FOOD SAFETY—FACTS AND FALLACIES

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ABSTRACT

Assurance of safety of foods is a paramount issue involving populations over long periods of time. Many aspects of food safety are discussed by the press and public in the emotional plane and in somewhat irrational manner. All foods are chemicals; and there is no special sanctity about ingesting naturally occurring chemicals. Indeed there occurs a number of toxicants in many natural foods. Over a period of time food technology has contributed to the preservation of the nutrient quality and naturalness of foods avoiding spoilage and deterioration of organoleptic quality. Often 'single issue' crusades extolling the importance of specific dietary ingredients or deprecating their widespread consumption are carried on with too much rhetoric and too little dispassionate judgement. Further, safety of food will be determined by human physiology related to issues of detoxification, excretion and metabolic elimination, etc. in the animal system, rather than by the ability to provide more sensitive methods of analysis. Ultimately, food safety is a matter of policy based on judgements of risk and benefits rather than measurements alone.

INTRODUCTION

The consumer is much more emotional about food than about any other item of consumption. This has given rise to not only unfounded concern about the safety of foods but also irrational and irresponsible statements about the safety of food in the press and in public forums. Highly slanted, totally uncritical and unsound views about the safety of food are being expressed and one gets the impression that the types of foods that we consume to-day are fabricated, inferior in nutritive content and embedded with poisons and carcinogens. However, it must be pointed out that unlike drugs for instance, which are prescribed to patients for a specified period of time, at a specific dose for a specific ailment, foods are freely chosen, with no limitations on intake or the persons ingesting. The consumer takes for granted that the Government and health authorities have taken sufficient care to ensure 'fitness for human consumption' and 'safety in use' of all food available in the market. Hence all the more the need for institution of all possible measures for ensuring the quality of food from the field to the table. Furthermore it is difficult to define food quality. Unlike engineering goods which can be produced according to specifications and regulated in terms of conforming to the specifications or not, or pharmaceuticals where the quality criteria are directly related to the composition, in the case of foods, specifications on the composition or those related to size, shape or characteristics conform only partially and certainly not the sole criterion for the evaluation and assurance of quality. The composition characteristics of the food raw materials vary with climate, soil conditions, the type and strain of the plant material, use of fertilizers and pesticides, harvesting practices, storage and a host of changing patterns and practices at the consumer end. On top of it all, food is a perishable product and the chemical, enzymic and microbiological changes occurring in foods add to or detract from its flavour and taste and therefore its organoleptic acceptability. While there are no really true indicators of food quality except as recognized *after* eating, in the case of food safety, we have to recognize it *before* eating.

PARANOIA ABOUT 'NATURAL' FOODS

In this context, a discussion on the present 'fetish' for 'natural' foods may not be out of place. There is a general misconception among the public that natural food and what is occurring in natural foods is acceptable and safe and processed foods and what are added extraneously to food are undesirable and unsafe. Nothing can be farther from the truth. Most people equate naturalness with goodness. Does being natural make it good? Viruses, and germs are natural—are they good? Should we succumb to their lethal embrace? Indeed if we were to list the unnatural things we do (and use) every day, such as switching on the light, flying, phoning, vaccination, automobiles, etc they would constitute a tribute to human inventiveness and testify to our need to escape the limitations of nature.

The causation of lathyrism, a serious neurological disease, due to ingestion of Kesari dal is well known and it is endemic in many parts of India. Most pulses, legumes and oil seeds that we eat contain various types of antitryptic factors, hemagglutinins or hemolysins and other growth inhibitory substances and unless they are adequately processed and detoxified they will be harmful to human health. A number of vegetables, especially of the Brassica family and soya bean contain goitrogens. It is well known that tapioca contains cyanogenic glycosides and steam treatment is necessary to remove these compounds. A number of vegetables such as cabbage, spinach and foodgrains, contain polycyclic hydrocarbons which have been experimentally shown to be carcinogenic. This does not, of course, mean that people who eat vegetables get cancer because of that; we have been living with vegetables for a long time.

Many of the plants of daily use brim with the presence of toxicants, carcinogens and terratogens. Safrole, estragole and methyleugenol and related compounds present in many edible plants are carcinogenic. Black pepper contains safrole and piperine, a closely related compound which is tumorigenic. Edible mushrooms contain hydrazines which are carcinogenic or mutagenic. Celery, parsnips figs and parsley contain linear furocoumarins such as psoralen derivatives which are potent light activated carcinogens. Potato glyco alkaloids, solanine and chaconine are potent cholinesterase inhibitors and possible terratogens. Many flavanoids, quinones and their phenol precursors, theobromine present in tea and cocoa, pyrrolizidine found in a number of herbs are known to be harmful. Pyrolized amino acids from burnt or cooked foods, cyclopropeniod fatty acids (sterculic, malvalic) erucic acid, gossypol, vicine and convicine from broad bean etc. have been reported to have detrimental effect on health.

Even after taking such a plethora of toxicants and carcinogens, mankind seems to thrive. Higher standards of living, greater world travel, increased demands on convenience foods and rapid growth of low calorie foods have increased the demand for safer foods with additives for the control of microbial and other types of spoilage and better preservation of colour and flavour. Under the existing circumstances such as (1) high density of population in the cities and urban areas and the need for transport and translocation of agricultural produce to the consuming sectors, (2) perishability of much of agricultural and animal produce such as vegetables, foods, meat, eggs, fish, etc. and lack of adequate food storage facilities, and (3) the high seasonality of many fruits and vegetables, the food producers, distributors and manufacturers are indeed performing a yeoman service to the population at large. In addition to ensuring regular supply to the consumption centres they are also doing a great service in ensuring avoidance of waste even in the face of tremendous bottlenecks in transport and distribution systems so that today an average consumer has available a wider variety and choice of foods of every type than was available in the past. Indeed, people who are talking of "natural foods" available in the past are, in fact, talking of a non-existent past, unless they are consuming the foods they themselves were producing.

In this context we need to pay more urgent consideration to radiation preservation of foods,

which is a 'cold' process in that there is only a slight rise in temperature of the food during treatment and therefore preserves and extends the shelf life of many 'fresh' products by three or four-fold compared with other methods currently in use. The World Health Organisation concluded in 1981 that 'any food irradiated to an average dose of one megarad or less was wholesome for human consumption'. Doses upto 3 megarads might be used for treatment of spices contaminated with microorganisms, while doses upto one-tenth of a megarad have recently been proposed for inhibition of sprouting in potatoes and onions, maturation of fruits and vegetables or the disinfection of insects from foods. Irradiation could eventually replace chemical fumigants such as ethylene oxide and ethylene dibromide (suspected carcinogens) in the treatment of spices, cereals and fruits. Commercially 'sterile' food products have been prepared with radiation doses of about five megarads, which effectively destroy both agents of disease and microbially induced food degradation. Compared with traditional methods of food processing, the energy requirement for irradiation is also relatively low. However, foods containing high levels of fat cannot be irradiated, since noticeable flavour changes occur. In a country like India where storage of grain and other farm produce is a major bottleneck, immediate steps to institute irradiation preservation is long overdue.

SINGLE ISSUE SYNDROME

Another major concern in issues concerning food safety is 'single issue syndrome' afflicting us today. We have some nutritionists recommending a higher accent on proteins, others recommending a lower accent on the same with a high priority for calories. We have the "fiberologists" who would like to have more fibre in food, and those with sucrose-phobia who contend that sugar is unphysiological and should be reduced as much as possible from the diet, if not totally eliminated. We have the anti-lipidwallas who would have us consume as little fat as possible, and the more vehement anti-saturated-lipidwallas who would have none of saturated fats in the diet. We have saccharin haters who would not allow even diabetics to use foods or drinks with saccharin, and the cholesterol baiters who would look upon blood cholesterol as the worst internal enemy of man. We have also the anti-salt protagonists who would not only limit intakes of salt but also expound theories that humans do not need any extraneous salt at all in their diet.

Many crusades on these types of 'single issues' of nutrient items, stretched out of proportion to their quantitative significance in the dietaries, are producing public controversies unhinging all logic. For example, let me refer to the debacle on saccharin. The carcino-genecity of saccharin is a subject in which a number of toxicologists have revelled with the sole objective that the function of toxicology is to find toxicity. Thus the Canadian investigators did carcinogenecity test with rats using hundred thousand times ADI (average daily intake) of saccharin in man. Since saccharin is not metabolised and is excreted, they also used as experimental animals a special strain of rats which are prone to bladder tumour when exposed to non-metabolised materials. In fact, bladder tumour was inevitable and could have been as easily produced by any other non-metabolisable material ingested including carboxy methyl cellulose. The scare regarding the use of nitrite for cure of ham or bacon without looking into the benefit of using nitrite, *viz.* freedom from exposure to clostridium botulinum toxin is another important issue that is agitating the minds of many people. On the other hand, the fact that we produce more nitrate and nitrite right in our own body than from exposure in the additive form is not at all highlighted.

To such people afflicted with 'single issue syndrome' food colours produce hyperkinesia and hyper activity in children, coffee drinking produces chromosome deletion and anything added to food to make it organoleptically acceptable is "bad". The prevalence of this type of syndrome where one issue is overworked without regard to other issues equally important is not valid in science. This has been the ailment even in United States where each agency looks at its own area of expertise, overdraws the picture and

produces hysterical outbursts without sanity or sense. Responsibility, rationality, commonsense and a sense of balance are the main victims of such one agency or one issue syndrome. I would like to place before you the thesis that after all the body with its physiologically maintained "milieu interieur" and homeostasis and its lymphatic system is designed to deal successfully with slight aberrations in the external environment and it would be foolish on our part like "three men in a boat" in Jerome K. Jerome's book to visualise all types of dangers lurking in every corner.

NEED FOR SANITY AND JUDGEMENT

Off and on, we hear about the presence of pesticide residues in milk and other foods. The scientist who determines these and makes a song and dance about its presence is usually unaware of the general innocuity of these materials and their toxicological insignificance in the quantities purported to be present. In the popular forum just because a chemical has been and can now be estimated in even concentrations as low as one part per billion—it does not mean it is present in any significant quantities to affect the health and well-being. Human toxicology does not change depending on the recent possibility of the estimation of a toxicant. These toxicants have been in foods since times immemorial and it just so happens today that we have more sensitive methods of analysis. Further, if for example a scientist finds parts per billion of a pesticide, say in milk, his responsibility does not end by publishing this in newspapers, but he should extend his work to determine the source of the contamination, whether it is from any one of the food ingredients or grass etc. so that public authorities can institute measures to reduce widespread contamination of the environment and ingress of migrant chemicals into the food chain. The manufacturer is usually the pig in the middle. He is often inculpated in various aspects of pesticide residue contamination in foods, but those primarily responsible for the indiscriminate use of pesticides in the environment not only go scot-free but are not even pointed at.

Starting with water, the microbial loads on almost any item of food produced in India are rather heavy. Indeed the major problems in food affecting the consumer in this country are microbiological and toxicological and we are frittering away our energy in discussing issues like minor additives to food such as colourants, preservatives and anti-oxidants etc. We seem to be straining at a gnat while swallowing a camel. The large part of our population are affected by food and water originating infections such as amoebic dysentery, typhoid, infectious hepatitis, poisoning due to clostridial staphylococcal toxin and other enteritic poisons. Similarly, in our country, there is a great deal of unethical trade which adulterates foods with inferior material such as, for example, chana dal with kesari, sugar with sand, tea leaves with iron filings, chilli and turmeric powder with azo dyes, mustard oil with argemone oil, edible oils with mineral oil, milk with water, soft drinks with spurious dyes and so on. Our law or legislation, like the proverbial fisherman's net, depends upon the size of the sieve, bigger fish are caught and a lot of smaller ones are let go by—and the problem in our country is our inability to reduce the mesh size to catch the innumerable small frys.

Chemical purity of food additives such as food colours, preservatives, flavours, anti-oxidants, etc. are easier to specify and achieve. Since these materials are synthesized chemically it is possible to introduce purification steps and procedures ensuring proper quality of the ingredients added to foods. However, quality specifications of food related to toxicology are of more crucial importance from the consumer's point of view. It is the responsibility of the health authorities with the support and help of analysts and toxicologists to ensure that various chemicals constituting health hazards are not carried into foods. In this category are included (1) adventitious crop contaminants such as kesari dal in tur dal, ergot in bajra, datura in jawar, argemone in mustard; (2) agricultural chemicals such as insecticide and pesticide residues (DDT, BHC, malathion, methyl bromide, etc); (3) solvent residues in solvent extracted oils and edible flour; (4) poisonous metals such as lead, mercury, cadmium, arsenic, etc; (5) migrant chemicals from various packag-

ing materials, paper laminates, lacquers, sealing compounds, plasticisers, optical bleachers and whitening agents for paper board, etc.; (6) microbiological infestations such as fungal infestations of *Aspergillus flavus* in groundnut and other oilseeds and cereals, bacterial growth of Staphylococcus in milk or Clostridia in meat, etc.

While the presence of adventitious crop contaminants cannot be completely controlled and strict surveillance and control measures to obtain produce of desired quality are required, the other types of contamination can be avoided if precautions are taken and necessary steps enforced during the cultivation, storage and processing of the food products. It is in this area where we need to enforce stricter discipline from the manufacturing and public health point of view and this can only be done by education and enforcement of chemical discipline to ensure quality. Even here a drive towards "zero risk" and requirements for complete elimination of purported harmful materials would be suicidal and would be like throwing away the baby along with the bath water.

WHAT IS FOOD SAFETY

Finally, let me come to the discussion on the question as to what constitutes food safety. There is always a dilemma facing the regulatory authorities in their efforts to produce safe and nutritious food yet promoting innovation and technology required by our growing population. While it is generally expected that without modern methods of food processing, packaging and storage, it would not be possible to satisfy the demand of industrial societies for a regular supply of a wide variety of foods, it is also necessary to emphasize, as Shakespeare wrote, "the best safety lies in fear". But this fear should not posit us to a situation in which considerations of safety lead us not to assurance but to anxiety and prognostications of gloom and disaster. I believe such prognostications are unwarranted. The consumers who suspect that responsible manufacturers misuse food additives seem to be unaware of the various steps taken from the chemical and toxicological point of view to screen substances which the law permits to be added to foods. There is no reason for concern on the use of permitted additives to food for technological or nutritional reasons and indeed for distrust and doubt over the vast array of testing methods or their adequacy for the determination of safety of food. Indeed it may comfort you all to know that the food industry is now processing, transporting and distributing an extraordinary range of products satisfying not only the basic needs of foods for survival but also the equally important aesthetic desires of our population. Perhaps the fault of technology has been that it has opened our eyes to possible dangers of which we were once blissfully ignorant.

In the ultimate analysis, food safety is a matter of policy, not of measurement. A likely hazard due to intake of a particular food with a putative toxicant can be evaluated, but decision about its use or recommendation as to the form or level at which it can be used is a matter of judgment. To the extent that we are able to arrive at a sound judgment regarding these issues dispassionately after examining all relevant data after balancing benefits and risks, unswayed by outbursts of emotion, we would be successful in contributing towards building up a more responsible food industry and a healthier nation.