As a rule, large numbers of *Salmonella* species must be ingested to cause salmonellosis, but it must be recognized that these bacteria will grow at relatively low temperatures (above 41 F). Considering the few cases of salmonellosis which have been reported as being caused by the consumption of frozen foods, there must be little likelihood that frozen foods will be defrosted and held at temperatures above 41 F for long periods. The fact that most frozen foods are cooked prior to eating may have some significance in this case, although it has been shown that cooking is not a sure method of destroying all *Salmonella* bacteria which may be present in a food product, and in some cases in which trouble has been encountered, increases in these organisms have taken place during cooking.

Since toxigenic *Staphylococci* will not grow at temperatures below 50 F staphylococcal gastroenteritis from frozen foods may be of less probability than salmonellosis. In either case, frozen foods appear to be relatively safe compared with certain other types of food products. Unless they are grossly mishandled, it is unlikely that the consumption of such products will cause food infections or food intoxications.

The statement has been made that precooked frozen foods constitute a special problem because of the ease with which they are contaminated and invaded by microorganisms although this is not necessarily the case. It has not been shown that precooked foods provide a better medium for bacterial growth after defrosting than do other types of frozen foods. Even pathogenic bacteria of the type causing food infections and intoxications will grow in most frozen uncooked foods after defrosting, provided that suitable incubation temperatures are encountered and the growth of other bacterial types do not interfere with the growth of such pathogens. Precooked frozen foods after defrosting are subject to the growth of such pathogenic bacteria, but not necessarily to a greater degree than is the case with other types of frozen foods.

It is considered that in any plant producing precooked frozen foods in which adequate microbiological control procedures and checks have been set up, the viable bacterial content should be much below that which is encountered in uncooked frozen products. This in itself should contsitute a safety factor. It should be possible to package many precooked products at temperatures which would destroy nonspore forming types of pathogenic bacteria.

Some doubt has been expressed regarding the use of hermetically-sealed cans for frozen food packaging. Tests with frozen vegetables would indicate the probability that *Clostridium botulinum* will develop, to be no greater with foods packed in hermetically-sealed containers than with foods packed by other methods. The experience of different commercial organizations now packing a number of frozen foods in hermetically-sealed containers would appear to prove that the use of this type of container provides no special public health hazard as far as frozen foods are concerned.

PLANT SANITATION

Many of the food industries of the United States are just beginning to apply the sanitary principles which were developed by public health officials in regulating certain segments of the dairy industries. The food industry in general has in many cases been required by government regulation to handle foods so that they are relatively safe. Regardless of this, there can be no doubt that much could be done to improve sanitation in many food packing plants. It is also true that improvements in sanitary procedures could be made in some plants preparing frozen foods.

Personnel in plants producing products which may be eaten after defrosting without further cooking or without cooking to high temperatures, should pay special attention to plant sanitation. Such plants are those producing cooked shrimp, cooked lobster meat, canapés, oysters, waffles, and others.

All plants preparing frozen foods should have an adequate supply of potable water. It is considered that in-plant chlorination of water supplies is a desirable feature for food plants of this kind and that such an installation might even assist in simplifying the cleanup. It is not considered that breakpoint chlorination of heavily polluted water permits the use of such water even for cleanup.

Waste elimination systems which do not allow the accumulation of materials such as ensilage around or near the plant are essential. Such wastes held near the plant become breeding places for flies which eventually find their way into the plant itself. Waste accumulation areas in the plant become breeding places for insects such as cockroaches, beetles, and ants.

Plant construction should be such as to prevent the entrance of insects and rodents. This involves rat-proof of building construction and adequate screening. In the case of doors which must be opened frequently, special measures must be taken to prevent the entrance of insects.

Plant construction should also be such that steam may be properly vented to the outside. The accumulation of steam in the plant causes condensation and dripping which may become a means of contamination of the food products produced. Hoods used to eliminate steam should be so constructed that condensed moisture does not run back and drip within the hooded area.

Floors should be constructed of impervious material, such as either cement or tile, and should be easy to clean. In areas where waste materials may accumulate during processing, floors should be sloped to drains.

All equipment contacting foods should be constructed of a smooth metal which is not corroded by the material with which it comes in contact. Such construction provides for easy cleaning and generally improves sanitary conditions.

The use of hoppers should be avoided if possible. In processing some types of products, the use of large hoppers may lead to difficulty in disposing of product found to be below standard. Also in the case of partially processed material, the use of hoppers may cause product to be held up at this point for a longer period than is desirable.

When hoppers are used they should be funnel-shaped and have no angled corners. The bottom of the flumes should also be rounded and without angled corners to facilitate cleaning.

Machinery should either be mounted on a solid base or raised above the floor in such a manner that cleaning can readily be accomplished.

All machinery, belts, containers and other equipment contacting foods should be thoroughly cleaned with hot water and detergents, rinsed with cold water, then sanitized with some bactericidal agent, such as chlorinated water, several times daily. The floors in processing parts of the plant should also be thoroughly cleaned periodically.

While cleanup itself may be carried out by production personnel, cleanup procedures and the detergents and sanitizing agents used should be specified by the quality control group. Moreover, quality control representatives should inspect all areas after cleanup and determine that a suitable job has been done.

It is also the function of the quality control group to make frequent bacteriological line checks on product as it is processed in order to determine that no significant build up of microorganisms is taking place on equipment located at any particular point.

Both viable plate counts and microscopic counts should be made a number of times daily on finished product or on packaged product just prior to freezing. If batch-type production is used, such as might be the case with certain precooked products, at least one package from each batch should be examined bacteriologically.

It is considered absolutely essential in plants producing precooked frozen foods that both total microscopic counts and viable plate counts be used in quality control procedures. The microscopic count may be used to determine whether any batch of product should be isolated until further tests to determine sanitary quality have been made. The speed with which the microscopic count can be made allows for such a separation of the product.

In any food plant operation, the success of a quality control program depends upon the cooperation and vigilance of management officials as well as that of personnel carrying out the actual tests.

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