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The Insidious Food Hazards as New Categories in HACCP and ISO-22000 Based Systems

Mohamad Azzam F. Sekheta[1,2]*, Abeer H. Sahtout[1], Issam Farid Soukhaita[1], Mirvana A. Airoud[3], Kinda A. Airoud[4] and Hanan Y. Qudsieh[1].

[1]*Sekheta Bros Company, R&D Department, Gdaideh, Aida Str. No. 1, 21000 Aleppo, Syria,* [2]*University of Belgrade, Faculty of Chemistry, Studentski Trg 12, 11000 Beograd, Serbia,*
[3]*University of Parma, Faculty of Medicine, Via Volturno 39, 43100 Parma, Italy,*
[4]*University of Parma, Faculty of Pharmacy, Via Universita, 12-I, 43100 Parma, Italy.*

Abstract : It is widely recognized that the absence of any food safety program or system such as HACCP and ISO-22000, might lead to food poisoning among wide range of population caused by food contamination. The importance of such food safety programs or systems lies in the fact that prevents food contamination or at least minimizes risk. As it is well known, in all enhanced food safety systems, hazard analysis play major roles in order to determine the critical control points (CCPs) for different types of hazards such as biological, physical and chemical hazards, which could effects food starting from farms and ending in the stores or restaurants. Unfortunately, many food safety systems world wide are often not integrated among government agencies, hampering communication and cooperation (1) and that due to low level of knowledge and the lack of training understaffed, or untrained for the rapid changes that have occurred in risk assessment, changes in production and distribution methodologies, and new foods and emerging pathogens.
In this paper, we are focusing on some different types of hazards that are insidious hazards which include different categories and subcategories such as food handlers, electronic hazard and long terms & wide ranging insidious hazards.

Key words: Insidious hazard, Hidden hazard, Ergonomic hazard, ISO-22000, HACCP

* Corresponding author, mailing address: Dr. Sekheta, Mohamad Azzam F., Sekheta Bros Company, R&D department, Jdaideh, Aida Street, No. 1, 21000 Aleppo, Syria. Phone: 00963-944-364-053, Fax: 00963-21-268-5231. Mailing Address: P. O. Box: 10405, Aleppo (SAR); E-mail: sebc@scs-net.org

Introduction

Although a nutritious and adequate food supply is vital to human survival, it can also pose health risk from food-borne illnesses. Safety measures and risk indicators are regulated by most governments, administrations, organizations worldwide and others.

Consumers have raised questions about food safety standards and the role that governments play in ensuring safe food supply. On the other hand, safe production, distribution, and consumer handling of food require knowledge of food-borne pathogens, chemical toxins, food quality, labeling, and food safety education too. Consumers have expressed concern about the safety of food additives, agricultural and veterinary chemical residues, biological, chemical and physical contaminants, radionuclide contamination and uncontrolled and unacceptable food handling practices and processing which can result in the introduction of hazards to food at all stages along the food chain, from primary production to the consumer.

These concerns have been voiced most often by consumers in the developed world; however, continuous development and improvements in global communication have heightened the interest of consumers throughout the world on these matters. Finally, this new era of globalization requires a careful effort designed to build and maintain consumer's confidence worldwide in recent achievements in food science and technology.

RISK ANALYSIS

As there are many hazards associated with food that can and do result in injury and harm to human health, food safety is a worldwide issue affecting hundreds of millions of people every year who suffer from diseases caused by contaminated food or from some kinds of food poisoning. Unfortunately, due to the fact that

hazard analysis is one of the most difficult works as some hazards are hidden or insidious, current food safety systems are still not perfectly prepared.

Uncontrolled application of agricultural chemicals, environmental contamination, and use of unauthorized additives, microbiological hazards and many other abuses of food along the food chain, can all contribute to the potential of introducing or failing to reduce hazards related to food. With increased awareness of the effects of food hazards on human health, the increasing importance and rapid growth of world food trade and the demand by consumers for safe food supply, analysis of the risks associated with food has become more important than ever before.

In general, risk analysis process comprises three separate elements; risk assessment, risk management and risk communication. It is widely recognized as the fundamental methodology underlying the development of food safety standards.

Categories of Hazards Associated with Food Industry

In fact, HACCP and ISO-22000 based systems are designed to prevent the occurrence of potential food safety problems. This is achieved by assessing the inherent risks attributable to a product or a process and then determining the necessary steps that will control the identified risks. The goal of implementing a particular HACCP and ISO-22000 system is to prevent or minimize risks associated with biological, chemical, and physical hazards to acceptable levels as it is based on prevention rather than detection of hazards.

In this paper, we are going to divide the major food hazards into three major groups:

A-) Expected Food Hazards as Defined by Codex Alimentarius Commission:

Codex Alimentarius Commission defines hazard as a biological, chemical or physical agent in, or condition of, food with the potential to cause an adverse health effect. Microorganisms that can cause disease or illness are called pathogens and they are biological food safety hazards that must be evaluated in a hazard analysis. Most of these pathogens are killed or inactivated by adequate cooking and numbers are kept to a minimum by adequate cooling during distribution and storage. If it's determined that a pathogen is reasonably likely to occur at a level that will cause illness, this hazard would need to be controlled in a HACCP plan (2). In general, there are three types of pathogenic organisms that can be potential food safety hazards: bacteria, viruses and parasites.

Chemical contamination of food products can occur at any stage of food processing. Exposure to some chemicals may cause immediate symptoms and other chemicals may require exposure over prolonged periods to have a toxic effect. Although, certain chemicals can be considered food safety hazards, the presence of a chemical may not always mean there is a hazard as the amount of the chemical may determine whether it's a hazard or not.

Physical hazards on the other hand, are the most commonly reported consumer complaints because the injury occurs immediately or soon after eating, and the source of the hazard is often easy to identify.

B-) Hidden Hazards in Food

Unfortunately, many food manufacturers seem to be not aware enough of such hazards. It is HACCP team's responsibility to consider such hazards while analyzing hazards along the food chain in their establishments. The most common categories of hidden hazards in food chain from farm to fork are: Irradiated food, canned food, heavy metal residues in food, household chemicals, microwave ovens-cooked food, cling wrap in contact with food, bottled water in PET bottles, soft drinks, energy drinks and artificial sweeteners, artificial flavorings and colorings, refrigerators, fat and cooking oils, cooking food in aluminum and Teflon coated vessels and other cookware, vitamin and mineral tablets, the Ingredients in "Dietary Supplements" promoted for sexual enhancement and many others. This group of hazards will be discussed in our next paper which is under construction.

C-) Insidious Hazards in Food

This group includes different categories and subcategories of hazards effecting on food safety. In order to implement a particular HACCP, ISO-22000 or any other food safety system more successfully, it is more than a need for assistance from an expert to deliver more skills to the HACCP team in order to enable them to analyze all categories of possible and/or eventual food hazards.

In this paper, we are going to consider the following categories as major possible insidious hazards to food and water supplies:

1-) Insidious Hazards of Food Handlers

There are number of hazards that can be found in almost any workplace in food industry. There are obvious unsafe working conditions, such as unguarded machinery, slippery floors or inadequate fire precautions, but there are also a number of categories of insidious food hazards including:

Mental Health of Food Handlers:

Psychology in Worker's Compensation has been viewed much more favorably in the last decade. Prior to that, there was little consideration of the psychosocial factors involved in a work-related injury and reactions to the injury. Employers, employees and unions are starting to realize that, mental health problems are the single most important cause of disability responsible for a global burden of disease larger than that due to infections.

In fact, mental health of food handlers is one of the most important ingredients in preventing foodborne illness. Sekheta et al., (3) consider mental illness of

food handlers as a very important issue. Large percentage of employers understand the relationship between health and productivity and are improving their management strategies by developing and implementing systems supportive of work, family and life issues, such as flexi time, part-time schedules, child care benefits, personal leave, wellness health programs, and family counseling. Training food handlers in general and those monsters with disabilities in particular on how to mind their psychiatric symptoms at work in order to ease or master their stress is quite desirable.

The Effects of Ergonomic Hazards on Food Handlers:

Ergonomics is the study of fitting the work/job to the individual. Ergonomics matches the design of tools, controls, and equipment to fit the safety needs of the operator. Many ergonomic problems in food industry result from technological changes such as increased assembly line speeds, adding specialized tasks, and increased repetition. Any of those conditions can cause ergonomic hazards such as excessive vibration and noise, eye strain, repetitive motion, and heavy lifting problems. Improperly designed tools or work areas can be also ergonomic hazards.

Poorly designed work stations/practices lead to Musculoskeletal Disorders MSD. Understanding basic ergonomic principles is essential for prevention of these injuries. Each employee needs to understand the ergonomic risk factors related to his or her work tasks and solutions to minimize such risks. Beside the ergonomic hazards in food Industry, there are a lot of occupational hazards such as burns, cuts, fires, cleaning chemicals, CO poisoning, heat stress, cold stress, slips, trips, falls and many others.

Ergonomic hazards in food industry are avoided primarily by the effective design of a job or jobsite and by better designed tools or equipment that meet food handlers' needs in terms of physical environment and job tasks. Evaluating working conditions from an ergonomics standpoint involves looking at the total physiological and psychological demands of the job on the food handlers. Engineering controls, where feasible, are the preferred method for controlling MSD hazards as they act on the source of the hazard and control employee exposure to the hazard without relying on the employee to take self-protective action or intervention. Finally, it is important to point out that the benefits of a well-designed, ergonomic work environment in food industry can include increased efficiency, fewer accidents, lower operating costs and more effective use of personnel.

Improper Food Hhandlers Hygiene:

Food Industries, unions and Governments worldwide are starting to realize that, improper food worker hygiene problems are the single most important cause of foodborne illness:

Clean hands are the most important food safety tool. Food Handlers must be trained on proper hand washing. Food handlers not allow to work if they have any risk having infection. They must stop working with food when they are sick and that until all symptoms are gone. Food handlers must check times and temperatures regularly in cooking, pasteurization and cooling. As in cooking, food handlers must take cooling seriously; certain bacteria can make poisons that are not destroyed. It is important to cool food through the "Danger Zone" as fast as possible to keep bacteria from growing.

As insidious hazard gloves, will always have a role to play in ensuring safe and healthy workplace, but only if selected and used correctly. Some gloves, contain substances capable of causing allergic (type IV) reactions. Other gloves contain harmful chemicals such as thiurams, and di-thio-carbamates. Today, we and a lot of other colleagues scientists concerned of food safety are wondering whether the gloves are a help or a hazard.

Cleaners and disinfectants must be suitable for using safely in food establishments. Special written procedures should be followed and applied. Workers in the sanitation team should have special training too.

Another important food safety issue is reducing food cross contamination and workplace accidents. Therefore, food handlers must keep food-contact surfaces washed, rinsed, and sanitized after each use to remove germs that can cause illness. As, the used sanitizer becomes less effective gradually, food handlers should change it more often. They must keep equipment and kitchens clean in order to reduce the potential for food contamination.

It was also found that the highest prevalence rates occurred amongst the youngest age group with the lowest socioeconomic status or probably, most of those who prefer to work in the night shifts.

2-) Electronic Hazards Effecting Cyberspace

While only a few cases of intentional contamination of food have been proven, the risk of possible terrorist threats to food should be given serious consideration by governments through health authorities and the food industry worldwide. Existing food safety management systems such as HACCP and ISO-22000 can be enhanced, while putting in place appropriate security measures to protect the whole food chain including the production itself as well as the related distribution systems too. A novel HACCP based defeating plan against terrorist threats to Cyberspace controlling food processing and water supplies is being enhanced and established by Sekheta, M. A. et al., and the risks & possibilities of combining terrorism and computers are addressed too (4). According to the world health organization WHO, the contamination of food for terrorist purpose is real and current threat, at the same time, contamination of food at one location could have global public health implication.

Nowadays, more chemicals and biological agents are related to the effects of aerosol exposure, many agents

also could be delivered through food or water. These agents might be utilized including industrial or biological toxins and or microbial pathogens (5). The possibility of contaminating food and water supplies deliberately by a terrorist attack aiming on cyberspace must be taken seriously. The key to preventing from such terrorist attacks is coming from improving quality control and implementing a reasonable security measures at production facilities based on vulnerability assessment. There may not be an optimal cyberspace controlling system for all food businesses at all stages along the sophisticated food chain but enhanced HACCP approaches have clear benefits (6).

3-) Long-term and Wide-ranging Insidious Hazards and Risks

3-1) Genetically Modified Food (GMF):

Although GMF is a revolutionary new technology still in its early experimental stages of development, this technology has the power to break down fundamental genetic barriers-not only between species-but between humans, animals, and plants (7). The introduction of genetically modified foods in consumer markets worldwide is currently a hot topic for debate.

Genetically engineered foods are different from other foods. Genetic engineering allows, for the first time, foreign genes, bacterial and viral vectors, viral promoters, and antibiotic marker systems to be engineered into food. The most insidious dangers of genetic engineering are inherent to the process; it greatly enhances the scope and probability of horizontal gene transfer and recombination, the main route to creating viruses and bacteria that cause disease epidemics. Newer techniques, such as DNA shuffling, allow geneticists to create in a matter of minutes in the laboratory millions of recombinant viruses that have never existed in billions of years of evolution Disease-causing viruses and bacteria and their genetic material are the predominant materials and tools of genetic engineering, as much as for the intentional creation of bio-weapons (8). Genetically engineered foods are also inherently unstable. It is important to put the fact that the genetic instability of these GM foods can be also a major culprit in reducing their nutrients. A number of studies over the past decade have revealed that genetically engineered foods can pose serious risks to humans, domesticated animals, wildlife and the environment. Human health effects may include higher risks of toxicity, as each genetic insertion creates the added possibility that formerly nontoxic elements in the food could become toxic (9). The genetic engineering of food creates two separate and serious health risks involving allergenicity (10, 11). Another insidious risk of GM foods is that they could make disease-causing bacteria resistant to current antibiotics, resulting in a significant increase in the spread of infections and diseases in the human population. Virtually all genetically engineered foods contain antibiotic resistance markers which help the producers identify whether the new genetic material has actually been transferred into the host food. There should be a ban on the use of antibiotic resistance marker genes in GM food, as the risk to human health from antibiotic resistance developing in microorganisms is one of the major public health threats that will be faced in the 21st century (12). A group of scientists from UK found that the rats consuming genetically altered potatoes showed significant detrimental effects on organ development, body metabolism, and immune function (13).

Large groups of scientists and activists see the new technology "GMF" as one giant experiment that could go dangerously wrong should genetically modified crops cross-pollinate, migrate, or mutate in nature. Recently, soybeans, corn, cotton, and canola are the most commonly engineered crops. A new report on the impact of GM on the genetics of the modified crops by an independent group of scientists (14) has highlighted huge gaps in scientific knowledge and the need to greatly improve scientific assessment procedures before GM crops are licensed.

Supporters to GMF, on the other side, say the first wave of any new technology is flawed. Still, we are not able to get a clear answer to our simple question whether we can eat genetically modified foods safely or not, as the answer we get depends on who we ask about this very controversial subject.

Actually, consumers worldwide, but mainly in the undeveloped countries, eat food that's genetically modified every day without knowing it. That's because processed foods like vegetable oils and food additives including baby and infant food, often use foods that have been genetically engineered, and there's no requirement that they be labeled as such.

Food and Drug Administration (USA), believes that the genetically modified foods are no different from their unmodified counterparts, so there's nothing that needs to be reported. But the authors of this paper together with many other scientists worldwide disagree. Most of us think labeling is the key and without labels, that's next to impossible. Fortin and Renton (15), examined the impact of additional product benefits on consumer attitudes towards GMF. Results indicate that genetic modification in food products has a negative impact on attitudes. More importantly, the presence of additional product benefits resulting from GMF was not enough to offset this negative view.

3-2) Unacceptable Levels of Pesticide and Fertilizers Residue:

Today, millions of children worldwide, age five and under face possible health risks from eating fruit, vegetables and even baby food containing unacceptable levels of pesticide and Fertilizers residue. Although food and chemical makers insist the food is safe, pediatricians believe there is cause for concern.

Pesticide and veterinary drug residues: According to the reports of National Academy of Sciences in USA, 15%

of people are at least significantly harmed by pesticide exposure each year. Symptoms, which are often mistaken for the flu or allergies, include: headaches, breathing difficulties, diarrhea, coughing, sleep disorders, and temporary paralysis.
Long-term consequences of exposure include lowered fertility, birth defects, liver & kidney dysfunction, neurological damage, immune system disorders, cancer and death (16, 17).
More than 90% of the pesticides on the market lack minimal required safety screenings. Of the 34 most commonly used lawn pesticides, 33 have not been fully tested for human health hazards. The few tests that are done are preformed by the manufacturers, not the governments or their institutions.
Pesticides are also called Persistent Organic Pollutants POP's. Some commonly used Pesticides, commonly called the dirty dozen are DDT, lindane, aldrin, dieldrin, endrin, chlordane, heptachlor, mirex, toxaphene, hexa chlorobenzene, poly chlorinated biphenyles, dioxins and furanes.
These Pesticides poison the soil and water for many years and enter our food chain through fruits, vegetables and grains as well as through meats and fish. These Pesticides have a half life of between 40-150 years and hence will persist to even poison our great grand children. This is why most of the world's population has pesticide levels in their bodies which are 20 to 1000 times more than what the WHO considers to be safe. As a result the incidence of cancer, allergies and auto immune diseases has sky rocketed world wide.
Millions of people are engaged in some aspect of managing pesticide risks too. Much of this regulatory intervention in pesticide commerce and use came after Pesticides were in wide circulation, in response to our growing understanding of the consequences of their use. According to Michelle Miller (18), there are four areas of experience with pesticide policy. Public policy makers struggle with identifying acceptable risk from Pesticide and then managing for that risk within the agreed critical limits (CLs).
Fertilizers: They are artificial nutrients added to the soil to increase the yield of food. If applied carefully in the correct dosage they have few adverse effects on health but if applied indiscriminately in the wrong doses as it is the case in some parts in China, Egypt, Lebanon, Nigeria, Sudan and many other undeveloped countries worldwide (19, 20), they affect the soil, the water, our health and our bodies.
3-3) Sugars and Artificial Sweeteners:
Sugars: This product's atomic density (98.4 to 99.5 %) falls under the category of poison. It takes years before it ruins someone's pancreas, his adrenal glands and his endocrine system. Had it been ten times as dangerous, nobody would have touched it. But since it is a slow and insidious poison, consumers worldwide relish it ever so much. Most known sugar related health problems are Allergies, Cancer (cancer cells feed on sugar), Vaginal yeast infections, Menstrual difficulties, Mental illness, Hormonal problems, Heart Disease and more. This industrial sugar also paralyzes the intestinal peristaltic functions and leads to immune system failure. White sugar also destroys brain cells and elevates the internal temperature of the body. In 1996, Ann Louise Gittleman (21) in her book "Get the Sugar Out" says that no matter what form it takes, sugar paralyzes the immune system in a variety of ways.
Artificial Sweeteners: They fall into two major categories:
The bulk sweeteners, such as mannitol, sorbitol, xylitol and hydrogenated glucose syrup, have approximately the same calorific value as sugar and replace it in many processed foods, but they are not so readily absorbed. The sugar alcohols, hydrogenated glucose syrup and xylitol, actually help to prevent tooth decay. However, any of these bulk sweeteners can cause diarrhoea if consumed in quantity.
Intense sweeteners, such as Aspartame (E951), Tagatose, Acesulfame-K, Sucralose, Stevia and Saccharin, provide virtually no calories and are mainly used in diet products. They have produced worrying adverse reactions and are cause for concern. Many clinical studies represent merely a fragment of the diverse effects chemical sweeteners can have on diabetic individuals, particularly Type I diabetics, (22). An important point that is overlooked: it is vital to monitor chemical sweetener interactions with the various types of diabetic medications.
Aspartame has been used throughout the world in soft drinks and other low-cal or sugar free foods since 1974. It was first approved for use in the UK in 1982. It is known by the name NutraSweet, aspartame or E951. It is made up of three chemicals: Aspartic acid, phenylalanine, and methanol. Aspartame sugar substitutes cause worrying symptoms from memory loss to brain tumors (23). But despite US FDA approval as a 'safe' additive, aspartame is one of the most dangerous substances ever to be foisted upon an unsuspecting public where billions of people are now Aspartame victims.
Still, many people want to know what other artificial sweeteners they may safely use instead of aspartame. Our first recommendation is NOT to use any chemical sweeteners at all, but merely use natural sugars or learn to adjust to the natural sweetness of raw foods themselves. If sugar substitutes are being used to help manage someone's weight, he/she should make them part of a sensible plan that includes healthful eating, exercise and lifestyle changes.

4-) Other Insidious Hazards in Food
There are too many other insidious hazards which can affect badly on food and consumer's health too. It is hard to talk about them all in this paper. The main other insidious hazards in food are: heavy metals mainly in

caned foods, natural toxins, irradiated food products, Toxic Chemicals, and so many others.

Suggested Added Control Measures for Insidious Hazards

In the following, authors suggest some common control measures for all categories of hazards including the insidious hazards in food industry based on enhanced HACCP or ISO-22000 system. These control measures for hazards in general and insidious hazards in particular, must be taken by a professional HACCP coordinator/team and whenever it's needed, with preferably the assistance of external experts or consultants and should include:

Training all food handlers on the correct and hygienic ways of hand washing, food handling, processing, delivering and storaging.

Training food handlers with disabilities on how to mind their psychiatric symptoms at work in order to ease or master their stress.

Reducing food cross contamination and workplace accidents.

Using food grade packaging and rubbing materials

Hiring external experts, trainers and consultants whenever it's needed.

Developing a flow diagram depicting an operation from primary steps or production process to consumption. Modifications should be made whenever it's needed.

Developing and revising food safety plan

Preparing an enhanced list of hazard analyses together with suggested measures needed to control or eliminate those hazards.

Controlling and monitoring the cyberspace through written procedures.

Preparing an inventory of eventual or possible insidious hazards with clear identification of the controlling measures needed.

Developing and instituting preventive measures needed to prevent or reduce all categories of identified hazards.

Establishing and developing preventive or risk control measures to reduce all hazards including the insidious to acceptable levels.

Preparing correct labeling for all food products mainly those containing ingredients of possible insidious hazards.

Varying choices or using more than one sweetener in a food company's products. (Some sweeteners enhance each other’s sweetness; blends often use less of each, reducing your exposure to any one sweetener).

Establishing critical limits (CLs) for the determined critical control points CCPs.

Establishing or developing monitoring procedures for each CCP, taking into consideration that monitoring procedures work and are both tolerable and feasible for the food organization.

Improving quality control and implementing a reasonable security measures at production facilities based on vulnerability assessment and that in order to prevent from possible terrorist attacks.

Establishing and developing a procedure as a corrective action system under HACCP and ISO-22000.

Avoiding ergonomic hazards in food industry by the effective design of a job or jobsite and by better designed tools or equipment that meet food handlers' needs in terms of physical environment and job tasks.

Evaluating working conditions from an ergonomics standpoint involves looking at the total physiological and psychological demands of the job on the food handlers.

Providing adequate ventilation in the form of hoods and forced air as stated in the internationally well defined standards and codes or in accordance to the required standards in the country of the manufacturer.

Disallowing stock build-up of toxic, flammable, or corrosive materials.

Having efficient and appropriate clean-up agents for spills

Having suitable safety equipment available (e.g., extinguishers and respirators).

Ensuring that all possible problems are fixed. Revise critical controls and/or monitoring procedures accordingly.

Establishing a Verification of the System; Test or verify periodically the developed security program or plans in order to ensure that it works properly.

Finally, establishing effective record keeping for the HACCP and ISO-22000 systems applied is one of the most important issues. This would include records of all categories of hazards and their control methods, the monitoring of safety requirements and action taken to correct potential problems.

Conclusion:

Safe food may be defined as a product which contains no physical, chemical or microbial organisms or by-products of those organisms which if consumed by human will result in illness, injury, or death. The definition purposely does not use the term contaminants because many of the potential hazards in food that HACCP and ISO-22000 systems are designed to address are typically found in or on the food. It is their concentration, numbers or size that creates potential safety problems. However, in the present study, we discuss the insidious hazard; this group of hazards includes different categories which also can effects in one way or another food safety. One of the most important categories is the food handlers themselves. Beside the unsafe conditions which may face the food handlers and can affect the working condition, mental health is one of the most important factors that may prevent food borne illness. The food-handler's hygiene is one of the most important issues that also can prevent food contamination.

The second category of the insidious hazards was the electronic hazards. There is a great possibility of terrorist threats to food and water supplies aimed at

Crippling the Cyberspace in many food establishments worldwide. HACCP and ISO-22000 can play roles in protection such threat by controlling all the system for all food production.

Many studies show that food exposed to genetic engineering modifications may pose serious risk to human's health and also bad effect to our environment. Governments should ensure that non-genetically modified foods continue to be widely available and affordable to consumers, and that GMF are labeled in a consistent and understandable manner. Also, export of GMF to developing countries should be carefully monitored to ensure that packaging, labeling and possible environmental consequences are fully regulated.

We don't tend to think about what is invisible to us, or what pesticide, fertilizers and other chemicals which exposure in our bodies can do, some of these chemicals can developmental delays, behavioral disorders, and motor dysfunction.

Sugar can also paralyze the intestinal function and may cause immune system failure. They called it the white poison and it can be also count under the insidious hazards. This white poison can also ruin pancreas, adrenaline gland and endocrine system.

Finally, controlling measures for all hazards including the insidious is the key to have much safer food production controlled by enhanced HACCP and ISO-22000 systems.

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