

Food Protection for the 80's¹

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ABSTRACT

New social, economic and political demands for conservation of energy, water and consumable products coupled with changes in lifestyle including more meals eaten away from home will require new approaches to food handling. These modifications may increase or uncover new hazards and potential opportunities for foodborne illness. Microbial hazards will remain a major problem but will be only one of the many concerns of the consumer about food. Increases in awareness of newly identified pathogens, carcinogens, mutagens and the like will demand greater efforts but will also increase cost of foods. Acute sensitivity to escalating costs will in turn bring about more objective evaluations of benefit/risk ratios on all programs. Education of producers, handlers, processors and consumers will be required so that they may monitor and serve as protectors of the food system thus minimizing regulatory costs and placing responsibility at the point of action. This process will be successful only with appropriate educational and research support to evaluate and implement modified programs.

New social, economic and political demands for a variety of changes make it imperative that those individuals working with food protection be extremely alert to change if they are to be successful. These various new demands, in turn, will frequently require new approaches to satisfy these needs and produce appropriate end results.

Most of the changes that are anticipated may be presently underway and should continue through the 1980's. A shifting age distribution in the population is one of these changes. Anyone who reads news magazines or daily newspapers is well aware of the shifting age distribution that is resulting in the closing of elementary schools and in requiring services by various expanding age groups. Modifications in social attitudes are evident and are an ever-present aspect of our life (12). Social attitudes have recently made a greater impact on food protection than earlier and will continue to do so. Changing consumption patterns have been evident for years, and consumption of various types of nutrients will continue to shift (7). Current economic concerns for inflation, for taxes and for general consumer spending do not show evidence of decreasing in the next decade. No short-term solutions to economic problems appear to be imminent. In general, a new awareness by all towards food, nutrition, safety and quality will result in changes in food protection activity. An expanding use of foodservice establishments will allow the foodservice market to continue to grow beyond its \$100 billion level

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in 1978 (10). This foodservice increase must be accompanied by increases in food protection activities directed at that aspect of our industry (6).

Consumer concerns will increase, and consumers will evaluate closely the relationships between benefits, risks and costs. Consumer attitudes remain very positive in relation to safety but are increasing in their intensity toward value and conservation. These general consumer attitudes must be reflected in the food protection programs of food processing industries, in foodservice and in the home.

NEW CHALLENGES

Examples of new challenges for food protection programs include the need to reduce water consumption and energy use in cleaning and sanitizing of processing equipment, of foodservice dishes and of other materials and equipment associated with food. Constant modification of technology in the area of food preparation and processing results in new and different prepared foods stored and preserved in a variety of ways. Examples include prepared and stored entrees and use of special ovens, including microwave, that cook in a variety of different ways. Another challenge is removal of traditional components from specific foods; for example, removal of nitrite, salt, or other food additives to produce a natural food, or substitution of a specific "natural" component for an "artificial" component in foods, poses a continued challenge to food protection.

Some of the questions that must be answered in the next decade follow. Who will set the risk/benefit ratios that we will live by? Who will enforce regulations? Who will verify the safety of foods? What approaches can be expected in answering and solving our problems? Consider some of the current and future directions for food protection in research, in education, in regulation that might speak to these questions.

RESEARCH

In research, government appears to be emphasizing more compliance and less research in the areas of food protection and sanitation, and will continue to follow this path. The food industry appears to be reducing the amount of effort it is expending on developmental research and is increasing its auditing activities. There is no indication that this trend will diminish. In academic areas, applied studies will continue to play a great role in research, but there are indications that there will be more

funding for certain basic, more fundamental research. This is indeed needed.

Some examples of research that are going on at present can be readily used to predict the kinds of research efforts that should be expanded and emphasized in the next decade. Research must be conducted on the evaluation of all facets of new processes. For example, the long-time low-temperature (LTLT) roasting of beef has recently undergone much evaluation and will be discussed in more detail later. There will be a need to test the removal of various preservatives and other food additives that have traditionally been present in foods. Alternative adjuncts to these foods also must be tested. An example of this would be removal or reduction of concentration of sodium nitrite added to cured meats and the inclusion of sorbic acid or potassium sorbate as an alternative preservative. Research of this type will be discussed later. Furthermore, there will be a demand for study of newly identified potential hazards. These would include microbial pathogens, as well as carcinogens, mutagens and the like. Rapid, simple test methods to identify potential problems in foods will continue to be a needed area for development in research. Finally, it will be essential to respond to the needs identified for specific educational efforts to support adequate food protection in the 1980's.

As an example of research evaluating an entire process, recent work in our laboratory (17,18) has been directed at studying the effects of constantly rising temperatures on growth and survival of *Clostridium perfringens* and salmonellae in beef. Studies on salmonellae supported a recent rule for the LTLT cooking of beef published by the USDA in July. The data that we obtained also indicated that *C. perfringens* could in fact grow to a reasonable population if the rate of heating a piece of beef during cooking was sufficiently slow to permit growth. Our current studies on *C. perfringens* growth and survival in these systems indicate that if one controls *C. perfringens*, one will also control the salmonellae. These findings also indicated that in the future the rate of heating of the product should be considered as well as the time at a given final temperature if the entire process is evaluated for control of unwanted bacteria. It is evident that there is a need to conduct an overall evaluation of any processes that are developed. A simplistic approach based on evaluation of one-time and one-temperature relationship may not be sufficient. It may be necessary to evaluate the overall cooking process just as we evaluate the overall thermal process in canned foods. One must identify which problem organism must be controlled, evaluate the entire cooking temperature profile for the process and use these with computer assistance to verify the safety of a variety of processes whether they be industrial, institutional or in the home.

Another example of research that we feel will be important in the next decade is the study which we are doing on reduced concentrations of nitrite in chicken

frankfurter emulsions and the influence of the addition of sorbic acid combined with reduced amounts of nitrite to control *Clostridium botulinum* toxin production under elevated temperature abuse conditions (16). Our data indicate that when the concentration of nitrite is reduced from the customary 156 $\mu\text{g/g}$ to 40 $\mu\text{g/g}$ (ppm) in the chicken emulsions, the protection is reduced to a level essentially the same as that of a product with no nitrite at all. However, if 0.2% sorbic acid is combined with this low level of 40 μg of sodium nitrite/g, the margin of safety is extended 4- to 8-fold beyond that observed at the current level of 156 μg of sodium nitrite/g. This is an example of the kind of research that will be needed for each situation where the removal, decrease in concentration or substitution for a traditional food additive or food preservative are proposed and the safety of the product comes under question. Testing of alternative adjuncts for potential hazards from changes of traditional adjuncts is an absolute future research demand.

Foodborne microbial threats also require extensive research. The Center for Disease Control in Atlanta frequently lists over 60% of foodborne outbreaks occurring in a year as "etiology unknown." For example in 1975, 306 of 497 foodborne disease outbreaks were listed as "etiology unknown" (3). In 1976, 306 or 438 outbreaks were of unknown etiology (4). Obviously, there is a need to identify various potential foodborne hazards. Common foodborne microbial hazards that are readily recognizable include *Staphylococcus aureus*, *Salmonella* sp., *C. botulinum*, *C. perfringens*, enteropathogenic and enterotoxigenic *Escherichia coli* and mycotoxins.

Other foodborne microbial threats that may or may not increase in importance in the next decade include *Yersinia enterocolitica*, *Bacillus cereus*, *Vibrio parahaemolyticus*, *Vibrio cholerae*, *Campylobacter* sp., viruses and a host of foodborne parasites. Beyond this, the potential danger from carcinogens, mutagens and other dangerous materials emphasizes the real need to study potential hazards. This is not intended to be alarmist. Whether it be a mutagen or a known microbial agent, one must constantly weigh the risks and benefits of the situation. The risk of death from inhalation or ingestion of food *excluding* foodborne intoxications and infections is 2,200 deaths per year in the United States, far in excess of the reported hazard from foodborne infections or food poisonings (11). What risk in the future will the public be willing to take in regard to foodborne intoxications and infections when benefits appear high and the risk is relatively low? Smoking of 20 cigarettes per day generates a risk of death of 5,000 per million persons per year (15). How does one compare that risk to a potential hazard of consuming a slightly mutagenic substance that happens to be a food additive used at a very low concentration (13)? Obviously, there will be no shortage of needs for research to support intelligent decisions in an adequate food protection program.

EDUCATION

Directions in education are as difficult to forecast as directions in research. Some examples where education must meet challenges include responding to the increase in numbers of students from a variety of curricula entering the food area, whether it be foodservice, food processing or food regulation. The expansion of information and scientific knowledge on food results in a greater demand for proper education and training. Thus, there will be a need for more continuing education for a greater variety of students and this continuing education will undoubtedly continue to be offered by a great variety of organizations and institutions. Not only will the universities and the private colleges be active in continuing education, but also a greater number of private organizations and individuals will be highly visible in this needed area of instruction. Education must and will have greater interaction with economic and socio-political activities. We see such increased need for interaction today in our relationships between government, industry and the consumer. Accordingly, food protection education must use the latest information obtained frequently from various research groups to assist students in making intelligent decisions for appropriate regulatory approaches.

REGULATORY ACTIVITY

What type of regulatory directions are anticipated? Increased economic, social and political pressures will result in a greater need for a broader use for the Hazard Analysis-Critical Control Point (HACCP) approach (1) to food protection. The identification of specific items, functions, and activities within food processing, foodservice, food handling and food distribution which can be monitored and used to verify that the product is not hazardous must be regarded as one of the most promising approaches to food safety. This can be expanded beyond food safety to monitoring of general quality assurance and to many operations in foodservice. Expansion of the foodservice industry (14) would indicate that a need exists for a program based on HACCP identification. Snyder has recently developed a program for quality assurance which bases many of its premises on the critical control point approach (9). Coupled with an appropriate educational program, this should relieve regulatory personnel of certain routine responsibilities and free them to make maximum use of their expertise.

After much discussion and study, selection of microbiological criteria will be placed more in the hands of international groups (5). Industry and government operations will also continue to set or establish their own microbiological criteria for food purchasing specifications (8). The critical control point approach coupled with appropriate education of producers, handlers, processors and consumers will permit them to monitor and serve as protectors of the food system while minimizing regulatory costs and placing the responsibility at the location where action can be taken and

where discrepancies can be corrected. Obviously this process will be successful only with appropriate educational and research support to evaluate and implement modified programs.

To paraphrase a comment in a recent address by Bauman (2), we as an organization must approach food protection in the 1980's in a positive dimension, emphasizing our capability of providing America and the world with very safe and readily available food in many forms and at a variety of locations. This can only give us new opportunities for renewed efforts and for innovative approaches to insure adequate protection.

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