradiated citrus.
AU: de-Jesus-EF; Rossi-AM; Lopes-RT
AD: Programa de Engenharia Nuclear, COPPE/Universidade Federal do Rio de Janeiro, Brazil.
SO: Appl-Radiat-Isot. 1996 Nov-Dec; 47(11-12): 1647-53
this source is not Available by this library
LA: ENGLISH
AB: ESR spectra of the hard seed cover and kernel coating of irradiated orange and tangerine fruits were obtained under different sample drying conditions to analyze the effect of treatment on ESR line at g = 2.0033 (line A). The spectra shows almost the same lines that appear in stalks, achenes, seeds and skins of fresh fruit. The peak-to-peak intensity of the line A of the spectra shows a linear variation with dose in the range studied (up to 5 kGy) under controlled sample preparation. Q-band ESR spectra shows that this line is composed for three different lines from different species. A1, A2 and A3. The A2 and A3 lines are associated with dose but grow also during drying of the sample and are probably due to 'cellulosic' components of the seed cover. The A1 line appears only when sample is dried and is probably associated with the quinones of the internal kernel coat.

12 of 23

TI: Use of ESR for the detection of irradiated dates (Phoenix dactylifera L.).
AU: Ghelawi-MA; Moore-JS; Dodd-NJ
AD: University of Salford, U.K.
SO: Appl-Radiat-Isot. 1996 Nov-Dec; 47(11-12): 1641-5
this source is not Available by this library
LA: ENGLISH
AB: One variety (Aple) of Libyan dry dates (Phoenix dactylifera L.) was irradiated in a 60Co source to absorbed doses of 0.8, 1.0, 1.5 and 2.0 kGy. Unirradiated date stone contains a radical with a single line g = 2.0045, feature A. Irradiation to a dose of 2.0 kGy (the recommended dose for fruits in U.K.) induces the formation of additional radicals with signals g = 1.9895 and 2.0159, feature C. The single line having g = 2.0045 decays in both unirradiated and irradiated samples whereas the additional signals g = 1.9895 and 2.0159 remain almost unchanged over a period of time 15 months stored at room temperature and 4 degrees C.

13 of 23

TI: Current status of the EPR method to detect irradiated food.
AU: Desrosiers-MF
AD: Physics Laboratory, National Institute of Standards and Technology, Technology Administration, Department of Commerce, Gaithersburg, MD 20899, USA.
SO: Appl-Radiat-Isot. 1996 Nov-Dec; 47(11-12): 1621-8
this source is not Available by this library
LA: ENGLISH
AB: This review gives a brief outline of the principles of the EPR detection method for irradiated foods by food type. For each food type, the scope, limitations and status of the method are given. The extensive reference list

aims to include all which define the method, as well as some rarely cited works of historical importance.

14 of 23

TI: "Contamination" with genes?]
AU: Naess-K
SO: Tidsskr-Nor-Laegeforen. 1997 Jan 10; 117(1): 84
this source is not Available by this library
LA: NORWEGIAN; NON-ENGLISH

15 of 23

TI: The effects of milling and processing on wheat contaminated with ochratoxin A.
AU: Osborne-SG; Ibe-F; Brown-GI; Petagine-F; Scudamore-KA; Banks-JN; Hetmanski-MT; Leonard-CT
AD: FMBRA, Chorleywood, Herts, UK.
SO: Food-Addit-Contam. 1996 Feb-Mar; 13(2): 141-53
this source is not Available by this library
LA: ENGLISH
AB: Samples of sound home-grown wheat (one hard and one soft milling) were obtained, cleaned, and gamma-irradiation used to reduce numbers of viable naturally-occurring fungi. Each sample was inoculated with a toxigenic strain of Penicillium verrucosum and monitored for ochratoxin A formation. When ochratoxin A had reached a level of 60 micrograms/kg, the samples were milled into ten fractions which were analysed for ochratoxin A by an HPLC method with immunoaffinity column clean-up. Each straight-run white flour was baked into bread which was analysed in the same way. Relationships between ochratoxin A levels in naturally-contaminated wheat and the products of milling and baking were established. The recovery of ochratoxin A in wholemeal compared with the cleaned wheat was essentially complete and no significant loss occurred on baking white or wholemeal flour into bread. Recoveries in the straight-run white flours, however, were only approximately one-third for the hard wheat and two-thirds for the soft wheat of the ochratoxin A in the uncleaned wheat. The reason for this was that a much higher proportion of the ochratoxin A was found in the bran and offal fractions from hard wheat than from soft. Conversely, a much higher proportion of the ochratoxin A was found in the reduction flour from soft wheat than from hard. Scouring was examined as a possible method of decontamination of wheat prior to milling. This process removes a proportion of the pericarp (bran coat) prior to milling. The results of the study confirmed that scouring reduced the ochratoxin A level in white and wholemeal flour three-fold for both the hard and soft wheat.

16 of 23

TI: Economics may be cause for lack of food irradiation [letter]
AU: Gonder-E
SO: J-Am-Vet-Med-Assoc. 1997 Jan 1; 210(1): 18
this source is not Available by this library
LA: ENGLISH

17 of 23

TI: Ochratoxin A in wheat: a second intercomparison of procedures.
AU: Wood-GM; Patel-S; Entwisle-AC; Boenke-A
AD: Leatherhead Food Research Association, Surrey, UK.
SO: Food-Addit-Contam. 1996 Jul; 13(5): 519-39
this source is not Available by this library
LA: ENGLISH
AB: The European Commission, Measurements and Testing Programme (BCR) has undertaken a project to improve methodology and to prepare certified reference materials for ochratoxin A determination. The first phase of this project, an intercomparison of procedures for the determination of ochratoxin A in wheat, at a content of approximately 13 micrograms/kg, has already been reported. The

second intercomparison study, described in this paper, involved 26 European laboratories, from 11 countries, which analysed wheat naturally contaminated at a level of approximately 7 micrograms/kg, and a 'blank' wheat sample (ochratoxin A content < 0.2 microgram/kg). The participants used a variety of procedures which involved different extraction solvents and clean-up procedures. All laboratories used HPLC as the determinative step. Some laboratories also used immunoaffinity column clean-up in comparison with their normal method. Recoveries of the normal methods used by laboratories ranged from 58 to 114%; only three laboratories obtained recoveries outside the accepted range of 70 to 110%. Recoveries of the immunoaffinity column methods, using two sources of column, ranged from 58 to 114% for one and from 4 to 86% for the other. The between-laboratory reproducibility coefficient of variation for all results was 34% for the normal methods, and 34 and 42% for the two types of immunoaffinity columns. It was noted that, after the results were corrected for spike recovery, some laboratories became outliers owing to low spike recoveries. Further investigations of the spiking protocols used by each laboratory showed that the time left for evaporation of the spiking solvent was crucial to the recovery obtained.

18 of 23

TI: Potentials of cold pasteurization for the safety of foods of animal origin.
AU: Mussman-HC
SO: J-Am-Vet-Med-Assoc. 1976 Dec 15; 209(12): 2057-8
this source is not Available by this library
LA: ENGLISH

19 of 23

TI: Migration of dioctyladipate plasticizer from food-grade PVC film into chicken meat products: effect of gamma-radiation.
AU: Goulas-AE; Kontominas-MG
AD: Department of Chemistry, University of Ioannina, Greece.
SO: Z-Lebensm-Unters-Forsch. 1996 Mar; 202(3): 250-5
this source is not Available by this library
LA: ENGLISH
AB: Food-grade PVC film containing 28.3% dioctyladipate (DOA) plasticizer was used to wrap chicken meat samples, with and without skin, contained in a polystyrene tray. Samples were then irradiated with gamma-radiation [60Co] at doses equal to 4 kGy and 9 kGy corresponding to "cold pasteurization". Irradiation was carried out at 8-10 degrees C and samples were subsequently stored at 4-5 degrees C. Contaminated chicken meat samples were analysed for DOA at intervals between 7 h and 240 h of contact, using an indirect GC method. Identical non-irradiated (control) samples were also analysed for their DOA content. Results showed no statistically significant differences in migrated amounts of DOA between irradiated and non-irradiated samples. Neither were differences observed between samples irradiated at 4 kGy and 9 kGy. This was supported by identical IR spectra recorded for irradiated and non-irradiated samples and leads to the conclusion that, at such intermediate radiation doses (< or = kGy), the migration characteristics of PVC film are not affected. DOA migration was found to be time dependent, approaching equilibrium after approximately 170 h for the chicken flesh plus skin samples and 120 h for the chicken flesh samples. The amount of DOA migrated into chicken flesh plus skin samples was significantly greater (3.2-22.3 mg/dm2) than that for chicken flesh samples (0.9-8.9 mg/dm2). After 240 h of sample/film contact under refrigeration, loss of DOA was approximately 35.6% for chicken flesh plus skin samples and 14.3% for chicken flesh samples. Sample spoilage, as demonstrated by off-odour development, occurred after approximately 120 h of refrigerated storage. Diffusion coefficients for DOA were calculated and were found to be lower for chicken flesh (1 x 10(-13) than for flesh plus skin (4.4 x 10(-13)) samples.

20 of 23

TI: Why not irradiate? [letter]
AU: Erbeck-DH
SO: J-Am-Vet-Med-Assoc. 1996 Oct 15; 209(8): 1379
this source is not Available by this library
LA: ENGLISH

21 of 23

TI: Technological and chemical characters of bread prepared from irradiated wheat flour.
AU: Zaied-SF; Abdel-Hamid-AA; Attia-FA
AD: National Centre for Radiation Research, Cairo, Egypt.
SO: Nahrung. 1996 Feb; 40(1): 28-31
this source is not Available by this library
LA: ENGLISH
AB: The present work is a part of research programme aimed to use gamma irradiation to decrease the growth of fungi and the concentration of mycotoxines which present naturally in collected samples of wheat flour from Egyptian markets (first part). To follow the technological, rheological and chemical characters of bread "Balady" common type in Egypt, same samples of wheat flour were irradiated with 2, 4 and 8 kGy for these purposes. The Egyptian bread type (Balady) had been prepared from irradiated and non-irradiated samples. The chemical analysis proved a significant induction in reducing sugars (RS) which increased gradually with increasing doses as 16.75%, 30.30%, 43.24% after using 2, 4 and 8 kGy respectively. Same trend was observed with total sugars (TS), less changes were observed in non-reducing sugars (NRS) and starch content. Results obtained showed that an actual reduction in dough development time, stability, weaking of dough and height of bread especially for irradiated samples at 4 and 8 kGy but 2 kGy was less effective. The reduction of Alkaline Water Retention Capacity (AWRC) was clear at high doses whereas 2.0 kGy improved the freshness of aged "balady" bread. Concerning, the evaluation of organoleptic characters of bread as judged by the panelists, all the samples were accepted either irradiated or not. But, the lowest values of acceptance resulted from irradiated samples with 4 and 8 kGy. Therefore, using 2 kGy can be recommended for keeping quality of wheat flour to avoid the infestation or pathogenic infection. Whereas high doses (4-8 kGy) can be use for eliminating the mycotoxins with some changes of quality which can be overcome by using some additional matters to get more acceptable bread and less changes in technological characters.

22 of 23

TI: Irradiation as a cold pasteurization process of food.
AU: Loaharanu-P
AD: Food Preservation Section, International Atomic Energy Agency, Vienna, Austria.
SO: Vet-Parasitol. 1996 Aug; 64(1-2): 71-82
this source is not Available by this library
LA: ENGLISH
AB: A number of emerging pathogenic microorganisms and parasites in food, the wide publicity of outbreaks of foodborne diseases and the increasing number of immuno-compromised population have resulted in a need to develop proper strategies and technologies to protect health of consumers. Regulations in most countries which are promulgated to ensure safety of foods, are not properly enforced to protect consumers' health especially with regard to food of animal origin. While regulations are in place and properly enforced for liquid foods such as milk or fruit juices, more solid foods especially those of animal origin, e.g. poultry, meat and seafood, which are often contaminated by pathogenic microorganisms and parasites, are not similarly regulated. The number of incidences of foodborne diseases can the subsequent economic impact to the society can be enormous. Recently, an increasing number of national and international organizations have recognised the use of irradiation as a method to ensure hygienic quality of more solid food of animal origin in the same

manner as thermal pasteurization does for liquid foods. The effectiveness of irradiation as a cold pasteurization method to control foodborne disease caused by pathogenic microorganisms and parasites, especially in food to be consumed raw or partially processed, is established. Its role in overcoming trade barriers of food of animal origin based on the principle of the Agreement on the Application of Sanitary and Phytosanitary Measures, adopted during the GATT Uruguay Round will be discussed.

23 of 23

TI: Strategies to reduce transmission of Toxoplasma gondii to animals and humans.
AU: Dubey-JP
AD: US Department of Agriculture, Agricultural Research Service, Parasite Biology and Epidemiology Laboratory, Beltsville, MD 20705, USA.
SO: Vet-Parasitol. 1996 Aug; 64(1-2): 65-70
this source is not Available by this library
LA: ENGLISH
AB: Toxoplasma gondii is found in the tissues of food animals and is an important cause of abortion and mortality in sheep and goats throughout the world. It causes mental retardation and loss of vision in congenitally infected children and death in immunosuppressed patients. A live vaccine, using a nonpersistent strain of T. gondii, is available in New Zealand, the UK and Europe which prevents T. gondii abortion in sheep. A live vaccine using a mutant strain of T. gondii (T-263) is being developed in the USA to reduce oocyst shedding by cats. As yet, there are no drugs to kill T. gondii tissue cysts in human or animal tissues. Freezing to -12 degrees C, cooking to an internal temperature of 67 degrees C, or gamma irradiation (0.5 kGy) can kill tissue cysts in meat.

1 of 24

TI: Public perceptions of everyday food hazards: a psychometric study.
AU: Fife-Schaw-C; Rowe-G
AD: Department of Psychology, University of Surrey, Guildford, England.
SO: Risk-Anal. 1996 Aug; 16(4): 487-500
this source is not Available by this library
LA: ENGLISH
AB: In this paper, we discuss the conduct and results of a study aimed at eliciting public perceptions of food-related hazards. This study employs the psychometric approach of Paul Slovic and colleagues and aims to extend the recent work of Sparks and Shepherd on defining the primary dimensions of food-related risk perceptions. The study surveyed a nationally representative sample of the general public (respondents = 293; adjusted response rate = 30.1%). Respondents provided ratings on subsets of 22 potential food hazards (e.g., food irradiation and presence of listeria) on a total of 19 risk characteristics (e.g., "perceived severity of risk" and "adequacy of governmental regulations"). In spite of the use of a number of new characteristics and food hazards, Principal Components Analysis revealed a broadly similar factor structure to that obtained by Sparks and Shepherd, suggesting the generalizability of the key dimensions (concerning the severity and awareness of hazards). Interestingly, the positioning in the factor space of potential hazards about which little was generally known (e.g., campylobacter) as being serious and in need of regulation, may suggest a possible "starting position" in the perception of new hazards that have not previously been the subject of risk communications.

2 of 24

TI: Comparison between irradiated and thermally pasteurized liquid egg white on functional, physical, and microbiological properties.
AU: Wong-YC; Herald-TJ; Hachmeister-KA
AD: Department of Foods and Nutrition, Kansas State University, Manhattan 66506, USA.
SO: Poult-Sci. 1996 Jun; 75(6): 803-8
this source is not Available by this library
LA: ENGLISH
AB: A comparative study was undertaken to determine the effect of irradiation and thermal pasteurization on the functional, physical, and microbiological properties of liquid egg white (LEW). The LEW was irradiated or thermally pasteurized then stored at 4 C for 3 mo. Both treatments destroyed the inoculum, Salmonella typhimurium. The microbial growth rate was slower in the irradiated LEW than in the thermally pasteurized treatment. Irradiated samples had 47% lower foam drainage and more stable viscosity than samples that were thermally pasteurized. Volume of angel food cake prepared with irradiated or pasteurized LEW decreased 48 and 57%, respectively, after 90 d. Color did not differ between treatments. Ionizing radiation is an alternative processing method that inhibits microbial growth and helps maintain functionality of LEW.

3 of 24

TI: Effect of some factors used to the chicken meat preservation and processing on the protease activity.
AU: Przysiezna-E; Skrabka-Blotnicka-T
AD: Academy of Economics, Animal Food Technology Department, Wroclaw, Poland.
SO: Nahrung. 1996 Aug; 40(4): 200-5

this source is not Available by this library
LA: ENGLISH
AB: The obtained results indicated that the cathepsin activity was higher by about 60% in the extract from thigh than from breast muscles. Freezing and defrosting (not stored) of chicken meat did not influence the breast muscle cathepsin activity while they caused a decrease of activity of about 20% in the case of thigh muscles. The increase in cathepsin activity was noticed in both kinds of muscles during storage at -20 degrees C up to 4 months (43.6% and 19.4% for thigh and breast muscles respectively). The activity of cathepsin in extract from 5 months stored meat reached 80% in case of breast muscles and 83% in case of thigh muscles in relation to control sample respectively. The cathepsin activity significantly increased during heating of breast muscles up to 60 degrees C, but in case of thigh muscles it was slightly higher than at 50 degrees C. The heating of cured chicken breast muscles up to 60 degrees C caused a non significant growth in cathepsin activity opposite to raw muscles. The cathepsin activity from all cured samples heated up to 70 degrees C were several times lower in relation to control samples. The cathepsin activity of both thigh and breast muscles were resistant to gamma radiation. The investigated factors caused changes in the activity of cathepsin but none of them caused its total inactivation. The changes of cathepsin activity depended on the kind of muscles and the kind and the value of acting factors.

4 of 24
TI: [Detection of treatment of chicken breast with ionized rays and gradation of radiation dosage with the help of headspace gas chromatography and discriminant analysis evaluation]
AU: Eisner-T; Rothweiler-B; Marx-F; Pfeilsticker-K
AD: Institut fur Lebensmittelwissenschaft und Lebensmittelchemie der Universitat Bonn, Germany.
SO: Z-Lebensm-Unters-Forsch. 1996 Jan; 202(1): 63-5
this source is not Available by this library
LA: GERMAN; NON-ENGLISH
AB: Chicken breast was irradiated with doses of 3, 5, and 7 kGy. Headspace gas chromatographical analysis demonstrated the tendency that the amounts of volatile compounds (mainly pentanal, hexanal and heptanal) are higher in irradiated samples in comparison with non irradiated. Statistical evaluation of the gas chromatograms by discriminant analysis enabled the detection of irradiation. Unknown samples could be classified in the groups "un-irradiated" or "irradiated" in most cases.

5 of 24
TI: Salmonella, Campylobacter and Escherichia coli O157:H7 decontamination techniques for the future.
AU: Corry-JE; James-C; James-SJ; Hinton-M
AD: Department of Clinical Veterinary Science, University of Bristol, Langford, UK.
SO: Int-J-Food-Microbiol. 1995 Dec; 28(2): 187-96
this source is not Available by this library
LA: ENGLISH
AB: Raw meat, particularly poultry meat, remains an important, and probably the major source of human infection with campylobacters and salmonellas. In spite of decades of effort it has so far proved extremely difficult to raise food animals free of these pathogens. For the foreseeable future, therefore, the most effective approach must be to decontaminate the final raw product. In this way numbers of these pathogens entering kitchens and commercial food processing premises will be reduced substantially, and hence opportunities for cross-contamination onto ready-to-eat foods or for survival during cooking or other processes will be much lower. The ideal method of decontamination will have the following attributes: it will not change appearance, smell, taste or nutritional properties; it will leave no residues; it will pose no threat to the environment; it will encounter no objections from consumers or legislators;

it will be cheap and convenient to apply; it will improve the shelf life by inactivating spoilage organisms as well as pathogens. Various techniques will be listed and their potential assessed (see Table 1).

6 of 24

TI: Spoilage and shelf-life extension of fresh fish and shellfish.
AU: Ashie-IN; Smith-JP; Simpson-BK
AD: Department of Food Science and Agricultural Chemistry, Macdonald College of McGill University.
SO: Crit-Rev-Food-Sci-Nutr. 1996 Jan; 36(1-2): 87-121
this source is not Available by this library
LA: ENGLISH
AB: Fresh fish and shellfish are highly perishable products due to their biological composition. Under normal refrigerated storage conditions, the shelf life of these products is limited by enzymatic and microbiological spoilage. However, with increasing consumer demands for fresh products with extended shelf life and increasing energy costs associated with freezing and frozen storage, the fish-processing industry is actively seeking alternative methods of shelf life preservation and marketability of fresh, refrigerated fish and at the same time economizing on energy costs. Additional methods that could fulfill these objectives include chemical decontamination, low-dose irradiation, ultra-high pressure, and modified atmosphere packaging (MAP). This review focuses on the biochemical and microbiological composition of fresh fish/shellfish, the spoilage patterns in these products, factors influencing spoilage, and the combination treatments that can be used in conjunction with refrigeration to extend the shelf life and keeping quality of fresh fish/shellfish. The safety concerns of minimally processed/MAP fish, specifically with respect to the growth of Clostridium botulinum type E, is also addressed.

7 of 24

TI: Detection of irradiated fruits by gas-chromatographic methods.
AU: el-Dien-S; Farag-A
AD: National Center for Radiation Research, and Technology, Nasr City, Cairo, Egypt.
SO: Z-Lebensm-Unters-Forsch. 1996 Jun; 202(6): 451-7
this source is not Available by this library
LA: ENGLISH
AB: To detect those fruits which have been subjected to low-dose irradiation (0.5-3 kGy), two methods of chromatography (GC-MS and LC-LC-GC-FID) were used to determine the radiolytic compounds of lipids formed after irradiation, such as alkanes and alkenes. Extraction of volatile hydrocarbon compounds from some parts of irradiated fruits, e.g. the flesh (avocado), seeds (papaya) and kernels (mango and apricot) was carried out. The analysis of hydrocarbons by GC-MS proved the suitability of using C17:1, C16:2, C15:0 and C14:1 as markers for avocados irradiated with a low dose (0.75 kGy). The same indicators appeared following the analysis of papayas and mangoes irradiated with 1.5, and 3.0 kGy. Also, C15:0, C14:1 and C16:3 can be used to identify apricots irradiated with a low dose (0.5 kGy). The detection of alkenes was only improved by a more selective isolation, e.g. of dienes or trienes by LC-LC-GC-FID. Within a few minutes, apricots and avocados irradiated at low doses (0.5 and 0.75 kGy) can be recognized by the indicators C16:2, C17:2 and C16:3, without interfering peaks. In all cases, C16:1, C16:2, C16:3 as well as significant amounts of C17:2 can be used as markers for fruit irradiation.

8 of 24

TI: Great expectations: the coroner's report on the haemolytic-uraemic syndrome outbreak [letter]
AU: Holt-JA
SO: Med-J-Aust. 1996 Jun 17; 164(12): 758
This source is Available by this library

Call Number: From: 1966+
LA: ENGLISH

9 of 24

TI: Estimating the economic benefits of avoiding food-borne risk: is 'willingness to pay' feasible?
AU: Donaldson-C; Mapp-T; Ryan-M; Curtin-K
AD: Health Economics Research Unit, University of Aberdeen, Foresterhill, Scotland.
SO: Epidemiol-Infect. 1996 Jun; 116(3): 285-94
this source is not Available by this library
LA: ENGLISH
AB: In this paper, the results of a pilot study of willingness to pay (WTP) to avoid poultry-borne illness are reported. Through this, the problems of devising an economic measure of the 'intangible' benefits of prevention of food-borne risk are explored. The study is the first to allow those against a prevention policy (irradiation of poultry-meat) to register their WTP not to have the policy implemented. The study demonstrates that it is feasible to obtain answers to WTP questions from a self-selected sample. Future studies should ensure greater representativeness of respondents, that better information about benefits is provided to respondents and that an appropriate method of aggregation of benefits is used.

10 of 24

TI: Free radicals and food irradiation.
AU: Dodd-NJ
AD: CRC Department of Biophysics, Paterson Institute for Cancer Research, Christie Hospital NHS Trust, Manchester, U.K.
SO: Biochem-Soc-Symp. 1995; 61: 247-58
this source is not Available by this library
LA: ENGLISH
AB: Ionizing radiation can be used to control insect and microbial infestation of foodstuffs, inhibit sprouting, delay ripening and reduce the dangers from food-poisoning bacteria. Irradiation produces free radicals, most of which decay rapidly, although some are more persistent. These latter radicals can be detected and characterized by electron spin resonance (ESR). In bone and other calcified tissues, the radiation-induced radicals are distinguishable from naturally occurring radicals, and their stability makes them ideal for radiation dosimetry. The radicals induced in plant material, such as seeds and dried spices, are generally indistinguishable from the endogenous radicals and decay over a period of days or weeks. However, in many of these materials, a radiation-specific radical can be detected at low concentration, thereby permitting identification of irradiated samples, although precluding accurate dosimetry. ESR, although not universally applicable, currently provides the most specific method for the detection of irradiated food.

11 of 24

TI: [Identification of foods preserved by radiation]
AU: Stachowicz-W
AD: Laboratorium Identyfikacji Napromieniowania Zywnosci.
SO: Rocz-Panstw-Zakl-Hig. 1995; 46(4): 329-39
this source is not Available by this library
LA: POLISH; NON-ENGLISH
AB: Analytical methods suitable for the detection of irradiated foods are reviewed. The detection methods are classified as physical, chemical, microbiological and biological, respectively. Reliability, robustness, sensitivity, accuracy and simplicity of each method are discussed.

12 of 24

TI: [Food irradiation]
AU: Migdal-W

AD: Instytutu Chemii i Techniki Jadrowej, Warszawie.
SO: Rocz-Panstw-Zakl-Hig. 1995; 46(4): 323-8
this source is not Available by this library
LA: POLISH; NON-ENGLISH
AB: A worldwide standard on food irradiation was adopted in 1983 by Codex Alimentarius Commission of the Joint Food Standard Programme of the Food and Agriculture Organization (FAO) of the United Nations and the World Health Organization (WHO). As a result, 41 countries have approved the use of irradiation for treating one or more food items and the number is increasing. Generally, irradiation is used to: food loses, food spoilage, disinfestation, safety and hygiene. The number of countries which use irradiation for processing food for commercial purposes has been increasing steadily from 19 in 1987 to 33 today. In the frames of the national programme on the application of irradiation for food preservation and hygienization an experimental plant for electron beam processing has been established in Institute of Nuclear Chemistry and Technology. The plant is equipped with a small research accelerator Pilot (10MeV, 1 kW) and an industrial unit Elektronika (10MeV, 10 kW). On the basis of the research there were performed at different scientific institutions in Poland, health authorities have issued permission for irradiation for: spices, garlic, onions, mushrooms, potatoes, dry mushrooms and vegetables.

13 of 24

TI: Safety and nutritional adequacy of irradiated food [letter]
AU: van-As-D
SO: S-Afr-Med-J. 1995 Nov; 85(11): 1200
this source is not Available by this library
LA: ENGLISH

14 of 24

TI: The effect of substrate on the radiation resistance of yeasts isolated from sausage meat.
AU: McCarthy-JA; Damoglou-AP
AD: Department of Food Science (Food Microbiology, Queen's University of Belfast, UK.
SO: Lett-Appl-Microbiol. 1996 Jan; 22(1): 80-4
this source is not Available by this library
LA: ENGLISH
AB: The radiation resistance of a selection of yeasts isolated from sausages was assessed in phosphate-buffered saline and in sausage meat. The yeasts Candida zeylanoides, Debaryomyces hansenii and Trichosporon cutaneum exhibited sigmoidal survival curves in both substrates whilst the more sensitive Sporobolomyces roseus exhibited an exponential survival curve in buffer but a sigmoidal curve in meat. Irradiating C. zeylanoides, D. hansenii and T. cutaneum in sausage meat changed the shape of their survival curves to significantly alter the calculated parameters Ds (the dose in kGy that must be achieved before reduction in numbers occurs) and D10sig (the dose in kGy required after the shoulder to achieve a 1 log cycle reduction in numbers). The Ds values were reduced while higher D10sig values were obtained demonstrating that the sausage meat contributed a protective effect to these yeasts at higher irradiation doses. For the yeast S. roseus, similar numbers of survivors were recovered from both substrates at initial low irradiation doses (0-0.5 kGy) with the protective effect being demonstrated again at higher doses (> 2 kGy). These findings should be considered when defining a commercial process to reduce the numbers of yeasts in these products.

15 of 24

TI: Comparative effects of gamma and microwave irradiation on the quality of black pepper.
AU: Emam-OA; Farag-SA; Aziz-NH
AD: Faculty of Specified Education, Benha, Egypt.
SO: Z-Lebensm-Unters-Forsch. 1995 Dec; 201(6): 557-61

this source is not Available by this library
LA: ENGLISH
AB: Powdered black pepper from Egyptian markets, was irradiated with different recommended doses of gamma rays (5.0 and 10.0 kGy) and with microwaves for different periods (20, 40 and 75 s) to improve its hygienic quality. The most common bacterial isolates were of three genera Bacillus, Clostridium and Micrococcus (7.5 x 10(6)), whereas the predominant fungi (7.8 x 10(4)) were Aspergillus species, A. glaucus, A. flavus, A. niger and A. ochraceus. Doses of gamma irradiation used (5.0 and 10 kGy) were sufficient to decrease spore-forming bacteria (SFB) and to inhibit the fungal flora and coliforms which contaminated the black pepper powder. Microwave treatments for 40 s and 75 s were of the same effectiveness whereas treatment for 20 s was less so. GLC analysis proved the presence of 31 peaks, only 19 compounds were identified as monoterpene hydrocarbons (56.71%), the major one being beta-phellandrene and limonene. Sesquiterpenes were also present, mainly beta-caryollphyllene (3.69%) as well as oxygenated compounds such as terpenol, geraniol, Me-chavicol, eugenol and anisol. Gamma irradiation at 5 kGy and 10 kGy respectively decreased the numbers of identified compounds from 21 (86.58% concentration) in untreated pepper to 16 (59.22% concentration), 15 (54.06% concentration). In comparison, microwave treatments, particularly for 40 s and 75 s, increased the concentration of the same compounds. The results obtained indicate that microwave treatment, under these conditions, is a safe and suitable technique for decontamination of black pepper which does not result in a great loss of flavour compounds, as compared with recommended doses of gamma irradiation.

16 of 24
TI: Combined effect of gamma radiation and heating on the destruction of Listeria monocytogenes and Salmonella typhimurium in cook-chill roast beef and gravy.
AU: Grant-IR; Patterson-MF
AD: Department of Food Science (Food Microbiology), Queen's University of Belfast, Northern Ireland, UK.
SO: Int-J-Food-Microbiol. 1995 Oct; 27(2-3): 117-28
this source is not Available by this library
LA: ENGLISH
AB: The effect of heating alone (60, 65 or 70 degrees C), heating after irradiation (0.8 kGy) and heating after irradiation and storage for 14 days at 2-3 degrees C on the destruction of Listeria monocytogenes and Salmonella typhimurium in artifically inoculated minced cook-chill roast beef and gravy was investigated. Inoculated minced roast beef samples (5 g) were heated in Stomacher bags completely immersed in a water bath at each of the test temperatures. Survivors were enumerated and D and z values were determined for each of the pathogens. Observed thermal D values for two strains of L. monocytogenes at 60, 65 and 70 degrees C in the absence of pre-irradiation were 90.0-97.5 s, 34.0-33.0 s and 22.4-28.0 s, respectively, whereas thermal D values after pre-irradiation were 44.0-46.4 s, 15.3-16.8 s and 5.5-7.8 s at 60, 65 and 70 degrees C, respectively. This reduction in D values provides evidence for radiation-induced heat-sensitisation in L. monocytogenes. There was some evidence of heat-sensitisation of S. typhimurium at 60 degrees C, but not at either 65 or 70 degrees C. The z value also decreased as a consequence of pre-irradiation to a dose of 0.8 kGy (11.0-12.7 degrees C). The radiation-induced heat-sensitivity in L. monocytogenes was found to persist for up to 2 weeks storage at 2-3 degrees C prior to heating. As cook-chill products are intended to be reheated prior to consumption the results of the present study sugyest that any L. monocytogenes present in a cook-chill product would be more easily killed during reheating if it were to be treated with a low dose of gamma radiation during manufacture.

17 of 24
TI: Irradiated versus fumigated spices in sausage.
AU: Bolander-CR; Toma-RB; Davis-RH; Medora-NF

AD: California State University, Long Beach, Department of Home Economics-Food Science 90840, USA.
SO: Int-J-Food-Sci-Nutr. 1995 Nov; 46(4): 319-25
this source is not Available by this library
LA: ENGLISH
AB: The efficacy of gamma radiation and ethylene oxide fumigation as decontaminating treatments for spices used in sausages was compared. Microbial loads of sausages containing irradiated, fumigated or non-treated spices were examined over three intervals of time. No significant differences between microbial loads of Mexican sausages containing irradiated spices (10 kGy) verses ethylene oxide-treated spices were found. Mexican sausages containing treated spices had significantly lower yeast, mould and spore counts than control sausages. After 8 weeks of storage, only the microbial loads of control sausages suggested spoilage. No discernable differences in treatment efficacy were noted with respect to yeast, mould and spore counts in Italian sausages.

18 of 24

TI: Position of the American Dietetic Association: food irradiation.
SO: J-Am-Diet-Assoc. 1996 Jan; 96(1): 69-72
this source is not Available by this library
LA: ENGLISH

19 of 24

TI: [Electron spin resonance spectroscopy investigations of fresh fruit. Evidence of treatment with ionizing radiation]
AU: Helle-N; Wolbert-A; Linke-B; Ehlers-D; Kruger-KE
AD: Staatliches Veterinaruntersuchungsamt fur Fische und Fischwaren Cuxhaven, Germany.
SO: Z-Lebensm-Unters-Forsch. 1995 Oct; 201(4): 355-60
this source is not Available by this library
LA: GERMAN; NON-ENGLISH
AB: This paper describes the development of a method for the identification of irradiated fresh fruits by measurement of the e.p.r. spectra of pips, kernels or stones. Measurement parameters were optimized and the irradiation specific spectrum was assigned to a cellulose radical by comparison with the e.p.r. spectrum of pure cellulose. Several fruits especially different varieties of strawberries were examined giving the following results: Detectable minimum doses were between 0.4 kGy and 0.9 kGy and the intensity of the irradiation specific signals was found to be linear up to doses of 11 kGy. The lifetime of the specific radicals (at room temperature and at deep freezing temperatures) was long enough compared to the storage time of fresh fruits. Additional information about the nature of the unspecific central signal was gained measuring the samples which were stored at different temperatures. The main conclusion of this study is that the e.p.r. method seemes to be well suited for the use in routine control and should be tested in an intercomparison to establish a routine method for the identification of irradiated fresh fruits.

20 of 24

TI: Alteration of apparent viscosity of irradiated pepper--a tool for semi-quantitative estimation of irradiation dose.
AU: Esteves-P; Polonia-I; Andrade-ME; Empis-J
AD: INIA, Quinta do Marques, Oeiras, Portugal.
SO: Z-Lebensm-Unters-Forsch. 1993 Oct; 201(4): 351-4
this source is not Available by this library
LA: ENGLISH
AB: The feasibility of using apparent viscosity (eta a) as a method for detecting the occurrence of previous irradiation of pepper was studied. Apparent viscosity of heat-treated suspensions of white and black pepper, nonirradiated or irradiated with different doses of ionising radiation (gamma), was measured under different "shear rates". Results of previous research were therefore expanded and their usefulness examined; low shear rate conditions

were found to be preferable for the detection and semi-quantitative evaluation of irradiation doses. The experimental methodology for semi-quantitative estimation was developed and its scope and limitations are presented.

21 of 24

TI: Irradiation for the prevention of foodborne diseases.
SO: Bull-Fan-Am-Health-Organ. 1995 Sep; 29(3): 279-81
This source is Available only few issues by this library
Call Number: From: 1972-1993
LA: ENGLISH

22 of 24

TI: Effect of irradiation on the microbiological status and flavouring materials of selected spices.
AU: Farag-SE; Aziz-NH; Attia-FS
AD: National Centre for Radiation Research and Technology, Nasr City, Cairo, Egypt.
SO: Z-Lebensm-Unters-Forsch. 1995 Sep; 201(3): 283-8
this source is not Available by this library
LA: ENGLISH
AB: Spices from Egyptian local markets were irradiated with different recommended doses (0, 5, 10, 20 and 30 kGy). The spices tested included dried leaves of marjoram (Majorana hortensis Moench), rhizomes of ginger (Zingiber officinale Roscoe) and powdered hot pepper (Capsicum annum L.). The study included the isolation and identification of micro-organisms in spices following their irradiation, as well as gas chromatographic (GLC) chemical analysis for the presence and structure of volatile oils, pungent and pigment materials. The results showed that hot pepper was contaminated more (9.2 x 10(5)/g) than marjoram (4.2 x 10(3)/g) and ginger (14.3 x 10(3)/g) with respect to total aerobic bacterial content. The total contents of moulds were 4.8 x 10(3)/g, 5.7 x 10(3)/g and 19 x 10(3)/g in the same spices, respectively, but the pathogenic moulds and bacterial strains differed according to the type of spice. Irradiation at 10, 20 and 30 kGy caused complete elimination of micro-organisms, whereas 5 kGy was less effective. With the GLC method chosen 18 and 50 compounds could be detected in the extracts of marjoram and ginger, respectively; gamma-terpinen and zingiberen being the major compounds in marjoram and ginger, respectively. A noticeable reduction was observed in the amount of terpenes present in irradiated marjoram; they were converted to monoterpenesalcohols. Ginger was more sensitive to irradiation, especially at high doses, but moderate changes were detected at low doses (5 and 10 kGy). A slight, but significant effect on the capsaicin (pungent compound) in hot-pepper was observed following irradiation, whereas no changes in total pigments resulted at any dose. These results prove that 10 kGy is a sufficiently high dose to eliminate the micro-organisms in spices, causing only slight changes in the flavouring materials.

23 of 24

TI: Consumer acceptance of irradiated poultry.
AU: Hashim-IB; Resurreccion-AV; McWatters-KH
AD: Department of Food Science and Technology, College of Agricultural and Environmental Sciences, University of Georgia, Griffin 30223-1797, USA.
SO: Poult-Sci. 1995 Aug; 74(8): 1387-94
this source is not Available by this library
LA: ENGLISH
AB: A simulated supermarket setting (SSS) test was conducted to determine whether consumers (n = 126) would purchase irradiated poultry products, and the effects of marketing strategies on consumer purchase of irradiated poultry products. Consumer preference for irradiated poultry was likewise determined using a home-use test. A slide program was the most effective educational strategy in changing consumers' purchase behavior. The number of participants who purchased irradiated boneless, skinless breasts and irradiated thighs after

the educational program increased significantly from 39.5 and 61.9% to 83.3 and 85.7% for the breasts and thighs, respectively. Using a label or poster did not increase the number of participants who bought irradiated poultry products. About 84% of the participants consider it either "somewhat necessary" or "very necessary" to irradiate raw chicken and would like all chicken that was served in restaurants or fast food places to be irradiated. Fifty-eight percent of the participants would always buy irradiated chicken if available, and an additional 27% would buy it sometimes. About 44% of the participants were willing to pay the same price for irradiated chicken as for nonirradiated. About 47% of participants were willing to pay 5% or more than what they were currently paying for nonirradiated chicken. Seventy-three percent or more of consumers who participated in the home-use test (n = 74) gave the color, appearance, and aroma of the raw poultry products a minimum rating of 7 (= like moderately). After consumers participated in a home-use test, 84 and 88% selected irradiated thighs and breasts, respectively, over nonirradiated in a second SBS test.

TI: Irradiation-induced off-odour in chicken and its possible control.
AU: Patterson-RL ; Stevenson-MH
AD: Department of Food Science, Queen's University of Belfast, Northern Ireland.
SO: Br-Poult-Sci. 1995 Jul; 36(3): 425-41

LA: ENGLISH
AB: 1. Volatiles isolated from irradiated raw chicken were analysed by gas chromatography (GC) in conjunction with olfactory assessment of the effluent carrier gas to locate compounds with strong smells. 2. Sixteen odours of differing intensities were registered, some, but not others, coinciding with recognisable GC peaks. Identifications were made on the basis of retention data, mass spectrometric information and odour quality agreement. 3. Dimethyltrisulphide was found to be the most potent and obnoxious compound (foul gas, sulphurous), followed by cis-3- and trans-3-nonenals (soapy), oct-1-en-3-one (mushroom) and bis(methylthio-)methane (foul). With the exception of oct-1-en-3-one, none of these compounds has been reported before in irradiated raw chicken. 4. alpha-Tocopherol and ascorbic acid induce stability in tissues in vivo and post mortem. Chickens were reared on diets supplemented with high concentrations (800 mg/kg food) of each of these vitamins. Yields of irradiation volatiles from the tissues of these birds were very much reduced, compared to yields from similar tissues from birds fed unsupplemented diets. 5. Concomitantly with the reduced yield of volatiles, less odour was associated with the samples when analysed by GC-olfactory analysis. 6. The use of enhanced concentrations of the two vitamins in combination in the diet of poultry may provide a means of controlling development of off-odour in irradiated raw chicken, thus improving acceptability to the consumer.

1 of 24

TI: Detection of irradiated chicken meat by analysis of lipid extracts for 2-substituted cyclobutanones using an enzyme linked immunosorbent assay.
AU: Elliott-CT; Hamilton-L; Stevenson-MH; McCaughey-WJ; Boyd-D
AD: Department of Agriculture for Northern Ireland, Belfast, UK.
SO: Analyst. 1995 Sep; 120(9): 2337-41
this source is not Available by this library
LA: ENGLISH
AB: The means to detect the irradiation of food has been investigated for many years. In recent times radiolytic products, termed 2-alkylcyclobutanones (2-CBs), have been identified as excellent markers of irradiation in lipid-containing foods. An ELISA test was developed, which was capable of detecting a number of these compounds in irradiated chicken meat. A polyclonal antiserum was raised to a 2-CB containing a terminal carboxyl group conjugated to a carrier protein. This antiserum was highly specific for cyclobutanones containing C10 and C12 side chains. During assay validation the limit of detection of the assay was calculated to be 0.064 microgram of 2-CB per gram of fat, within- and between-assay variations ranged from 6.7 to 18%. During experimental studies, chicken meat irradiated at doses ranging from 2.5 to 10 kGy were assayed and correctly identified as being treated. Quantitative comparisons between the ELISA and GC-MS revealed a good correlation (r2 = 0.93) between the two methodologies in concentrations of 2-CB detected in irradiated samples.

2 of 24

TI: Effect of gamma-radiation on migration behaviour of dioctyladipate and acetyltributylcitrate plasticizers from food-grade PVC and PVDC/PVC films into olive oil.
AU: Goulas-AE; Kokkinos-A; Kontominas-MG
AD: Department of Chemistry, University of Ioannina, Greece.
SO: Z-Lebensm-Unters-Forsch. 1995 Jul; 201(1): 74-8
this source is not Available by this library
LA: ENGLISH
AB: Food-grade PVC and PVDC/PVC films containing 28.3% dioctyladipate (DOA) and 5.0% acetyltributylcitrate (ATBC) plasticizers, respectively, were brought into contact with olive oil and were irradiated with gamma-radiation [60Co] at doses equal to 4 kGy and 9 kGy corresponding to "cold pasteurization". Irradiation was carried out at 8-10 degrees C and samples were subsequently stored at 4-5 degrees C. Contaminated oil samples were analysed for DOA and ATBC at intervals between 7 h and 97 h of contact, using an indirect GC method. Identical nonirradiated (control) samples were also analysed for DOA and ATBC content. Results showed no statistically significant differences in migrated amounts of DOA and ATBC between irradiated and non-irradiated samples. Neither were differences observed between samples irradiated at 4 kGy and 9 kGy. This was supported by identical IR spectra recorded for irradiated and non-irradiated samples and leads to the conclusion that at such intermediate radiation doses (< or = 9 kGy) the migration characteristics of both PVC and PVDC/PVC films are not affected. The amount of DOA that migrated into olive oil was dependent on time, reaching equilibrium after approximately 47 h of contact (302.8 mg/l). The amount of ATBC that migrated into olive oil was non-detectable (< 1 mg/l) for all samples stored at 4-5 degrees C after 97 h. In non-irradiated samples (PVDC/PVC in contact with oil) stored at 20 degrees C, small amounts of migrated ATBC were determined (3.3 and 5.1 mg/l after 29 h 94 h of contact

respectively).(ABSTRACT TRUNCATED AT 250 WORDS)

3 of 24

TI: Rumen degradability of dry matter and crude fibre of irradiated and sodium hydroxide treated straws.
AU: Gralak-MA; Mahmood-S; Barej-W
AD: Department of Animal Physiology, Faculty of Veterinary Medicine, Warsaw Agricultural University, Poland.
SO: Arch-Tierernahr. 1994; 47(1): 63-74
this source is not Available by this library
LA: ENGLISH
AB: Wheat straw (WS) and triticale straw (TS) were treated with 2- and 4%-NaOH and/or 300- and 600-kGy radiation doses (accelerated electrons) for improvement of the nutritional value of these feeds. Beside the chemical composition of straws, the nylon bag rumen disappearance of dry matter and crude fibre was estimated. NaOH did not influence the chemical composition of straws, while irradiation significantly reduced the level of crude fibre (CF), neutral detergent fibre (NDF) and acid detergent fibre (ADF) proportionally to the dose. The level of nitrogen free extractives (NFE) and alpha-linked glucose polymers pronouncedly increased in the radiated straws. NaOH treatment raised potential rumen degradability of DM and irradiation did so in the case of potential as well as effective degradability. It was not able to prove the summarized influence of both treatments on DM and CF rumen degradability of the straws. The dynamics of the rumen disappearance of DM was different in the straws.

4 of 24

TI: [Raising quality and safety of raw foodstuffs and food products and improving nutrition structure of the population]
AU: Sviachovskaia-IV
SO: Vopr-Pitan. 1993(3): 44-8
this source is not Available by this library
LA: RUSSIAN; NON-ENGLISH

5 of 24

TI: Effects of gamma irradiation on mycotoxin disappearance and amino acid contents of corn, wheat, and soybeans with different moisture contents.
AU: Hoosbmand-H; Klopfenstein-CF
AD: Department of Grain Science and Industry Kansas State University Manhattan 66506, USA.
SO: Plant-Foods-Hum-Nutr. 1993 Apr; 47(3): 227-38
this source is not Available by this library
LA: ENGLISH
AB: The effects of gamma irradiation on degradation of aflatoxin B1 in wheat, corn, and soybeans and of T-2 toxin in wheat, deoxynivalenol (DON) in soybeans, and zearalenone in corn at 9, 13, and 17% moisture were studied. Radiation doses of 5, 7.5, 10 or 20 kGy were applied to spiked grain samples, and the residual toxins were measured using an enzyme linked immunosorbent assay (ELISA). Irradiation does of up to 20 kGy did not significantly affect aflatoxin B1 in any of the three grains, but significant reductions occurred in T-2 toxin, DON, and zearalenone concentration at doses of 10 or 20 kGy and in T-2 toxin at the 7.5 kGy dose. Two-way analysis of variance with Tukey's Multiple Range Test showed no significant interaction between radiation dose and grain moisture level. Irradiation of the ground grains at doses higher than 5 kGy resulted in small, but significant, losses of lysine in corn (only at 7.5 kGy), wheat, and soybeans, and methionine was reduced in wheat and corn samples. In some cases, phenylalamine decreased in corn and wheat, and histidine levels in wheat were reduced in samples receiving 7.5 kGy of irradiation. Other essential amino acids were not affected significantly by irradiation.

TI: Safety and nutritional adequacy of irradiated food [letter]
AU: Smit-BJ
SO: S-Afr-Med-J. 1995 Jun; 85(6): 544, 546
this source is not Available by this library
LA: ENGLISH

TI: Growth of untreated and radiation-damaged Listeria as affected by environmental factors.
AU: Farkas-J; Andrassy-E; Meszaros-L; Banati-D
AD: Department of Refrigeration and Livestock-Products Technology, University of Horticulture and Food Industry, Budapest, Hungary.
SO: Acta-Microbiol-Immunol-Hung. 1995; 42(1): 19-28
this source is not Available by this library
LA: ENGLISH
AB: The growth of untreated Listeria monocytogenes 4ab No. 10 and that of the surviving fraction of its population treated with 0.8 kGy gamma rays was investigated in a microtitreplate system at incubation temperatures between 3 degrees C and 35 degrees C in Tryptic Phosphate Broth (TPB) or Brain Heart Infusion Broth (BHIB) media containing NaCl between 0.25 to 16.75% (w/v), and acidified with citrate-phosphate buffers to pH values between 4.63 and 7.06. The initial viable count was 3 x 10(3)/ml. Time periods to visible growth were recorded. Radiation survivors showed increased salt- and pH-sensitivities and increased minimum temperature for growth in TPB-based media. Adverse effects of sub-optimal environmental factors (reduced water activity, pH and temperature) and radiation injury were much less pronounced in BHIB-based media. Polynomial equations describing the combined effects of hydrogen ion and salt concentrations on the detectable growth at 30 degrees C were constructed for quantitative assessment of interactions. The results demonstrate that combining environmental stresses with low-dose irradiation can control growth of L. monocytogenes.

TI: Sensitivity of Campylobacter spp. to irradiation in poultry meat.
AU: Patterson-MF
AD: Food Science Division (Food Microbiology), Department of Agriculture for Northern Ireland, Belfast.
SO: Lett-Appl-Microbiol. 1995 Jun; 20(6): 338-40
this source is not Available by this library
LA: ENGLISH
AB: The sensitivity of Campylobacter jejuni (three strains), Camp. coli (three strains), Camp. fetus (one strain) and Camp. lari (one strain) to irradiation in poultry meat was investigated. There was no significant difference in the counts obtained on Blood or Skirrows agar. Preston agar gave a significantly lower recovery of the pathogens after irradiation so these results were not included in calculations of D10 values. The D10 values ranged from 0.12 to 0.25 kGy and there was a significant difference in the radiation sensitivity between different Campylobacter spp. and within strains of the same species. These values indicate that Campylobacter spp. are more radiation-sensitive than Salmonella and Listeria monocytogenes irradiated under similar conditions. Therefore irradiation treatments suggested to eliminate the latter from poultry carcasses would also be sufficient to remove Campylobacter.

TI: [Detection of enzyme activity in decontaminated spices in industrial use]
AU: Muller-R; Thedald-R
AD: Institut fur Forschung und Entwicklung, CPC Deutschland, Heilbronn, Germany.
SO: Z-Lebensm-Unters-Forsch. 1995 Mar; 200(3): 203-8
this source is not Available by this library

LA: GERMAN; NON-ENGLISH
AB: A range of decontaminated species of industrial use have been examined for their enzymes (catalase, peroxidase, amylase, lipase activity). The genuine enzymes remain fully active in irradiated spices, whereas the microbial load is clearly reduced. In contrast steam treated spices no longer demonstrate enzyme activities. Steam treatment offers e.g. black pepper without lipase activity, which can no longer cause fat deterioration. Low microbial load in combination with clearly detectable enzyme activity in spices is an indication for irradiation, whereas, reduced microbial contamination combined with enzyme inactivation indicate steam treatment of raw material.

10 of 24

TI: [Bakery goods from irradiated and unirradiated eggs--detection of irradiation in a processed food]
AU: Pfordt-J; von-Grabowski-HU
AD: Staatliches Lebensmitteluntersuchungsamt Oldenburg, Germany.
SO: Z-Lebensm-Unters-Forsch. 1995 Mar; 200(3): 198-202
this source is not Available by this library
LA: GERMAN; NON-ENGLISH
AB: The detection of radiation-specific degradation products in fat has become an established method which has successfully been applied to egg products. This study is making evident the detectability of irradiated eggs as an ingredient of specified processed foods. Tart layers were produced from both irradiated and non-irradiated liquid whole egg. When the fat components were isolated from the tart layers and investigated by GC/MS, the presence of irradiated eggs could clearly be shown. While the radiation-induced hydrocarbons and 2-alkylcyclobutanones could not be found in unirradiated samples, tart layers from irradiated eggs contained these substances. Especially for the hydrocarbons a satisfying correlation between radiation dose and concentration could be observed. The concentrations of radiation-induced compounds were generally lower in the tart layers than in the liquid egg samples they had been produced from.

11 of 24

TI: A microbiological screening method for the indication of irradiation of frozen poultry meat.
AU: Wirtanen-G; Salo-S; Karwoski-M; Sjoberg-AM
AD: VTT Biotechnology and Food Research, Finland.
SO: Z-Lebensm-Unters-Forsch. 1995 Mar; 200(3): 194-7
this source is not Available by this library
LA: ENGLISH
AB: A microbiological screening method for the detection of irradiation of frozen poultry meat was developed on the basis of the combined use of total cell count by the direct epifluorescent filter technique (DEFT) and viable cell count by the aerobic plate count method (APC). Samples of ground, deboned poultry leg were irradiated or not with dose levels of 3, 5 and 7 kGy using an electron beam accelerator. All samples were frozen before the irradiation treatment. The average values of the differences between DEFT and APC counts in control samples and those irradiated with doses of 3, 5 and 7 kGy were 1.14 log units for control samples, and 3.16, 3.68 and 3.79 log units for the irradiated samples. A difference of at least 2 log units can therefore be considered as a limit value indicating probable irradiation treatment necessitating further investigations.

12 of 24

TI: Enterohaemorrhagic Escherichia coli: an emerging food-borne pathogen with serious consequences [editorial]
AU: Robins-Browne-RM
SO: Med-J-Aust. 1995 May 15; 162(10): 511-2
This source is Available by this library
Call Number: From: 1966+

LA: ENGLISH

13 of 24

TI: Guaranteed safe meat?
AU: Vogel-LP
SO: J-Am-Vet-Med-Assoc. 1995 Feb 15; 206(4): 432-3
this source is not Available by this library
LA: ENGLISH

14 of 24

TI: [Electron spin resonance measurements on dried fruit. Carbohydrate composition and ESR signal structure of irradiated fruit]
AU: Mischke-J; Helle-N; Linke-B; Schreiber-GA; Bogl-KW
AD: Bundesinstitut fur gesundheitlichen Verbraucherschutz und Veterinarmedizin Fachgebiet Lebensmittelbestrahlung, Berlin.
SO: Z-Ernahrungswiss. 1994 Dec; 33(4): 258-66
this source is not Available by this library
LA: GERMAN; NON-ENGLISH
AB: While in a previous work the ESR spectroscopic detection of irradiated dried fruits was reported, in this paper liquid chromatographic determination of the carbohydrate fraction of these fruits is introduced and connected with the ESR results. After irradiation of dried fruits three different types of ESR spectra are observed. In most cases the dried fruits can be attached to these various types by means of their sugar composition. It was also found that the ESR spectra observed for sucruse-rich fruits are very similar to that of pure sucrose. The structure of the ESR spectra can change with storage. Probably, radical rearrangement reactions in the samples are responsible for these changes.

15 of 24

TI: Effects of infrared radiation, solar cooking and microwave cooking on alpha-amylase inhibitor in sorghum (Sorghum bicolor L.).
AU: Mulimani-VH; Supriya-D
AD: Department of Biochemistry, Gulbarga University, Karnataka, India.
SO: Plant-Foods-Hum-Nutr. 1994 Oct; 46(3): 231-5
this source is not Available by this library
LA: ENGLISH
AB: Three domestic cooking methods were studied in alpha-amylase inhibitory activity in sorghum grains. In all the treatments, overnight soaked seeds lost amylase inhibitory activity much faster. All the three treatments reduced the inhibitory activity. Use of solar cooker for reducing amylase inhibitory activity works out very economically and efficiently. Microwave cooking eliminates amylase inhibitory activity within 5 minutes.

16 of 24

TI: Supplementation of irradiated and non-irradiated cowpea bean (Vigna unguiculata L. Walp) protein with cereal proteins. Supplementation of soup with a protein blend of appropriate nutritional value.
AU: Dario-AC; Salgado-JM
AD: Setor de Nutricao Humana e Alimentos, Escola Superior de Agricultura Luiz de Queiroz, Universidade de Sao Paulo, Piracicaba, Brazil.
SO: Plant-Foods-Hum-Nutr. 1994 Oct; 46(3): 213-9
this source is not Available by this library
LA: ENGLISH
AB: The quality of the cowpea bean protein was improved through supplementations with flours from beans exposed to microwave oven treated with cereal proteins such as wheat, rice, corn, and sorghum. Biological assays results with these blends showed that the casein exceeded the other diets concerning digestibility only; however, in parameters such as biological value, net protein utilization (NPU), protein efficiency ratio (PER) and nutritional efficiency ratio (NER), no significant differences occurred. Among all

elaborated blends, the one with irradiated beans submitted to microwave oven for 30 minutes (65%) + rice (35%) presented the best results. The soup elaborated with the best supplemented blend was satisfactory concerning color, odor, flavor and texture.

17 of 24

TI: Effect of thermal treatments on the chemical and biological value of irradiated and non-irradiated cowpea bean (Vigna unguiculata L. Walp) flour.
AU: Dario-AC; Salgado-JM
AD: Setor de Nutricao Humana e Alimentos, Escola Superior de Agricultura, Luiz de Queiroz, Universidade de Sao Paulo, Brazil.
SO: Plant-Foods-Hum-Nutr. 1994 Sep; 46(2): 181-6
this source is not Available by this library
LA: ENGLISH
AB: Chemical and nutritional characteristics of irradiated and nonirradiated cowpea bean at 0.2 kGy submitted to several thermal treatments were studied. The cowpea bean flours irradiated at 0.2 kGy were superior to those non-irradiated concerning digestibility and the flours submitted to microwave oven were superior to those cooked under low pressure, autoclaved or even raw from the nutritional point of view. As to the presence of anti-nutritional factors, the results showed that the variety of cowpea bean under research presented neither trypsin inhibitor nor haemagglutinin activity, however, regarding tannin, a 0.006% content was found and considered negligible.

18 of 24

TI: [Chemiluminescence method for the detection of radiation-induced oxidation products in fat-containing foods]
AU: Matthaus-B; Wiezorek-C; Eichner-K
AD: Bundesanstalt fur Getreide-, Kartoffel- und Fettforschung, Institut fur Chemie und Physik der Fette, Munster, Germany.
SO: Z-Lebensm-Unters-Forsch. 1994 Oct; 199(4): 294-300
this source is not Available by this library
LA: GERMAN; NON-ENGLISH
AB: Radiation-induced oxidation of fatty foods was detected by a chemiluminescence method. Hazelnuts, peanuts and poultry were used as foodstuff samples. Additional investigations were performed with a model system and sunflower oil. The irradiation of the samples was carried out in a x-ray-fluorescence-apparatus. Thereby it is to note that the G-value of the x-ray-radiation is much higher than the G-value of a cobalt-60-source normally used for irradiation of food. A dependence of the integral of the light curve on the irradiation doses could be proved. Investigations with model systems which contained different amounts of alpha-tocopherol showed a decreasing chemiluminescence signal at low irradiation doses in presence of alpha-tocopherol. At higher doses the chemiluminescence signal enlarges with increasing amounts of alpha-tocopherol because irradiation products of alpha-tocopherol overlay its antioxidative effect. Irradiated poultry samples differ significantly from unirradiated samples after a deep-freeze storage of 26 weeks. A quantification of the doses is not possible without knowledge of the storage time, because the integrals decrease differently after irradiation during storage. In any case the chemiluminescence method is useful as a "screening method" for the detection of irradiation of foodstuffs with the possibility of automation and high sensitivity.

19 of 24

TI: Food irradiation.
AU: Woods-RJ
AD: Department of Chemistry, University of Saskatchewan.
SO: Endeavour. 1994; 18(3): 104-8
this source is not Available by this library
LA: ENGLISH
AB: Large amounts of food, perhaps as much as one quarter of the world's

agricultural production, is lost due to spoilage or contamination by harmful bacteria and other parasitic life forms. Food irradiation is an energy-efficient, non-chemical method of food processing that can help reduce these huge losses. Properly treated, irradiated foods retain their fresh appearance, flavour, and nutritional value, while most foods can be pre-packaged before irradiation, reducing the risk of recontamination. The technology for food irradiation is now well developed and irradiated foods are gaining public acceptance as they become more widely available.

20 of 24

TI: [Characterization of the minimal lethal dose of gamma irradiation for Penicillium citrinum]
AU: Norberg-AN; Serra-Freire-NM
AD: Instituto de Biologia do Exercito, Rua Francisco Manuel, Rio de Janeiro, Brasil.
SO: Rev-Inst-Med-Trop-Sao-Paulo. 1993 Nov-Dec; 35(6): 527-33
this source is not Available by this library
LA: PORTUGUESE; NON-ENGLISH
AB: The use of nuclear power through radiation or the destruction of microorganisms which cause food decay, and toxicosis, is specifically for peaceful purposes. Penicillium citrinum is a fungus which produce mycotoxins responsible for intoxication in humans and animals as a result of eating contaminated food. There is little informations on the resistance of P. citrinum to radiation. The objective of this research is to determine the lethal dose of gama radiation for these microorganisms. Seventy six suspensions containing approximately 100,000 spores/ml received a dose of radiation between 0.2 and 2.2 KGy (KiloGray), being one sample still alive re-irradiated with doses up to 3.0 KGy. The fungus were totally destroyed with a 2.2 KGy. Seventy six suspensions containing approximately 100,000 spores/ml received a dose of radiation between 0.2 and 2.2 KGy, being one sample still alive re-irradiated with doses up to 3.0 KGy. The fungus were totally destroyed with a 2.2 KGy dose. An increase in the resistance to lower dose levels of radiation was observed, in relation to the fungus which had not received irradiation. Conclusion: the Minimum Lethal Dose (M.L.D) of gamma irradiation, for P. citrinum is 2.2 KGy; the re-irradiation of the surviving fungus demonstrate that occur appearance of radio-resistant mutants.

21 of 24

TI: Fright [editorial]
AU: Thomasson-JB
SO: J-Tenn-Med-Assoc. 1994 Oct; 87(10): 444-5
this source is not Available by this library
LA: ENGLISH

22 of 24

TI: Nutritional and other implications of irradiating meat.
AU: Stevenson-MH
AD: Food and Agricultural Chemistry Research Division, Department of Agriculture for Northern Ireland, Belfast.
SO: Proc-Nutr-Soc. 1994 Jul; 53(2): 317-25
this source is not Available by this library
LA: ENGLISH

23 of 24

TI: Effect of microwave pretreatment on heterocyclic aromatic amine mutagens/carcinogens in fried beef patties.
AU: Felton-JS; Fultz-E; Dolbeare-FA; Knize-MG
AD: Biology and Biotechnology Research Program, Lawrence Livermore National Laboratory, CA 94551-990.
SO: Food-Chem-Toxicol. 1994 Oct; 32(10): 897-903
this source is not Available by this library

LA: ENGLISH
AB: To investigate a method to reduce the amount of mutagenic/carcinogenic heterocyclic aromatic amines formed during frying of ground beef, the mutagenic activity in Salmonella strain TA98 was assessed and the amount of known heterocyclic amines was determined by solid-phase extraction and HPLC. The beef patties received microwave treatment for various times before frying. Microwave pretreatment for 0, 1, 1.5, 2 or 3 min before frying at either 200 degrees C or 250 degrees C for 6 min per side reduced heterocyclic aromatic amine precursors (creatine, creatinine, amino acids, glucose), water, and fat up to 30%, in the patties and resulted in a decrease in mutagenic activity up to 95%. The sum of the four heterocyclic aromatic amines shown to be present--2-amino-3,8-dimethylimidazo[4,5-f]-quinoxaline (MeIQx), 2-amino-3-methylimidazo[4,5-f]quinoline (IQ), 2-amino-3,4,8-trimethylimidazo-[4,5-f]quinoxaline (DiMeIQx) and 2-amino-1-methyl-6-phenylimidazo[4,5-b]pyridine (PhIP)--decreased three- to nine-fold compared with control, non-microwaved beef patties fried under identical conditions.

24 of 24

TI: Evaluation of a gas chromatographic method to identify irradiated chicken, pork, and beef by detection of volatile hydrocarbons.
AU: Schreiber-GA; Schulzki-G; Spiegelberg-A; Helle-N; Bogl-KW
AD: Federal Institute for Health Protection of Consumers and Veterinary Medicine, Berlin, Germany.
SO: J-AOAC-Int. 1994 Sep-Oct; 77(5): 1202-17
this source is not available by this library
LA: ENGLISH
AB: A method suitable for routine application was used in an interlaboratory study to detect irradiation treatment of chicken carcass, pork, and beef. By using gas chromatographic analysis, 17 participating laboratories determined the quantity of 4 different radiation-induced volatile hydrocarbons (tetradecene, pentadecane, hexadecadiene, and heptadecene) in the fat fraction of coded specimens approximately 3 and 6 months after irradiation. The specimens of each type of meat were supplied by 2 different producers. The dose range tested (0.6-7.3 kGy) included levels commercially used to reduce the number of contaminating microorganisms (1-5 kGy). The method employed permitted a correct identification of irradiated or nonirradiated in 98.3% of the 864 specimens.

1/8/99

FEEDING POISON?

Plastic baby feeding bottles leach out toxic chemical

THE US Consumers' Union (CU) — an independent, non-profit testing and information organisation serving only consumers, and publisher of the US *Consumer Reports* — has warned parents to throw away all clear, shiny plastic baby bottles made of polycarbonate.

The above alert came on the heels of its findings — announced just 3 months ago — which show that such bottles leach out Bisphenol-A, an endocrine-disrupting chemical which has the potential to disrupt the hormonal development of children.

CU's latest findings confirmed the US Food and Drug Administration (FDA)'s findings in 1997 which indicated that BPA migrates out of clear plastic polycarbonate containers when heated.

At least 2 studies in Japan have also found Bisphenol-A migrating from polycarbonate, and more so from worn, scratched polycarbonate.

Bisphenol-A has been shown in laboratory studies to cause permanently enlarged prostates, reduced sperm production and increased aggression in male mice.

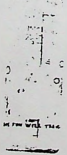
The above findings are a grave cause for concern

SUMER brings you the perils of polycarbonate and the blight of Bisphenol-A, and tells you what precautionary measures to take.

FILL a plastic baby bottle with warm water — hot, if you're planning a trip — mix in infant formula, shake well; later heat up bottle plus milk before feeding and what do you get? Baby milk laced with a chemical that can interfere with a baby's normal development!

Yes, plastic baby feeding bottles can leach out a toxic chemical, poisoning children. This shocking discovery was made in a recent US Consumers' Union (CU) test.

CU bought 6 plastic baby bottles made of polycarbonate and heated plastic from each in simulated infant formula. They found that the plastic from each of the bottles leached into their test formula a chemical called Bisphenol-A (BPA)

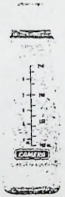


normal development.

Based on testing with an intact bottle, CU calculates that a typical baby who drank formula sterilized by heating in the bottle would be exposed to a BPA dose of about 4% of an amount that adversely affected test animals in studies by Frederick vom Saal, professor of biological science at the University of Missouri, Columbia (see separate story).

According to CU in the May 1999 issue of *Consumer Reports*, "Such exposure may sound very low. However, safety limits for infant exposure can be set as low as 0.1% of the level that has adversely affected animals.

"Babies who used the bottles we tested could be exposed to a BPA dose 40 times higher than that



made from water and ethanol.

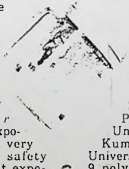
The vials containing the bottle strips were then heated in a dry, forced air oven at various temperatures (65°C - 100°C) and durations (30 minutes to several hours) designed to test a range of potential bottle-use scenarios.

The FDA found that BPA migrated out of the material at levels that resulted in detection of the substance in the range of 1 part per billion (ppb).

Recent Japanese studies have also concluded that BPA can leach out of polycarbonate baby bottles.

In a series of 1998 tests done by the Prefectural University of Kumamoto and University of Nagasaki, 9 polycarbonate baby bottles were first washed and sterilized, then filled with distilled water and heated in a 95°C dry oven for 30 minutes.

The tests showed that new baby bottles that were washed



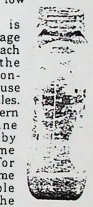
tles.

The Japanese tests also found leaching at temperatures as low as 60°C (140°F).

Although it is unclear at what age bottles begin to leach more BPA, the results raise concerns about the use of older baby bottles. It also raises concern over the routine exposure of baby bottles to extreme temperatures for long periods of time and inevitable scratching of the bottle during washing in ordinary home use.

Widely sold here

CAP's survey of several supermarkets in Penang found most plastic baby bottle used to be of the clear, shiny type. Not all label their ingredients. Most of the brands that do reassure you with claims like "made of high quality



polycarbonate.

Our survey shows that polycarbonate is also used in making drinking cups for babies. Two brands of drinking cups made of polycarbonate are *Camera Training Cup* and *Freedom House Weighted Drinking Cup*.

We also managed to buy a feeding dish (*Pigeon* brand) made of polycarbonate.

Our survey indicates that polycarbonate is widely used in baby feeding products. This means that Malaysian parents could be exposing their children to toxic BPA.

Since BPA acts like a hormone in the human body, it poses a grave risk to children.

For a young baby whose body is rapidly developing in response to tiny, perfectly timed hormone signals in the body, there is no way to know the subtle ways that an artificial hormone-like substance can interfere with that development. So why expose them to unnecessary risks?

Because of their metabolism, size and rapid development, children are far more vulnerable to toxic insults than are adults. Children should thus, in general, avoid unnecessary exposure to all chemical substances that could have developmental effects.

NOT-2

and more so from worn, scratched polycarbonate.

Bisphenol-A has been shown in laboratory studies to cause permanently enlarged prostates, reduced sperm production and increased aggression in male mice.

The above findings are a grave cause for concern as most plastic baby feeding bottles sold in Malaysia contain polycarbonate. A recent CAP survey turned up no fewer than 9 brands with this material. Are we feeding our young ones poison?

UTUSAN KONSUMER children. This shocking discovery was made in a recent US Consumers' Union (CU) test.

CU bought 6 plastic baby bottles made of polycarbonate and heated plastic from each in simulated infant formula. They found that the plastic from each of the bottles leached into their test formula a chemical called Bisphenol-A (BPA), which in lab animals has produced physiological effects similar to those produced by estrogen.

BPA is an endocrine-disrupting chemical (see box story). Endocrine disrupting chemicals interfere with or mimic the action of hormones, possibly upsetting

CU in the May 1999 issue of *Consumer Reports*. Such exposure may sound very low. However, safety limits for infant exposure can be set as low as 0.1% of the level that has adversely affected animals.

"Babies who used the bottles we tested could be exposed to a BPA dose 40 times higher than that conservative definition of safety."

The CU test was to replicate an earlier 1997 US Food and Drug Administration (FDA) test 2 years earlier. In the FDA test, cut-up strips of various baby bottles were placed in vials containing infant formula simulant

1998 tests done by the Prefectural University of Kumamoto and University of Nagasaki, 9 polycarbonate baby bottles were first washed and sterilized, then filled with distilled water and heated in a 95°C dry oven for 30 minutes.

The tests showed that new baby bottles that were washed gently before filling leached out between 1 and 3 ppb of BPA. Used bottles leached more — between 1 and 6.5 ppb. Bottles that were extremely worn and scratched were found to leach even more — BPA levels of between 10 and 28 ppb were detected in the water inside the bot-

so (here

CAP's survey of several supermarkets in Penang found most plastic baby bottles used to be of the clear, shiny type. Not all label their ingredients. Most of the brands that do reassure you with claims like "made of high quality polycarbonate" or "polycarbonate feeder ... non-toxic".

Among the brands of baby bottles sold which contain polycarbonate are: *Bibi, Bebe, Pigeon, Pureen, Puppy Winks, Doctor-Baby, Japlo, Tollyjoy* and *Camera*.

Pigeon's MagMag Drink Trainer Lid is also made of

rapid development, children are far more vulnerable to toxic insults than are adults. Children should thus, in general, avoid unnecessary exposure to all chemical substances that could have developmental effects.

To protect your baby from the potential harm of BPA leached out from plastic baby bottles, throw away all clear, shiny plastic baby bottles. Use glass bottles instead. They may be heavy and breakable, but it's a small price to pay for your baby's safety.

Bisphenol-A: What is it, where is it used?

PLASTICS are made by chemically binding monomers (plastic ingredients) into chains to form polymers, which are generally inert and usually insoluble in food.

However, some monomers can remain unattached and migrate into your food (more below).

Bisphenol-A (BPA) is a material made by combining acetone and phenol, which are both petroleum-based chemicals. BPA is used to make epoxy resins for adhesives, and polycarbonate plastics.

These polycarbonate plastics are used to make a variety of items including auto parts, household appliance parts, compact discs, bike helmets, and reusable bottles, and food and drink containers (including baby bottles).

Although BPA is a building block of polycarbonate plastic, not all of the BPA in polycarbonate fully "polymerizes" (ie become part of the plastic) to form polycarbonate. Some remain "unreacted". Some of the unreacted BPA get washed away in initial use and washings, but it can also migrate into the contents of the containers.

According to scientists at the University of Nagasaki, Japan, if the containers are scratched, even more leaching can occur. It has also been reported that BPA concentration can increase over time as the polycarbonate breaks down or depolymerizes.

BPA is a known endocrine disrupter — ie it can interfere with the hormone system — and dozens of studies have verified this effect over many years.

Before BPA was used as an ingredient in polycarbonate plastic the substance was recognized as a chemical that behaves like the hormone estrogen.

British scientists who analyzed organic compounds for estrogenic effects in the 1930s identified BPA as estrogenic in 1936 (*Nature*, 13 June 1936).

According to the US Environmental Protection Agency, even miniscule amounts of chemicals such as BPA can cause abnormal prostate development, lowered sperm production, early onset of puberty in females and changes in the breast and pituitary glands in laboratory animals.

BPA leached from PVC too!

RESEARCHERS at the National Institute for Environmental Studies said in an academic paper that they detected Bisphenol-A (BPA) in water in which pieces of 17 plastic products had been soaked for 14 days.

The plastics include vinyl chloride-based products such as dolls, teething rings and hoses, and epoxy resin-based products such as printed boards, said Takashi Yamamoto, leader of the National Institute for Environmental Studies research group.

Yamamoto said the water sample with the vinyl chloride doll had the highest concentration level of 38.1 micrograms per gram of water. One microgram is a millionth of a gram. The water samples with the vinyl chloride teething ring and hose also contained relatively high concentration levels, the paper said.

Apparently the BPA is used as an antioxidant in PVC. The leaching rate out of PVC was found to be far greater than BPA leaching from polycarbonate which contains BPA as material.

Why tiny amounts of some chemicals in our babies' food can be harmful

IT used to be thought that large amounts of chemicals are harmful and small doses are insignificant. But where endocrine-disrupting chemicals are concerned, extremely tiny amounts may be harmful. So say an increasing amount of emerging science.

HORMONE-DISRUPTING or endocrine-disrupting chemicals mimic the actions of natural hormones in the bodies of animals and humans. Many natural hormones act on body functions, especially fetal and child development, at extremely low levels. For example, estradiol is present in the bloodstreams of rodent fetuses at 0.2 parts per billion (ppb).

This extremely low level indicates that very small changes in hormone levels could have effects on fetal development. Extending this reasoning to manmade endocrine disrupters, it makes sense that a small dose of such it doesn't seem logical to test lower concentrations for effects.

Another problem was the difficulty in detecting concentrations of chemicals down to one ppb and less.

The above assumption has been proven wrong for some chemicals as our technology improved to measure smaller concentrations of substances.

New research

More recently, scientists have developed methods that measure smaller and smaller concentrations of chemicals — down to ppb or parts per trillion. And they have discovered that very small dose levels of endocrine-disrupting chemicals can have effects, especially on developing fetuses and infants.

Some effects have been shown to emerge in adults who were exposed in gestation to extremely low doses of a substance when their mothers were fed with these low doses.

Additional studies have found effects of natural and synthetic hormones and endocrine disrupters in children at higher levels, yet still well below those previously thought to be safe, when animals are exposed to them at the proper stage of development:

- Studies of the fungicides vincolozin and procymidone found that injection of small amounts of the substances into pregnant rats interferes with sexual differentiation among offspring and delayed the onset of puberty.
- A similar study of the pesticide methoxychlor found alterations of the reproductive tract of the male rat, decreased sperm count, and delays in mating.
- An examination of children inadvertently exposed to agricultural pesticides and other endocrine disrupters at levels below 1% of the acceptable daily intake suggests that exposure to these hormone disrupting substances may be associated with cryptorchidism, a male reproductive tract disorder associated with testicular cancer and infertility.

"Less can be
[illegible]

Sex organs in mice stunted by tooth-coating chemical

A STUDY conducted by N. Olea and colleagues in 1996 (*EHP*, 104: 298 - 305, 1996) found that saliva collected from dental patients an hour after having their teeth sealed contain high levels of Bisphenol-A (BPA).

The patients were treated with 50 mg of a dental sealant based on BPA. Their saliva, measured in a 1-hour collection after treatment, contained from 90-931 mcg of BPA.

The researchers also measured BPA in the saliva of an individual who had tooth sealant applied 2 years earlier and found 66.4 mcg in a 1-hour saliva collection before additional sealant treatment, suggesting that BPA may be continually released after the initial dental work.

People who swallow small quantities of the sealant during their treatment would be exposed to similar doses.

BPA mimics the effects of the female hormone estrogen in test-tube studies. To examine its effects on animals, Frederick vom Saal of the University of Missouri in Columbia and his colleagues fed the plastic, dissolved in vegetable oil, to pregnant mice.

For 7 days in the second half of their 3-week gestation, the mice ate 2 or 20 nanograms of BPA per gram of body weight per day.

Even at the lower dose, BPA affected the development of male fetuses. At birth, male pups were smaller than normal and had seminal vesicles that were 12% smaller than those in controls (*Toxicology and Industrial Health*, vol 14, p 239). In adults, seminal vesicles secrete the fluid in semen.

Vom Saal says that the lower dose used in his study is proportionally equivalent to the amount swallowed by patients in the first hour after treatment with a sealant containing BPA.

In canned foods

STUDIES conducted by J.A. Brotons and colleagues in 1995 revealed that Bisphenol-A (BPA) can be released from food can liners.

In their test, the liquid in some cans of tinned vegetables were found to contain both BPA, and a related chemical, dimethyl BPA.

According to the *Environmental Health* mushrooms.

The research also included an examination of cans of other, more fatty products, including condensed milk, pork and beans, and concentrated milk-based infant formula.

The products themselves were not analysed. Instead, the cans were emptied, cleaned, then filled with distilled water and autoclaved at 125°C

...e & child development, at extremely low levels. For example, estradiol is present in the bloodstreams of rodent fetuses at 0.2 parts per billion (ppb).

This extremely low level indicates that very small changes in hormone levels could have effects on fetal development. Extending this reasoning to manmade endocrine disrupters, it makes sense that a small dose of such chemicals could also have health effects if it were administered at the proper time during gestation, pregnancy, and child development.

"More is worse" theory outmoded

Prior to the late 1990s, most research on the potential health effects of chemicals focused on doses in the hundreds of parts per million. In general, researchers were seeking to find health effects that showed increased effects at increased doses of a substance.

Effects at each dose level were measured and compared with observations (almost always in animals) when no doses were administered. The idea was to identify a level at which no effects could be observed in rodents and other animals and use that dose to calculate a safe level for humans.

In part, the reason for this high dose testing was that the typical protocol for conducting risk assessments for health effects assumes that for each chemical, there is a dose level at which no adverse effects can be observed. If a study indicates a "no effects level" in the hundreds of parts per million, endocrine-disrupting chemicals can have effects, especially on developing fetuses and infants.

Some effects have been shown to emerge in adults who were exposed in gestation to extremely low doses of a substance when their mothers were fed with these low doses.

Additional studies have found effects of natural and synthetic hormones and endocrine disrupters in children:

- A study of pregnant mice fed Bisphenol-A (BPA) at 2 ppb for 7 days showed male offspring with reproductive system abnormalities.
- Two similar studies of pregnant mice fed with BPA, methoxychlor (a pesticide and endocrine disrupter) and other endocrine disrupters at 2 ppb showed that male offspring had enlarged prostate weights when they reached adulthood.
- A study of incubating turtle eggs showed that administration of estradiol, another endocrine disrupter, could result in potential male embryos developing as females. In other words, even when all other incubation conditions would favour the embryos developing as male, the authors determine that administration of very small amounts of an endocrine disrupter can induce sex reversal.
- A study of administration of estrogen administered to children for therapeutic reasons found that low doses of estrogen (4 ppb) had growth-promoting effects, showing more than a 60% increase in normal bone-growth rate.

Although these studies represent some of the lowest dose levels examined for effects (down to a single ppb), scientists are also finding effects of chemicals and other endocrine disrupters at levels below 1% of the acceptable daily intake suggesting that exposure to these hormone disrupting substances may be associated with cryptorchidism, a male reproductive tract disorder associated with testicular cancer and infertility.

"Less can be more" with endocrine disrupters

Some studies, in fact, are turning the old "dose-response" model upside down. Surprisingly, these studies are finding that some endocrine-disrupting chemicals only cause effects at very low levels, and that when high doses of some endocrine-disrupting chemicals are administered, the observed effect disappears.

Researchers theorize that the high levels of an endocrine-disrupting substance may overwhelm the hormone receptors in the body, preventing any biological effect. This seems to mimic the way natural hormones work in the body, where large releases of a hormone may have no effect, but tiny, perfectly timed releases may generate substantial effects.

Current regulatory systems for chemicals depends on the old "dose-response" model and identifying "no effects levels" of various substances. Endocrine-disrupting chemicals slip right through this regulatory net.

Laws and regulations have thus not addressed the risks posed by low-dose levels of some chemicals, like BPA.

STUDIES conducted by J.A. Brotons and colleagues in 1995 revealed that Bisphenol-A (BPA) can be released from food can liners.

In their test, the liquid in some cans of tinned vegetables were found to contain both BPA, and a related chemical, dimethyl BPA.

According to the *Environmental Health Perspective* (103: 608-612, 1995) which reported the findings, the highest levels of BPA were found in cans of peas, with an average of 23 micrograms (mcg) per can.

Other liquids containing BPA were from cans of artichokes, beans, mixed vegetables, corn and mushrooms.

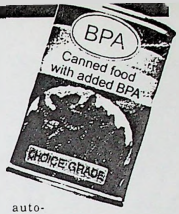
The research also included an examination of cans of other, more fatty products, including condensed milk, pork and beans, and concentrated milk-based infant formula.

The products themselves were not analysed. Instead, the cans were emptied, cleaned, then filled with distilled water and autoclaved at 125°C for 30 minutes, then the water was analysed.

Some of these water samples, including those from condensed milk cans, were found to contain BPA and were estrogenic.

All canned foods are autoclaved after canning; the fact that BPA is leached into water during autoclaving in these experiments suggests that any product packed in similar cans will contain BPA.

The research found that it is also likely that substantially more BPA will leach into fatty products.



In soup bowls

BISPHENOL-A (BPA) has also been shown to leach out of polycarbonate dishware into hot liquids. Higher temperatures increased leaching.

This was discovered in additional tests done by the Prefectural University of Kumamoto and University of Nagasaki.

In the study, new and used soup bowls were filled with 60°C-95°C water and held at this temperature for 30 minutes.

The tests indicated that BPA leached into the water in new bowls in greater amounts at higher temperatures — 1.9 parts per billion (ppb) at 95°C, 1 ppb at 75°C, "nothing detected" at 60°C — and that the leaching increased for used tableware (5 ppb at 95°C, 1.8 ppb at 75°C, and 1 ppb at 60°C).

The tests also confirmed that scratched polycarbonate shows even greater leaching (approximately 7 ppb).

Tests on food and beverages stored in metal cans lined with polycarbonate epoxy resin showed concentrations of BPA in the part per billion range and higher, depending on acidity of the liquids, heating conditions used to sterilize the contents, and serving temperature (in the case of beverages consumed directly from the cans).

Similar conclusions were also reached in a study done by the Yokohama City Univer-sity.

In the study, 3 different brands of new and used polycarbonate soup bowls from Japanese primary schools were filled with 60°C-95°C vegetable soup, water and other liquids, and allowed to cool at room temperature for 30 minutes.

Both new bowls and bowls previously used for 1-6 years resulted in BPA levels from 0.5-2 ppb in 95°C water. When 85°C water was used, only bowls previously used for 4 years or longer resulted in any detectable BPA.

No BPA was detected in the vegetable soup, possibly because the proteins in the soup lowered the sensitivity of the test to 10 ppb.

One of the 3 brands of bowls showed slightly higher leaching than the others. The city government subsequently decided it would no longer use that particular brand of soup bowl, and instructed schools to discard tableware that has been used for 4 years or longer.

POISON IN YOUR FOOD

READY for dinner. Serve yourself two chappatis and a handful of rice. Choose your pick of dals. And your favourite vegetables. Mustn't forget the salad: tomatoes embellished with carrots and cucumber. A bowl of curd, maybe. And for a fruity dessert: a banana or an orange.

Food faddists will tell you that this meal is a perfectly balanced diet. A similar lunch and a light breakfast would add up to that ideal figure of 2,200 calories daily. Just right to keep you trim and healthy.

Now gird yourself for the bad news. Along with those wholesome meals, you daily take half a milligram of two of the most widely used toxic pesticides in the country: Dichloro Diphenyl Trichloroethane (DDT) and Benzene Hexachloride (BHC). Not to mention a dash of malathion and endosulfan.

In all, that quantity is less than a pinpoint. But that's 40 times more than what average Americans or English ingest with their food. And equals the World Health Organisation danger level for daily intake of these pesticides.

It's hard to stomach, but true. It's not just drinking water that you have to worry about. But practically everything you eat. The chappatis and rice, dals and vegetables, meats and fruits and even milk, now pose a new threat not just to us but to our babies too.

Repeated surveys have shown that Indians are daily eating food laced with some of the highest amounts of toxic pesticide residues found in the world. In the process, they are exposed to the risk of heart disease, brain, kidney and liver damage and even cancer.

Even more frightening, studies indicate that right from the day our babies begin to suckle they are taking in pesticides deposited in breast milk. And some ready-made baby foods too are similarly contaminated. "We are not only slowly poisoning ourselves but jeopardising our future generations too," says toxicologist Dr K.N. Mehrotra, president, Society of Pesticide Science, India in New Delhi.

The impact of such poisoning is usually insidious. But already there are several alarming examples. In Karnataka's Shimoga and Chikmagalur districts, since 1975 over 300 people have been struck by a mysterious crippling attack of arthritis. One of them, Giriyappa, 50, a farm labourer, was among the ablest men of his village. Suddenly, he developed pain in his knees. Soon he found his muscles wasting away and within a year he had become a cripple. He now crawls around on his hands. "If it wasn't for my sons I would be starving," he says. In children, the disease, apart from crippling them, has inhibited their growth.

Photographs by HARDEV SINGH

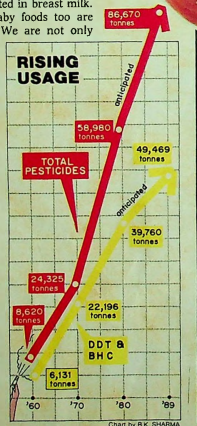


Chart by B.K. SHARMA

Indian food is laced with some of the highest amounts of toxic pesticide residues in the world.

Babies too are taking large doses of these toxins through breast milk and from some infant food.

As a result, Indians face a higher risk of heart disease, brain and liver damage and even cancer.

Yet the usage of pesticides continues to grow...

Initial studies indicated that these people, mostly farm labourers, had switched to eating crabs from nearby fields after their wages were cut. These fields were being sprayed with pesticides regularly. And in the classic food chain link *(see chart)*, the villagers who ate the crabs are believed to have been poisoned too. Researchers now suspect that these people were genetically vulnerable to the disease and the high dose of pesticides acted as a catalyst. An indepth investigation by several institutions is now on to verify these findings.

AROUND the same time an epidemic of epilepsy broke out in Lakhimpur Kheri district in Uttar Pradesh. Around 250 people suffered from sudden convulsive seizures that wracked the body. They complained of whistling noises in the ears, saw flashes of coloured lights and suffered from giddiness and headache. Reason: farmers in this area had been ignorantly using BHC to preserve their foodgrain.

For the mass of Indians, however, the threat from imbibing small doses of pesticides in their daily bread is more difficult to quantify. The problem is that these pesticides poison the body slowly. Most of them are made by rearranging atoms of various elements like carbon, hydrogen and chlorine into toxic molecules. These usually attack the nervous systems of the pests, first paralysing and then killing them.

When humans swallow chemicals like DDT and BHC they are absorbed by the small intestine. These then adhere to the fatty tissues—the storehouses of energy that are distributed throughout the body and account for 10 per cent of its weight. The toxins usually pile up in the fatty tissues of such vital organs as the thyroid, heart, kidney, liver, the mammary glands and the testes. They can be transferred from the umbilical cord blood to the growing foetus. And through breast feeding to babies. Over the years, the body can store about 50 to 100 milligrams of a wide variety of these toxins.

The debilitating impact of such a heavy load of toxins came through when the King George Medical College (KGMC) and the Industrial Toxicology Research Centre (ITRC) in Lucknow did a series of tests on workers spraying DDT and malathion regularly. At least half of the workers developed psychological symptoms like anxiety, sleep disturbance and depression. Many complained of severe headaches. One out of five of them had impaired memory and performed simple drawing tests clumsily. Some of them even suffered from retinal damage, blurred vision and saw flashes of light and black dots in front of their eyes.

The difficulty lay in proving whether the general population, which is usually not exposed to such high doses of pesticides, would exhibit simi-

RAGHVENDRA RAO

AN EXTREME CASE

Nagaraj, 10, is just one of the 300 people struck by a mysterious, crippling attack of arthritis in Karnataka's Shimoga district. The disease, which wastes away the joints and muscles, was first noticed in 1975. Initial studies indicate that these people, mainly farm labourers, switched to eating crabs from nearby fields after their wages were cut. With the fields being sprayed regularly by pesticides, the crabs ingested large doses of toxins. And the people eating them were poisoned by them as well.

A field being sprayed with pesticides: rampant misuse

lar symptoms. As Devika Nag, head of KGMC's Neurology Department who co-authored these studies, says: "It may take years for the build-up to act. Few doctors in general hospitals will link blurring of vision or a heart attack to signs of pesticide poisoning."

That link, however, is being found in several other studies. In Hyderabad, when researchers studied women having still-births they found a high amount of DDT and BHC pesticide residues in their blood. The chilling conclusion: these residues may inhibit normal pregnancy. More recently, an analysis of breast tumours by the Marathwada Agricultural University in Parbhani, Maharashtra showed that almost all of them contained a high content of DDT and BHC in the tissues. The worrying question: could these residues have been the carcinogen (cancer-inducing substance)?

"What we are seeing is the tip of the poisonous iceberg. And even that seems serious enough for us to sit up and take corrective action," says eminent toxicologist Dr C.R. Krishna Murti, chairman of the scientific commission probing the Bhopal gas tragedy. He points out that there are other contaminants that pose an equal threat to Indians, but fewer studies have been done on these.

Those colourful *jalebis*, *barfis* and *gulabjamuns*, for instance, are not as sweet as they look. Many of those brightly coloured dyes are made from harmful compounds that are known to cause kidney damage, eye defects and in some cases even affect the reproductive systems. A recent survey by the government-funded ITRC found a third of the samples analysed to be coloured with prohibited dyes. Among the most commonly misused dyes were orange, blue, bright green and red. And illegal dyes were even added to spices like turmeric and chilli powder.

Nor is the *sarson ka tel* (mustard oil), widely used for cooking, all that safe. An extensive survey in Uttar Pradesh recently found that in a fourth of the samples the oil had been adulterated with linseed and the highly toxic argemone oil. Argemone poisoning causes swelling of limbs, nerve damage, heart attacks and blindness. It's a common problem in West Bengal, Maharashtra, Andhra Pradesh and Uttar Pradesh.

If all this isn't enough a new danger to Indians comes from heavy metals like lead, cadmium, manganese and nickel. In March the results of an all-India survey found that the level of these metals in food samples had crossed the safety limits. And what's more, drinking water too was similarly contaminated.

Pesticides (some contain these metals) are only one of the suspects. Untreated industrial effluents being discharged indiscriminately into rivers and fields are a major culprit. The other, surprisingly, is the exhaust fumes spewed out by the surfeit of automobiles. These fumes are known to contain high amounts of lead and manganese. Apart from poisoning the air these settle on food and water sources. Each of these metals if consumed beyond tolerance levels can cause mental retardation in children, nerve damage, impotence, blindness and even death.

Other dangers remain areas of dark-

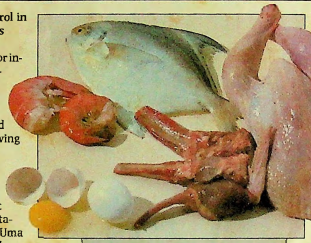
VEGETABLES

Malpractices abound. Farmers are known to spray methyl parathion on cauliflower to give it an extra white appearance. *Bhindi* (okra) is dipped in copper sulphate to make it look greener. And the norm that no spraying should be done a week before harvest is frequently violated. A thorough wash and a vinegar douse help to get rid of much of the toxins in vegetables.

People exposed to large doses of toxins developed impaired memories.

BHAWAN SINGH

Spraying for malarial control in Delhi: dubious benefits



ness. No one really knows, for instance, whether the widespread use of plastics to pack food products like milk is really safe. Or whether the host of preservatives and additives used in the growing instant food industry is harmful or not.

Most consumers in India too are casual about these threats. Asked what she thought about food contamination, Delhi housewife Uma Raghavan says: "I have been more worried about putting on weight." And Ajay Gupta, a businessman, added: "Food poisoning? I'll probably die in a road accident before that."

THE vast body of research on the menace of pesticides, however, will make anyone sit up and take note. Ironically, pesticides now play a vital role in checking the spread of malaria in the country and in boosting foodgrain production. For instance, DDT was so successful in curbing the mosquito menace that malarial cases dropped from 75 million a year in 1948 to barely 50,000 in 1961. However, with mosquitoes becoming increasingly resistant to it, malaria staged a come-back and now strikes around two million people yearly.

In agriculture, the chemical war began when high yielding variety crops were introduced in the '60s. These were more vulnerable to pest attacks. Currently pesticides protect around 80 million hectares of crops or half of the country's area under cultivation.

MEAT, FISH & EGGS

Non-vegetarian food too is highly contaminated. Goats swallow pesticides when they graze near fields being sprayed with them. Hens do the same through the feed they eat, which is usually the husk of grain. And the residues seep into eggs as well. Fish too contain high amounts of DDT residues. In West Bengal, people illegally spray endosulfan on water to stun fish and catch them.

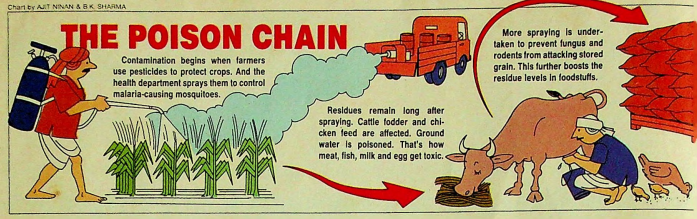
Women having still births have shown high serum levels of DDT and BHC.

The result: pesticide consumption has risen tenfold in just three decades and is expected to cross 80,000 tonnes this year. India is now both the largest manufacturer as well as consumer of pesticides in South Asia. There are over 131 different types of pesticides marketed under 203 different formulations by over 350 companies in the country. And as Dr Mehrotra puts it: "The Government is the largest peddler of this dope." The public sector Hindustan Insecticides manufactures all the DDT the country uses. Along with another public sector company, Hindustan Organics, it also accounts for a sixth of the BHC production.

Despite the proliferation of pesticides, DDT and BHC still account for 50,000 tonnes or two-thirds of the total consumption in the country. That's because these are 10 times cheaper than most other pesticides, easy to handle and attack a wide range of pests. However, they cause multiple problems. Once sprayed they do not degrade easily and can persist in the environment for as long as 20 years. The soil then becomes a reservoir for these pesticides steadily transferring them to edible crops, polluting the groundwater, trees and wildlife.

It was not till the '80s that the insidious threat from the explosion of pesticides started coming home. In 1984, a multi-centre study sponsored by the UN Food and Agriculture Organisation (FAO), analysed as many as 1,500 samples of cereals, pulses, milk, oil and meat from different parts of the country. The finding:

Chart by AJIT NINAN & B.K. SHARMA



almost all the samples were contaminated with DDT and BHC.

Even more worrying: in as many as 25 per cent of the samples, residue levels had crossed the WHO safety limit. In comparison, similar 'market basket' surveys done in developed countries showed that barely 1.2 per cent of the food samples had residues above the tolerance levels. "It's clear we have gone miles past the danger zone," says Dr Rajinder Kalra, project co-ordinator of the FAO study and senior toxicologist at the Punjab Agriculture University in Ludhiana.

Proof that those high levels of pesticides were finding their way into the body tissues came just as the FAO study was being completed. Under the Global Environment Monitoring Programme sponsored by the UN, India was among the 10 nations chosen for studying pesticide residues in human breast milk. Breast milk, because of its high fat content, is one of the best indicators of pesticide build-up in the body.

INDIAN findings were scary. Milk taken from 50 lactating women had DDT and BHC residues at least four times higher than in the other participating countries. Only milk taken from Chinese women had higher residues. Worse, Indian babies, along with Chinese, were imbibing at least eight times more DDT than breast-fed German, American and Swedish babies. "Our babies are now taking three times more than the acceptable daily limits for these pesticides and nothing is known about its impact on their health," says Krishna Murti.

The lack of information Krishna Murti complains about is a key problem that has led to the continuous use of pesticides. The damage to people exposed to heavy doses of such chemicals is well recorded. But to point the needle of suspicion at the comparatively low level of pesticides taken daily through food is "as difficult as telling you what causes cancer", says Dr T.S.S. Dikshit, assistant director of the ITRC in Lucknow.

There is no consensus too about whether food contamination limits have reached danger levels in the country. Toxicologists like Dr P.K. Ray, ITRC's bespectacled director, feel that, "residue levels have certainly not reached a point where we should be alarmed". But he adds quickly: "However, we should ensure that they don't go up." And a senior Agriculture Ministry official shies away from the question by stating that "the data on residue levels are too sporadic to draw national conclusions".

Worse, there has been no real effort to work out the risk from pesticide residues to the general population. In fact, the Industry Ministry told Parliament last year that "no specific instance of harmful effects of any pesticides on the human population has been brought to the notice of the ministry". Something the Agricultural Ministry contradicted in March by stating that over 137 fatal cases of pesticide poisoning have occurred in the past three years. No details were given about how these people died but it is usually instances of using pesticides to commit suicide that are reported.

Developed countries suffered from the same kind of laxity till 1962 when US genetic biologist Rachel Carson wrote *Silent Spring*—an epoch-making book that exposed the havoc being created by pesticides. With the massive public outcry against pesticides building up, these countries were forced to act on the large amount of studies on the harm caused by these chemicals.

With DDT, for instance, tests on animals showed evidence of its being a carcinogen and causing chromosomal changes. In the US, it was feared that the bald eagle, the national emblem, was becoming extinct because of widespread spraying of DDT on its habitat. It seemed to inhibit the reproductive ability of the bird. In humans, DDT was also associated with

CEREALS

Repeated surveys have shown that wheat, rice and maize, the daily diet of most Indians, are highly contaminated with pesticides like DDT and BHC. While levels in rice tend to be lower because of dehusking, in wheat, these pesticides don't degrade even when the flour is made into chappatis. The various dals also contain toxic residues, but the levels are not as high.

Malpractices in spraying have been a major cause of the high residue levels.

- Taking up on a war-footing the control of pests using their natural predators.
- Banning pesticides like DDT and BHC and replacing them by safer ones.
- Preventing industries from dumping poisonous effluents.
- Considering health costs while deciding pesticide policy.

for banning DDT's use in agriculture are to be issued only next fortnight—four years after the expert committee's recommendation.

The expert committee's recommendation in a way reflects the dilemma faced by the country in dealing with pesticides. In the West, after damaging studies on BHC and DDT led to the countries banning them, farmers switched to costlier but safer pesticides. In India, since pesticides account for 50 per cent of input costs in many crops, farmers are unlikely to use the expensive ones. And that could lead to a steep fall in foodgrain production.

So what is the way out? To the Government's credit, in the past few years it has been taking some positive steps. One was to encourage integrated pest management, a scheme that has led to a dramatic reduction in residue levels in the West.

ESSENTIALLY it's a programme which advocates the judicious use of pesticides and safer alternatives to fight pest attacks. One of the techniques is to teach farmers exactly when and in what quantities to use pesticides. For instance, farmers are advised not to begin spraying as soon as the brown plant hopper, that feeds on the rice crop, is noticed. Its predators, the spider and the mirid bug, could control the hopper population. Only if the population crosses certain limits are the farmers advised to spray.

Another technique is biological control of pesticides. Many of the pests have their natural biological enemies that if introduced could control their population without the use of these chemicals. Already the Government has introduced around eight such predators of common pests of sugarcane, rice and fruit such as apples. These have met with some success. Efforts to identify more such predators must be intensified. However, after releasing them, they have to be carefully monitored to ensure that they don't cause a new kind of pest attack. Both these programmes if taken up on a war-footing could drastically reduce the over-dependence on pesticides.

The Government has also been showing concern about the growing residue buildup in foods. In 1984, the Indian Council of Agricultural Research set up an all India coordinated research project on pesticide residues. While the project, involving 13 agricultural universities took three years to get cracking, some data has been compiled on residue levels in soils and certain food crops. And it is just completing another vital task: Fixing tolerance levels for daily intake of BHC.

However, even the Planning Commission admits that it can't do away with BHC and DDT till the much-vaunted 21st century. Most toxicology experts call for "a national pesticide management programme". Apart from more strictly regulating the manufacture of pesticides they want the monitoring system for pesticide residues to be beefed up. Laboratories to test residues need to be set up in each state. And they call for a regular 'market basket' survey, as done by several developed countries, to warn of dangerous buildups. Meanwhile the pesticide industry could join hands with the agricultural extension workers to train farmers on how to use smaller quantities of pesticides more effectively.

The Government needs to clean up its act too. Rather than just freezing production of the more persistent chemicals like DDT and BHC, these must be phased out rapidly. Even if the alternatives are costlier it is a lesser price to pay than the nation's health.

It also needs to chalk out a comprehensive policy on the types of pesticides to be used in the country. And while doing so, the health costs must be toted up. In other areas like heavy metal poisoning stricter control over industrial effluents and better exhaust cleaning devices could help considerably.

In all this speed is a must. For, as the late John F. Kennedy once said: "The loss of even one human life or the malfunction of even one baby—who may be born long after we are gone—should be of concern to us all. Our children and grandchildren are not merely statistics towards which we can be indifferent."

A poor country like India may find it difficult to uphold such high values. But it's about time we moved in that direction. After all neither we nor our children should be reduced to mere statistics. as is happening now.

—RAJ CHENGAPPA in Delhi, Lucknow & Ludhiana with CHIDANAND RAJGHATTA in Mysore

SWEETS

All those colourful *jalebis, barfis* and toffees are not as sweet as they look. A study in Uttar Pradesh found that in a third of the samples, the dyes used to colour the sweets were on the Government's prohibited list. Animal studies have shown that these illegal dyes damage the kidneys, spleen and liver and, in some cases, can harm even the reproductive system.

The dilemma: health of the individual versus boosting foodgrain production.

TRAVEL

The Downhill Stations

Under the tourist onslaught, the country's best summer getaways are collapsing. Concrete jungles have sprung up. Water and power are scarce. Garbage and traffic pile up. Lakes are polluted. And a whole way of life is being destroyed.

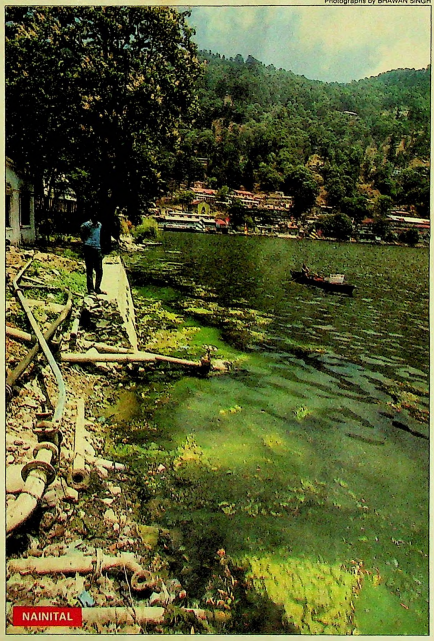
THESE days Ganesh Saili, 41, is busy planting trees around his one-acre plot atop Mussoorie's Landour hill. It's not out of a sudden interest in gardening. "I just want to block the view of my hometown," he says. And adds sadly: "What's happening to Mussoorie is reverse metamorphosis—a beautiful butterfly regressing into an ugly caterpillar."

Gone are his favourite childhood haunts—the magnificent oak and pine trees which draped the rugged mountain slopes. A hostile jungle of hotels and multi-storied apartments is all he can see now. No more do people drop into cosy coffee houses for a chat—there aren't any left. The once quiet Mall Road is cluttered with vehicles, video parlours and vociferous tourists. And the town, 28 km from Dehra Dun, has been in the grip of an acute water shortage for two years—something unheard of in the past. Laments Saili: "The entire fabric of the town has been torn asunder. It has no soul left."

It is a cancer that has struck not just Mussoorie but almost all the former colonial havens in the country. Srinagar, Shimla, Nainital, Mahabaleshwar, Ooty —names that evoked images of cool, undulating hills cloaked in a tapestry of brilliant green—have steadily slid downhill. Their symptoms are similar: flashy hotels coming up higgledy-piggledy to meet the massive influx of tourists. Building by-laws being blatantly violated. Obsolete water and sewage systems cracking under the onslaught of the rapid and unplanned growth. The narrow roads meant at best for pony rides now packed with noisy vehicles. And above all, an entire way of life fading away.

"Before, people came to hill stations to breathe the fresh air, take long walks and have a quiet laid-back holiday," says R.L. Nanda, 64. He owns one of the few remaining colonial hotels in Nainital, nestling at 6,569 ft on the Kumaon Hills in Uttar Pradesh. In fact, the British had a penchant for picking the best getaway spots. Mahabaleshwar was chosen as a health resort 150 years ago because as an official then observed: "Cold, coughs and

Photographs by BHAWAN SINGH



Two-thirds of Nainital's sewage is dumped into its famed lake. With the water highly polluted fish kills are common.

nerve and brain damage. The findings on BHC were as devastating. Animal studies showed clear evidence of its being a carcinogen apart from causing spontaneous abortions and leading to severe liver and kidney damage. And these are just a few of its ill effects.

That kind of damning evidence saw seven countries including the USSR, the US and West Germany ban DDT in the '70s. And nine other countries put severe restrictions on its use. BHC too has been banned in nine countries in North America and Europe and its use severely restricted in 13 countries.

These countries have now switched to safer pesticides like synthetic pyrethroids. The newer pesticides degrade rapidly once sprayed, cause less harm to the body and selectively kill target pests. Combined with stricter regulation, they have resulted in a significant drop in residue levels in foodstuffs.

IN India, however, officials seem strangely unmoved by the results of a series of tests done on animals. At the ITRC rabbits fed with large doses of BHC and endosulfan, another widely used pesticide, suffered from high blood pressure, severe heart damage and in many cases blindness. And mancozeb, a widely used fungicide, caused tumours in mice. In Mysore, when researchers at the Central Food Technology Research Institute administered large doses of DDT to rats they found that it caused deformities in the skeletal structure.

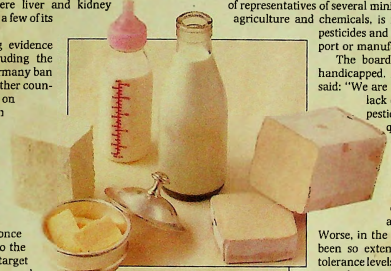
Anywhere else such studies would have created instant uproar and caused regulatory authorities to call for a more detailed investigation. Here, not only are these warnings ignored, even the agriculture and health ministries insist that there are no visible threats.

Other factors too are responsible for things coming to such a sorry pass. Regulation of the use of pesticides has been the weakest link in the chain. Only in 1968 did a comprehensive Insecticide Act come into force. Under it the Central Insecticide Board, which consists of representatives of several ministries including health, agriculture and chemicals, is in charge of screening pesticides and approving them for import or manufacture in the country.

The board, however, is severely handicapped. As one of its members said: "We are hamstrung both by the lack of facilities to test these pesticides and the inadequate data on their toxicology." That has resulted in an anomalous situation. Out of the 131 pesticides approved for use so far, only for 31 have tolerance levels been evolved. Worse, in the case of BHC, which has been so extensively used, so far no tolerance levels have been worked out. As Kalra says: "This makes a mockery of our laws because how can you prosecute someone unless tolerance levels are fixed."

Most of the chemicals have been approved for use based on toxicology studies done abroad. Experts say that this is a dangerous practice. As Dr A.T. Dudani of the Voluntary Health Association of India points out: "Most Indians are undernourished, have poor hygiene and are susceptible to disease. So we don't know their threshold limits for such pesticides." And as studies have shown, DDT could combine with other pesticides like BHC in the body and become a more toxic cocktail.

Even more difficult is penalising offenders. The state health and food departments, under the Prevention of Food Adulteration Act, are to check food contamination by pesticides and prosecute offenders. But most of these departments have neither the specialised equipment to test residue levels nor the staff to carry out checks. As a result, hardly any cases are registered. And thanks to its anti-malarial campaign, the Health Min-



MILK & MILK PRODUCTS

Experts feel that the real threat comes from milk and its products like butter, ghee and cheese. Since pesticides adhere to fatty tissues in the body, milk, which has a high content of fat, is an ideal storehouse for toxins. In bovine milk, contamination comes through the cattle fodder which has a high level of toxins. When milk is processed into butter residue levels get magnified.

Ineffective controls and a lack of strict guidelines have worsened matters.

istry itself is indirectly one of the major offenders responsible for the high level of residues. As one expert remarks: "The ministry would really have to prosecute itself first."

PESTICIDE manufacturers, on the other hand, plead helplessness about curtailing production. Dr S.P. Dhua, chairman of the public sector Hindustan Insecticides, says: "We are at the captive end because we are really catering to the demand of the health or agriculture ministry." Most manufacturers, however, feel that the health hazards are exaggerated. They point out that in a tropical country like India, because of more sunlight, pesticides like DDT and BHC degrade faster than in temperate zones. That fact, however, is still to be convincingly established. About developing a new cheap and safer chemical, the manufacturers say that it would cost a phenomenal Rs 20 crore—an amount none of them would like to invest.

Much of the problem too has come about because of misuse of pesticides by farmers. Most don't even take elementary precautions for handling them. While gloves and face masks are a must, farmers use their bare hands to sprinkle pesticides.

Nor are farmers too conversant with pesticide use. A study done on Punjab cotton farmers, who are considered to be the most progressive in the country, found that only 11 per cent used the right pesticide in the right quantity to fight the bollworm, a major pest of the cotton crop. And another 20 per cent were using the wrong type of chemical.

In other states, several farmers violate the rule that no spraying should be done a week before harvest to prevent high pesticide residues in vegetables. That has seen residue levels shoot up to dangerous levels in such vegetables as okra, tomatoes, cabbage and cauliflower.

Apart from high buildup in food products, that kind of misuse has led to other problems. The most serious being the rising resistance among pests. For instance, the bollworm has developed resistance to several pesticides. Spraying has now gone up in many states from seven times a crop to over 30. And the widespread use of DDT by the Health Ministry has seen four species of mosquitoes develop resistance to the chemical.

Summing up the situation, Shekhar Singh of Kalpavriksh, a voluntary organisation working on the pesticide problem, says: "There seems to be everything going wrong at each stage. There is no proper regulation of pesticides, there is no check on the buildup of residues in our foodstuffs and I'm afraid there is absolutely no public consciousness at all."

Prodded by the growing evidence of the chemical menace, the Union Government in 1984 decided to appoint an expert committee to review usage of pesticides like BHC and DDT. After assessing a whole body of data on DDT the committee concluded in 1985 that it may continue to be used in the health programme but be banned in agriculture.

The guiding reason, however, was not safety but economics. Agriculture now relies more on BHC and uses barely 400 tonnes or 4 per cent of the country's DDT production. But the Health Ministry said it just could not afford to stop using DDT. It pointed out that the cost of covering a population of one million would shoot up from Rs 33 lakh to Rs 195 lakh if malathion, a relatively safer pesticide, was used instead of DDT.

That meant that there was going to be no let-up on the poison explosion. The Health Ministry itself projects that by 1999 it needs 20,000 tonnes of DDT annually for its spraying programme. And with the Ministry continuing to spray DDT, residues will keep finding their way into the soil and edible crops. That fact came through when the Punjab Agriculture University recently proved that spraying of DDT around households resulted in residue levels shooting up in stored grain like wheat and rice.

Meanwhile, the Agriculture Ministry used the same economic argument to allow farmers to continue using BHC. The committee, which filed its report on BHC in 1986, made it clear that production of the pesticide should be frozen. It also wanted the Government to ban its spraying on vegetables, oilseed crops and in storage godowns. The Government has acted on these instructions though belatedly. BHC production was frozen at its current installed capacity of 41,900 tonnes last year. But farmers were only "advised" not to use it on vegetables and oilseeds. Orders

THE WAY OUT

- Regular 'market basket' surveys to warn people of dangerous buildup of toxins in food.

- Stepping up the integrated pest management programme to teach farmers to use pesticides judiciously.

FRUIT

Grapes are probably one of the most widely-sprayed fruits. Studies have shown that they contain a high residue level of several pesticides. A good wash with a dash of detergent or baking soda can knock out these toxins. In apples, the threat comes from the chemical daminozide, used as a growth regulator, and now suspected to be cancer-causing. Citrus fruit too contains toxic residues.

DDT and BHC, widely used in India, have been banned in at least 16 countries.

NUT - 4

Main Identity

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Cc: <umeshkapil@yahoo.com>; <kapilumesh@hotmail.com>
Sent: Tuesday, October 26, 2004 4:47 PM
Subject: RE: Deabte Continues : response from MI on Impact of "Wonder Candies" for poor Indian children and mothers

Dear All

Excerpts from Response received from Microutrienet initiatiative are mentioned Below

Dr R Sankar, MD, MNAMS, FICP
Regional Technical Advisor
The Micronutrient Initiative
208, Jor Bagh
NEW DELHI - 110003.
Tel: 91-11-24619411 ; Fax: 91-11-24617619
Email: rsankar@idrc.org.in

1. Contents of Wonder Candies

Nutrition fills
for 8/11/04

The fortified candy contain 3 gm sugar, it is centre filled; has 7 mg iron, 500 IU vitamin A, 10 mg vitamin C and 50 microgram folic acid.

2. Impact of Wonder Candies

Anaemia prevalence in children who received fortified candies decreased from 50.9% to 8.8% in 12 weeks of intervention and this difference was found to be significant compared to the placebo group.

3. What should be done in India as per MI to Reduce Anemia

The message is very clear that in order the administration of wonder candies should become part of primary health care intervention to reduce anemia from current prevalence of 74% to less than 10%.

Your comments are requested on the approach implicitly recommended by MI for India.

Regards

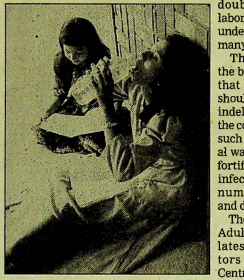
Prof . Umesh Kapil

All India Institute of Medical Sciences
New Delhi, India

11/7/2004

How safe is that bottle of mineral water?

By P Venugopal



Kochi: It's boom time for the bottled water industry in Kerala. But has quality become the casualty?

Within a span of four years, 25-odd mineral water units, big and small, have sprung up in the State to tap the emerging market. The present boom is attributed to the increasing health and hygiene consciousness among the people, apart from the prestige and snob value attached to mineral water. Once consumed only by foreign tourists, mineral water is now in great demand among domestic travellers, office-goers and flat-dwellers.

In the wake of the phenomenal growth of this industry, the question of how safe it is is relevant. A businessman in Kochi who bought two bottles of a popular brand of mineral water from a bunk in the city recently was horrified to find that the bottled water contained impurities, visible to the naked eye.

Following similar complaints from consumers, the health squad of the Cochin Corporation recently conducted random checking on the premises of mineral water dealers in the city and sent samples for testing at the Regional Analytical Laboratory at Kakkanad. But the samples tested were found safe.

The Bureau of Indian Standards has as far back as 1992 set certain stringent standards for the production of mineral water in the country, which is now covered under the Prevention of Food Adulteration Act. The Bureau has laid down 30 parameters to be followed for manufacturing mineral water, which relate to the permissible limits of various minerals, radioactive materials and dissolved solids, alkalinity, colour, odour, taste, turbidity, etc. But it is doubtful whether any laboratory in the country undertakes testing for so many parameters.

The code evolved by the bureau also specifies that the manufacturers should mark legibly and indelibly on the label of the container particulars such as type of the mineral water used (natural or fortified), manner of disinfection, batch or code number of production and date of bottling.

The Prevention of Food Adulteration Act stipulates that Food Inspectors appointed by the Central or State Governments should periodically take samples of eatables and beverages and get the products tested by Public Analysts in the Regional Analytical Laboratories or Central Food Laboratories set up by the Government so as to ensure conformity with the quality control norms. But there are certain lacunae in the Act. The public cannot proceed legally against the unscrupulous manufacturers on the strength of the adverse test results obtained from the Regional Analytical laboratory.

The test results of only the samples sent directly by the Food Inspectors or the Consumer Courts have legal standing. Even the Food Inspectors have to fulfil certain conditions before taking samples of any article of food on the premises of the suppliers or manufacturers.

The consumers can seek remedy against supply of spurious drinks only through the consumer court, which is a costly, time-consuming and cumbersome affair. Consequently, most duped consumers prefer to keep quiet.

Marketmen admit that it is very easy to duplicate popular mineral water brands. Water, the main raw material, is freely available from sources like canals, wells or public distribution system. Refilling of used bottles or getting caps or bottles manufactured is a simple process. But manufacturers hotly contest this claim. "Production of spurious mineral water is a costly proposition. Each mineral water company has a particular capping method which is tamper-proof," said Shaji, who produces 'Fresh Mineral Water' based in Thiruvananthapuram.

A source in the Regional Analytical Laboratory at Kakkanad confessed that it was quite common among petty shop owners in Pampa and Erumeli during the pilgrim season to refill used mineral water bottles with the raw water from the Pampa river and sell them to the customers.

"The average shelf-life of the mineral water filled in PVC bottles is two months. The bottled water is bound to get contaminated after this period. Water will be infected if the cap, supposed to be air-tight, becomes loose and air enters the bottle while handling," said an official of the laboratory. The Regional Analytical Laboratory has a Mobile Vigilance Squad which will quickly respond to complaints from the public and take samples from suspect traders.

The manufacturers claim that there is no cause for reservations about the quality of mineral water as it is produced and filled after treating raw water by a series of processes such as filtration, demineralisation and disinfection. Kochi-based Prima Beverages (P) Ltd claims to use the latest ozonisation technology to disinfect raw water at its 40,000-litre per day mineral water plant set up at Vazhakulam near Aluva a few months ago. The Bismillary plant in Kozhikode uses the multi-stage filtering using sand filter and ultra-violet filters and ozonisation. Nevertheless, it's not roses all the way. The Rs 300-crore bottled water industry in the country, which is expected to touch a turnover of Rs 1000 crore by the turn of the century, has become highly competitive with the entry of multinationals like Cadburys and Britannia and leading liquor manufacturers.

"A treatment plant entails an investment of anything between Rs 50 lakh and Rs 75 lakh. Packaging and transportation make up 40 to 50 per cent of the total cost of production. PET bottles with higher shelf-life costs not less than Re 1 a bottle. Add to it the margin offered to retailers, ranging from Rs 3 to Rs 7 a bottle, plus sales tax and excise duties. Which leave little or no profit margin," said a manufacturer.

But Thomas Jacob, Deputy General Manager, Prima Beverages, sounded optimistic. "The present seasonal demand for mineral water in Kerala is estimated to be of the order of 15,000 cartons (1.80 lakh litres) per month. With the high incidence of water-born diseases and increasing health consciousness among people, the market for mineral water in Kerala is bound to expand by leaps and bounds." ■

(With inputs from A Satish, Palakkad, K Venugopal, Thiruvananthapuram, and Latheef Kizhisseri, Kozhikode)

NUT-2

FOCUS

India's malnourished children

By Jagjit Singh

THE excellent progress made by India in health care is overshadowed when a United Nations Children's Fund (UNICEF) document reveals that this country accounts for the highest number of malnourished children under five in the world. The document, "The Progress of Nations", says that of the 190 million underweight children at the global level, as many as 72 million are in India alone.

In developing countries like India malnutrition is a principal obstacle to human productivity and to socio-economic development. Depending upon the degree of malnutrition, the effects are particularly serious for infants and children who need an adequate quantity and quality of food for their physical and mental growth and for realising their full genetic potential.

There is no denying the fact that the percentage of 1-5 year children suffering from severe malnutrition has decreased from 21.8 per cent in 1975 to 4.7 per cent in 1980. However, India continues to be placed in the first 48 countries of the world where under five mortality rate is still in three figures UNICEF report "The State of the World Children-1994." And to give just one example, 300 infants succumb to diarrhoeal disease—a severe form of malnutrition—in Bihar daily. Even if they survive the rigours of severe malnutrition, they become the victims of various ailments like bone deformities and brain damage as was recently found by the observers in the Dharhi and Chikhaldara areas of Melaghat region in Maharashtra.

Sample surveys conducted by the National Nutrition Monitoring Bureau revealed that the highest percentage of severe malnutrition (9.9 per cent) among 1-5-year-old children was observed in Gujarat which also had the lowest, 5.2 per cent of children with adequate nutrition.

Similarly, surveys by the National Institute of Nutrition (NIN) in the past indicate that the energy intakes of rural low-income group children are grossly inadequate cent of the children suffer from varying degrees of malnutrition.

Malnutrition in the family and especially in mothers emerges as one of the underlying causes of malnutrition in children. In considering the factors affecting the health and nutritional status of a child, it would be logical to see the mother and child as a single unit. And the fact remains that in India a large number of mothers themselves are malnourished. Anaemia continues to be the most serious hazard to maternal survival which is a major factor responsible for premature births, low birth weight babies and pre-natal mortality. And how this sorry state of mothers' health reflects badly in their children is evident from the studies conducted by (NIN) which show that 63 per cent of India's children below three years and 45 per cent between three and five years suffer from iron-deficiency anaemia—moderate to severe in 10 to 15 per cent cases. Even with this lower intake, the absorption is not full which further aggravates the situation. According to the UNICEF, of this already inadequate intake of dietary iron nearly 25 per cent is not absorbed. The recent findings regarding the effects of iron deficiency on brain chemistry and function indicate that iron deficiency has much wider implications beyond anaemia.

One wonders if India can achieve a stupendous coverage from 85 to 96 per cent in immunisation of children against six killer diseases during 1990-92, and why similar results cannot be achieved in containing malnutrition, especially when we have had bumper crops for many years.

(MGIMS Sevagram)

NUT-2.

" VANGUARD OF FIGHT WITH MALNUTRITION- IF NOT MOTHER THAN WHO ELSE CAN "

The rural health insurance scheme run by MGIMS aims at providing health care to the rural folk. We tried to analyse the reactions, misconceptions and problems that we came across during our attempt to educate a rural mother about her kids health. The following drawings have been drawn from a specific angle which stresses the part played by the irrational believes, emotive biases, myths and traditions amongst villagers in perpetuating malnutrition inthe poverty striken families. The sketches are distillate of our experiences and vividly portray the same.

1. There are two children. On the left is a little withered baby drowsing on the floor. On the right is a peevish baby- all bones and skin. Potbelly, bloated feet. Few lustreless fluffy hairs on the scalp keep on falling in handfuls.

It is a familiar rural scenario. Vilaggers call it 'Satvi' a disease characterized by extreme emaciation of the child Popular belief has it that the bloated Satvi is a reckless killer of babies.

2. Possibly an evil spirit is the villain of the piece here. There is not even ghost of a chance of cure in hospital- another popular belief.

3. It is perhaps not surprising, given these circumstances, that a villager sees a ray of hope in- and turns to- an exorcist. He offers him chicken, booze and coconut! Money is anathema to him but he accepts offerings! His modus operandi is complex: Chanting a numbojumbo he ties a soared thread on the arm, waves the broomstick vehemently like a sledgehammer, smears sacred ash(!) on the forehead and to and behold! The evil spirit is out!

Have you ever seen a baby recuperate by an exorcist?

4. The doctor is weighing a newborn. Weight: two Kg; He explains to the mother that her next baby should not be an emaciated one. How can such a thin built, semi-starved mother produce a plump baby? 'Have two square meals,' the doctor advises, because, he explaine further, 'baby gets its nourishment from the mother.'

Mother faces a dilemma. She has to quench her hunger by by-eating whatever scram remains beind after, her husband, kids, inlaws eat. often she sleeps hungry. How can she follow doctor's gastronomic advise "eat to your heart's content"?

She heeds the suggestion and puts aside a chunk of meal for her while preparing the meal. Her hawk-eyed mother-in-law looks inquiringly and yells at her.

Mother-inlaw should understand that for a healthy grandchild, her expectant daughter-in-law should get good nourishment. She should shower tender love on her daughter in law, not a fusillade of angry words.

5. .....' And don't feed the young one for two days,' a mother-in-law tells her daughter in law who has just delivered a child. For, she feels rather naively, that colostrum is bad for a young'un.

We do feed a young calf with cow's colostrum, don't we? If a cow's young one can be fed with colostrum, why not your baby?

6 Mother's milk is nourishing for the baby. Colostrum is so good for new born's health. Start breast feeding as early as possible.

7. Don't bottle feed the baby. Bottle hygiene is rather tedius, it needs to be boiled clean, its nipple shouldm't be touched with dirty hands, nor should it be touched without washing the hands. A bottle once used must be boiled again before revising the same. All these things are not possible in our villages. An infected bottle can lead to diarrhoea. A child starts losing weight, falls a prey to Kwashiorkar. We don't want bottle, we need cup and spoon!

....3

8. Tinned milk can not compete with the cow's milk

   Don't d lute milk

   Tinned milk fails to provide nourishment to the baby.

   The result is inevitable - Kwashiorkar!

9. Poverty in the midst of plenty? How is it that your baby doesn't get enough milk though it is so much produced in your villages.

   Milk from villages is sold in nearby cities. Sans milk child keeps on weeping.

10. Why milk is sold in market? Wiser from previous experiences, our cost-conscious farmer sells a litre of milk and gets money to buy 4 kilos of jowar. A litre of milk is barely enough to sustain him for a day but 4 kilos of jowar can last for 4 days. This is pragmatic rural economics'.

11. Pure milk is hard to come by even in villages- it is invariably diluted. Reason- to earn money.

Try as he might, a labourer can not buy milk in a village.

Then what should he do?

Keeping a cow is well nigh impossible for him.

From where will he arrange fodder to feed the cow.

Where is the land?

11a Consider goat. Even a labourer can keep it. Fodder is no problem. Equally nutritious milk. So easy to digest. A child can easily thrive on goat's milk. After all was it not Gandhiji who drank goat's milk? Do not underestimate goat's milk.

12. The best nutrition for an infant is milk. Breast milk is itself of course sufficient for first six months. Don't wean afterwards. He still needs something more. What next? There is no cow's or goat's milk available? What should you give?

An adult belly is big. Two meals provide enough for his body growth. A child's stomach is small. Five such bellies can be accomodated in an adult stomach. But a child needs as much food as an adult needs. Two meals are not enough, it needs five such feeds.

13. A child is a child is a child. If made to eat of his own, he won't be interested in food. Ever eager to play with his pals waiting out, he will gulp down the morsels hastily and drink too much water. Come mother, sit with your child, coax him, cajole him, feed him.

14. A labourer mother can ill afford to look after her young'un and ignore her work. Her wage suffers! She, therefore, hands over the baby to elder sister or grandmother and goes to work. If she takes her toddler along with her on the farm, she gets a caustic tongue lashing from the farm-owner-- "What for you've come here? To work or to feed your child? Who will work here? Get out!" She is sacked.

A farmer must be be compassionate enough to allow a mother to feed her child as per its needs. No, he is not obliging her, it is her right.

15. If many mothers face this problem, we can arrange a cradle-home. We may as well appoint a lady who'll look after the kids and also feed them while mother is away. But what if the fence starts eating the crop?

16. "If they can't afford bread, why not do they eat cake?" We're familiar with this opt-quoated foolish remark by french queen. Let us be wise. Let us feed our babies with whatever resources we have, available at home. What and how often?

Here is the plan____.

In the morning serve sweet steaming porridge.

17. As she goes to work, Jowar Roti softened in Dal will make a delicious dish.

18. At ~~noon~~ noon a meshed sweet banana will do.

19. Evening—A boiled potato sweetened with jaggery is in order.

20. Night____Mother returns home and prepares Khichari(Mixture of pulse and cereals).

21. There is no use wasting money earned by the sweat of your brow, purchasing ^Expensive protein packets. The solution outlined here is in the realm of the possible. Prepare Sattu. It is a popular myth that Sattu leads to diarrhoea. Any food, if gormandized Hastily, will certainly cause diarrhoea. Eat slowly, gradually increase the quantum. Instead of ^Bengal Gram use ground-nut, wheat, Jowar or rice in Sattu. We do prepare sattu on the auspicious occasion of Nagpanchmi, don't we? Keep aside some sattus for your young one.

22. Eat a banana and, as the old granny's tale goes, be prepared for unning nose. No, bananas surely won't cause common cold. They are simply in plenty in winter and winter is also the season for common cold. A mere coincidence, isn't it?

Don't blame bananas. They are so cheap, so nutritious, so sweet! Your baby has taken a liking for them!

23. Child's tantrums during eating are well known. A fastidious child will eat merrily if his food is sweetened with jaggery. "Jaggery to a child?" a mother may raise her eyebrows, "Won't it cause worms?" No and Never. It is another popular naive conception which sternly forbids us from giving jaggery to a baby. In fact it is the craving for earth and not the brown sugar which leads to worms.

24. 'Satvi,' the evil spirit, is an end result of perpetual starvation malnutrition vicious cycle. Poverty striken home breeds malnutrition. The crux of the matter is poverty. If you (sobriquet) poverty as 'Satvi,' then I fully endorse your idea of 'satvi mai'.

An evil triumvirate of diarrhoea, measles and whooping cough is the chief cause of perpetual weight loss in children. Persistant, chronic illness leads to emaciation. At least whooping cough and measles can be kept at bay. Use vaccine.

25. There is no use crying over spilt milk Advanced malnutrition, even if recognised, is not treatable. It must be nipped in bud. The figure shows ideal weight of a healthy baby as per its age a newborn weighs 3 kg, doubles by 6th month and triples by a year. It then puts on around 2kg/annum.

26. If the weight is less than the standard one, carefully note it. It would be tedious task trying to remember weight in kg. We suggest an alternative. The figure shows two babies being weighed. Both are 2- year-old. One is 12 kg.strong, the other weighs meagre 6kg. For the sake of convenience consider 12 kg. equivalent to 16 annas and 6 kg. equal to 8 annas. A mother should watch closely if her child is treading steadily along these milestone of development.

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