Chapter 21: New Trends in the Food Sector and Emerging Safety Issues

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Chapter 21: New Trends in the Food Sector and Emerging Safety Issues

The food ecosystem is constantly changing. Challenges like climate change, globalization of food industry, urbanization, emerging water- and food-borne diseases, antimicrobial-resistant bacteria, chemical contaminants in a greater number and variety of foods, increasing food costs, complexity of food supply chains, triple burden of malnutrition, changing food consumption pattern of consumers, etc. threaten food security and safety. New technologies and innovations are needed to address these challenges. Increasing food production, improving packaging, storage and transport to decrease food losses, newer methods of detection of contaminants and monitoring microbial growth, science-based methods of assessing risk and development of resource-efficient technologies are some of the ways of ensuring safe and wholesome food for the coming generations. This chapter discusses these trends as well as looks at emerging trends of fad diets and superfoods as well as sciences of nutrigenomics and molecular gastronomy. Technological advances in tools for communication have created the problems of 'information overload' and misinformation in the media. Let us see how the consumers can benefit from the advancements in technology as well as protect themselves from negative impacts.

Emergence of New Hazards

Technology is one of the driving forces of innovation today and it is challenging some of the most established companies to adopt to the new changes so that they stay relevant. The world is facing the challenge of population growth with an expected 10 billion mouths to feed by 2050. While use of biotechnology can increase the food supply, innovative solutions are needed for improving processing and packaging to increase shelf life and safety of food. Emerging new threats/hazards demand constant monitoring of the food supply with early identification systems. According to EFSA, an emerging risk is defined as "A risk resulting from a newly identified hazard to which a significant exposure may occur, or from an unexpected new or increased significant exposure and/or susceptibility to a known hazard." New biological or chemical hazards, which were not considered problematic earlier, are being detected in foods which earlier didn't have these hazards. In addition, hazards are causing illness in a greater number of people or in regions where they didn't exist earlier. These hazards have to be recognized and controlled before they become major threats.

Changes in the food consumption behaviour with expansion of commercial food services, new methods of large-scale food production, processing and preservation, and, environmental pollution have led to the emergence of newer food safety issues. Advances in food science and biotechnology have introduced new food products, crop varieties and genetically modified foods. With global treaties and lifting of trade barriers between nations there is a greater movement of food from one country to another. While this trend maybe welcome from the point of view of better trade and accessibility to diverse foods, it also raises concerns about introduction of pathogens in countries which were hitherto unexposed to them as well as emergence of allergies due to consumption of new foods, and other adverse effects.

Other hazards which are emerging world-wide are virulent new strains of microbes which do not respond to the standard treating protocol. Emergence of drug resistant strains of microbes is being blamed on indiscriminate use of medication both in veterinary practice and by humans. The microbes learn to adapt and undergo mutations which make them stronger and more resistant. Microbes are also being detected in foods which were earlier not believed to be carriers of pathogens. Let us learn about some of these emerging hazards in greater detail.

Microbial hazards

Emerging pathogens of concern are those pathogens which are either causing a new illness or the number of cases is now increasing sharply, or they are spreading the disease over a wider geographical area. For instance, increasing number of people are falling ill due to Listeria, *E. coli 0157:H7* and multidrug resistant strains of Salmonella, Brucella, etc. Bird flu, Swine flu, Coronavirus and other infections have been making an appearance adversely affecting the food industry.

Escherichia coli O157:H7 which causes diarrhea and hemolytic uremic syndrome, was earlier found in undercooked ground beef. It is now being detected in other foods like raw milk, apple cider, lettuce, brussel sprouts, uncooked sprouts, and soft cheeses made from raw milk. Listeriosis, caused by eating food contaminated with the bacterium *Listeria monocytogenes,* affects primarily pregnant women, newborns, and adults with weakened immune systems. It has been detected in foods like milk, soft cheeses, salads, processed meats and ready to eat chicken and meat preparations which are contaminated post cooking. It survives the cold chain storage and causes listeriosis in vulnerable individuals.

New parasites like *Cryptosporidium parvum*, which are resistant to chlorine and other disinfectants are being detected in treated municipal water which had otherwise been declared safe for drinking. North American outbreaks of cyclosporiasis, due to protozoan parasite *Cyclospora cayetanensis*, provide another example of a new disease which is now endemic in more than 27 countries. *Campylobacter jejuni* is now considered as the most common bacterial food-borne pathogen in most countries with several reporting the emergence of antibiotic-resistant strains. *Salmonella typhimurium DT104*, which infected wild and farm animals, is now increasing making people sick as well. Non-typhoidal strains of Salmonella are also increasingly leading to illness.

The threat of animal diseases being transmitted to humans has also been a major concern. Confirmed instances of the avian influenza viruses infecting humans have been documented. The type of virus with the greatest risk is the highly pathogenic avian influenza HPAI strain, H5N1. Outbreaks have become more common due to intensive poultry production. The influenza virus has shown presence of genes that have been adapted from both human and avian strains. Transmissible Spongiform Encephalopathies (TSEs) are another example of diseases which have emerged as a result of altering natural feed of animals. The prion disease jumped species and was implicated in human deaths as well.

Other examples of emerging pathogens include – *Toxoplasma gondii, Shigella, Vibrio parahaemolyticus, Yersinia enterocolitica*, etc. Antimicrobial Resistant (AMR) microbes is a growing concern which can be blamed on indiscriminate use of antimicrobial drugs, poor quality antimicrobials and use for non-therapeutic purposes in both humans and animals.

Chemical hazards

Use of new chemicals in food production, processing and packaging is introducing newer contaminants into our food supply. Earlier chapters have highlighted these concerns regarding pesticide residues, drugs used in animal husbandry and other chemical contaminants either occurring naturally in foods or being produced during processing or leaching into food from equipment or packaging. Advancements in analytical methods and equipment is enabling us to detect contaminants in foods which we considered as safe, with the prime example being of phthalates and other chemicals migrating from plastic bottles to water/food being stored in it. Plastic debris in the marine environment is contaminating the fish and other seafood with a cocktail of chemicals and microplastics.

Microplastics – An Emerging Threat

The United Nations warned about the presence of microplastics in fish in their Environment Project report for 2016. These tiny bits of plastic land up in the rivers and oceans due to poor waste disposal methods. They are ingested by marine life, which is food for man, thus increasing the risk of human exposure to these tiny bits of plastic and the chemicals present in plastics.

Milk, meat and eggs are usually the animal products in which residues of veterinary drugs were suspected, however in 2010 there was report of antibiotic residues in honey in India. This was because in commercial beekeeping, the bees are susceptible to infections and antibiotics are regularly used to tackle infections. Similarly, pesticide residues usually believed to be a problem in grains, vegetables and fruits are also finding their way into a greater number of processed foods and beverages in which contaminated water and raw ingredients have been used.

Ban on serving food in a newspaper

Use of newspaper for wrapping or serving food has been banned in India since 2016 as newsprint is made of toxic chemicals which leach into the food.

Chemical hazards may also naturally be present in plants and animals as has been discussed in earlier chapters. Increase in trade between countries has also introduced new foods to the population of the importing countries. In the country of origin, the local population had devised household cooking/ processing techniques to get rid of these toxins. The technique if not transferred to the importing country could result in them suffering the adverse effects. Factors such as climate change and ocean acidification have probably resulted in increased risk of toxic algal blooms and its outbreaks in India.

Ciguatera fish poisoning was identified in 2016 in Indian city of Mangalore. The samples of *Lutjanus bohar* and *Pristipomoides filamentosus* tested in 2016 from Karnataka and Kerala region were found positive for ciguatoxins. Its presence in the fish does not affect the taste, odour or appearance of the fish which makes it difficult to identify and remove the contaminated fish. Lack of an accurate method to detect the disease in humans and toxin present in fish also make this toxin an important concern in food safety.

Consumer fear regarding Food Irradiation and Genetically Modified Foods

The possibility of change in the structure of food components like proteins on exposure to irradiation or the production of a new harmful substances is a fear among consumer groups. Similarly, genetic modification of crops is looked at as 'meddling with nature,' which can result in production of allergenic food or food leading to adverse health effects. Long term studies to demonstrate the safety of these foods need to be carried out.

Trends in Consumption

There is an increased awareness among people about diet-related diseases across the world. This has triggered the trend of seeking 'health foods' and unfortunately 'quick-fix' solutions which do not need too much of an effort on the part of the individual. This has popularised fad diets or use of superfoods which promise health miracles or an ideal body shape.

Fad diets

Fad diets are popular diets which promise rapid weight loss or some other health benefit for which there is no real scientific evidence. These diets promote short-term changes instead of life-long changes. Their popularity has no association with the diet's effectiveness, nutrition soundness or safety. They, like fashion, gain popularity and a following for some time till they lose favour or until the scientific community highlights the adverse health effects that the diet is likely to cause. Most of these diets are low-calorie, weight-loss diets. Others are based on physiological or biochemical parameters like blood group. Creators of these diets often engage celebrities to endorse their diets. Most fad diets promise quick-fix solutions without much effort on the part of the consumer.

Box 1: How to spot a Fad diet

Fad diets can be easily identified as they tend to have the following features:

- Promoting only specific food groups or asking you to remove or drastically cut out certain food groups (for instance removing grains, vegetables, etc.)
- Promising rapid weight loss (more than 1 kg/week)
- Providing no scientific or medical evidence and relying on testimonies of celebrities or other individuals
- Offering 'herbal' supplements along with diet plan which will 'melt' or 'burn' the body fat.

Fad diets can sometimes lead to health problems. This is most often because they recommend cutting out of key foods from the diet. A number of these diets (e.g. Atkins, Keto diets, etc.) are low carbohydrate diets requiring the person to virtually cut out grains and some vegetables from the daily menu. Though keto diets have shown beneficial effects in patients of epilepsy, there is very little research data showing advantages for normal healthy people. In addition, diets high in animal protein have also been associated with increased urinary loss of calcium and increased load on kidneys. Some diets recommend the consumption of large amounts of a single food (like Cabbage Soup Diet, Banana and Milk Diet, Boiled Egg Diet, etc.). These diets cannot meet the nutrient needs of the body. Diets which drastically cut down on calories or any specific food group should only be undertaken on medical advice and under the supervision of a professional nutritionist. Trying out these diets on one's own often results in symptoms like weakness, fatigue, dehydration, nausea and headaches. Highly restrictive fad diets should hence be avoided. These diets are not sustainable as they are very different from regular diets which people are accustomed to consuming. People tend to regain any weight lost as soon as they revert to their regular diet and lifestyle.

Understanding Superfoods

The dietary guidelines of all countries emphasize the need for healthy food patterns and making healthy food choices from all food groups. Few foods however stand out from the others in being packed with beneficial nutrients and phytochemicals. Including these in daily diets enhances the diet quality and offers additional health benefits beyond those attributed to the function of nutrients present in them. These foods are referred to as 'functional foods' or 'superfoods.' The list of superfoods is long, and several benefits are attributed to them (Table 1). The beneficial effects are attributed to bioactive substances present in them. What is important to understand is that these foods add to the quality of diets and by themselves cannot be responsible for maintaining health of individuals consuming them. People still need to practice healthy lifestyles and eat nourishing meals. The term 'superfood' may also be used by some as a marketing gimmick to trick consumers into buying certain food products. These products usually tend to contain one or more of 'superfruits' or 'supergrains' as ingredients. Any health claims made about the products should be supported by scientific research data.

Table 21. 1: Some 'Superfoods' to Include in your Diet

Superfood	**Bioactive ingredients/nutrients**	**Health benefits**
Berries	Anthocyanins, fibre	Rich in antioxidants, protect against cancer, cardio-vascular disease, etc.
Fatty fish (e.g. salmon, tuna, mackerel, sardines, etc)	Omega 3 fatty acids	Important for brain development and health, protects against cardio-vascular diseases
Dark green leafy vegetables (spinach, mustard greens, kale, etc.)	β carotene, calcium, iron, fibre, several phytochemicals	Important for synthesis of haemoglobin, bone, eyes, and general health
Nuts (walnuts, almonds, etc.)	MUFA, protein	May reduce risk of cardiovascular diseases
Olive oil	MUFA, vitamin E, polyphenols	May reduce risk of cardiovascular diseases
Whole grains (oats, millets, brown/black rice, etc.)	Soluble and insoluble fibre, B vitamins, minerals and phytochemicals	Help in lowering cholesterol, protect against cardiovascular diseases, diabetes
Curd or yoghurt	Calcium, protein, live cultures of beneficial bacteria	Good for gut health, bones
Cruciferous vegetables (broccoli, cabbage, cauliflower, mustard greens, radishes, and turnips, etc)	Fibre, vitamins, and phytochemicals including indoles, thiocyanates	Protect against some cancers
Tomatoes	Lycopene	May reduce risk of some cancers
Turmeric	Curcumin	Reduces inflammation, antioxidant, antiseptic
Tea especially green tea	Flavonoids like catechins and epigallocatechin gallate	May reduce risk of cancer, rich in antioxidants

Using technology to tackle challenges

Documenting the outbreak of food borne illnesses is one of the biggest challenges in India. Hospitals and physicians play an important role in notifying the government about any new disease or pathogen they suspect. To deal with the problem, real time monitoring and tracking needs to be done with hospitals and clinics uploading on dashboards any newly detected cases of food borne illness and, hence establishing an accessible database. Similarly, data on any hazard detected in food and likely to become a public health problem needs to be communicated effectively to the public with guidelines on how to manage the risk. Effective communication among stakeholders is the key to controlling and limiting disease outbreaks and minimizing consequent economic losses. With advances in communication technology this has become easier.

Food processing

New and improved technology is also helping to improve food production – increasing productivity, preserving nutrients and improving safety. *Microwave Assisted Thermal Sterilization (MATS)* is a new patented technology which promises to provide packaged meals which seem freshly cooked in flavour and appearance and which retain their original nutrients. In conventional processing packaged food is kept in pressurized cookers to inactivate pathogens, spoilage microorganisms and enzymes. To mask the damage caused by long exposure to high temperature, additional flavours or colour may be added to food. MATS technology significantly reduces thermal processing time and improves nutrient, flavour and colour retention. This is a post packaging sterilisation process in which a 915M Hz microwave signal induces dielectric heating within the packaged food, which is immersed in pressurized hot water, resulting in a much shorter heating step (Barbosa-Cánovas et al., 2014; DSTO, 2019).

Food packaging

Fruits and vegetables are one of the essential components of our daily diet providing us with vitamins, essential minerals, antioxidants, dietary fibres etc. However, fruits and vegetables are highly perishable commodities which can spoil during the pre- and post-harvest period due to spoilage microorganisms, insects, temperature, stress factor etc. The shelf-life of food is directly related to the type of packaging technology used.

Edible coating/packaging is one of the effective methods to tackle this problem. It provides a two-fold solution. Not only does it protect the wholesomeness of the fruits/vegetables by shielding it from the external environment, but also does not cause any harm to the environment since it is easily degradable. Edible coating can be safely consumed along with the fruit or vegetable (Raghav et al., 2016).

Food transport and storage

Contamination can enter at any stage of food supply chain from farm to fork which includes production, processing, packing, transportation, storage, shelf display and consumption. Achieving the objectives of food quality partly relies on physical traceability throughout the chain. As a result, the management of the supply chain, more significantly the cold chain related to the manufacture, distribution and sale of perishable, and condition-sensitive products, should be given high priority.

Better methods of traceability of food products can also limit economic loss and adverse health consequences. If a certain batch of food is found to be a health threat, then it can be traced and recalled from the market preventing people from getting exposed to the hazard. *Radiofrequency Identification (RFID) Technology* is increasingly being used to trace products in the supply chain. RFID is a form of auto-identification, like a bar code or a license tag containing a unique serial number. RFID tags can also incorporate additional data such as details of product and manufacturer and can transmit measured environmental factors such as temperature and relative humidity. RFID technology can be applied in the food industry for supply chain management, temperature monitoring of

foods, and ensuring food safety by tracking of food products during distribution and storage. These tags also monitor the shelf life of food products such as meat, fruit, dairy etc. to which they are attached. The tag senses temperature and integrates it over time to determine the shelf life of a product, which can be communicated to a reader. RFID technology has also been used in monitoring the ripening of climacteric fruits during transportation and vending. Efforts are on to develop mobile apps which can be used to check whether, for instance, the packet of frozen food you are buying was kept frozen throughout its journey from the factory to the supermarket shelf! You would probably not buy the frozen food if you discovered that it thawed during storage at a warehouse or supermarket because the power went off (Kumar et al., 2009).

Another new technology is that of *Thermochromic labelling* which uses a special ink on the package of food products. These are used for products which need to be kept at certain temperatures during storage or need to be served at a particular temperature. The ink changes colour when the threshold temperature is reached informing the consumer whether the food is now safe to eat. These sensor tags slowly change after a package has been opened and indicate when the time has come to discard the food. The colour of the sensors changes more quickly if the product is not stored at the proper temperature and indicates spoilage of food due to temperature or storage abuse. It is also being used in some countries to let the consumers know for instance, whether their food is hot enough to eat or their beer is chilled enough to drink.

Use of *Internet of Things (IOT) Solution* for the food supply chain has become more relevant to the practical world due to increased use of mobile devices, cloud computing and data analytics in the recent years. The IOT refers to a type of network to connect anything with the Internet based on stipulated protocols through information sensing equipment to achieve smart recognitions, positioning, tracing, monitoring, and administration. The application of IoT in food supply chains is considered as one of the promising applications in near future to address the traceability and monitoring of the complex supply chain. Application of IOT covers all sectors of food production from farm to plate by providing real-time visibility and enables the automated, intelligent actions needed to ensure food does not get degraded or contaminated, is prepared in optimal settings and is delivered on time (Nirenjana et al, 2018).

Block Chain Technology is a decentralized accounting system in which entries are recorded in sequence in multiple identical "ledgers" stored on computers in multiple locations. This makes tampering with any one ledger futile, creating a highly trusted record of transactions. This technology works by integrating growers, distributors and retailers on a common blockchain which includes a trusted record of all data of a given food's journey through the end-to-end supply chain. Through this the user can trace the origin of a "contaminated" ingredient of the product in seconds which would have taken days by tracing through mix data of written and digital records. With this capability, retailers and restaurants can remove a contaminated item from circulation almost immediately and destroy only stock that came from that particular source. A blockchain-based cloud platform has been developed for the food industry by IBM Food Trust and is already employed by major food sellers.

Food safety testing

Advancement in techniques and instruments for detecting hazards has greatly contributed to management of hazards. These have an edge over conventional methods in that they can detect much lower levels of the contaminant and with greater accuracy. Food fraud/adulteration in meat, dairy, fish, etc. can now be tested by making use of the unique DNA composition of animals. Conventional DNA based molecular techniques are generally costly, time consuming and need trained staff. These challenges can be addressed by the *DNAFoil technology,* which is a portable and completely self-administered, on-site DNA test that does not require expensive PCR equipment or laboratory settings to confirm detection of food adulteration and it does it in as little as 30 minutes. It is a kit test method which includes a barrel that breaks, lyses, extracts, neutralizes and stabilizes DNA from various food matrices. This extracted DNA can be amplified by using enzymes and primers which can be further detected by running on test strip. Coupling micrometer-sized beads to DNA allows the results to be visualized by the naked eye (visible color reaction), enabling instant, simple to interpret, cost-efficient, and on-site detection, while eliminating the need for advanced expensive instrumentation. These DNAFoil kits are sensitive for target contamination and can detect any level of adulteration (down to 0.01%). These kits are also tolerant to a complex, high-salt, high-fat food matrix and do not require prior DNA purification and quantitation (Sheikha, 2019).

Raman Technology based rapid tests use Raman spectroscopy (RS) and its various derivative methods. It has been widely applied in detection of various substances in food. RS is a technique specialized in measuring the frequency shift of inelastic scattered light from the sample. When the photons from incident light strike a molecule, scattering photons of different frequency appear. These scattering photons are called as Raman Scattering and Raman spectroscopy is based on the effect of Raman scattering (Weng et al, 2019). Raman Spectroscopy is old technology but now a days it is coupled with machine learning and artificial intelligence to detect adulterants in edible oils and ghee. These are handheld devices and can be used as a pre-scanning equipment to detect the adulteration, so that analysts in laboratories don't spend time and resources to test a sample which is already pure.

BioSensors – Bioelectric Tongue and Nose are analytical instruments comprising an array of nonspecific, low-selective, chemical sensors. They are now incorporated with biosensors to improve its performance and can be used in detection and quantification of pesticides, contaminants in several food and water samples. It can also be used in monitoring the ageing of beers, determination of analytes or markers in food products and detection of spoilage microorganisms in different foodstuff. These devices are fast, reliable and easy to use and satisfy the current demand of the food sector to detect various adulterants, contaminants, flavours etc. (Ceto et al., 2016; Podrazka et al., 2018).

Future of food

With advancement of technology and strides being made in the field of food science we can look forward to new food products which are safer and more wholesome. Smart agriculture solutions are likely to boost yields. Better transport and storage will reduce food waste by letting companies monitor conditions like temperature and humidity in real time. Science based solutions which make efficient use of resources is the thrust of all innovations in the food sector.

Researchers have developed a 3D printing technology to prepare food using ingredients like millets, green gram, spices, etc. Taking just five to seven minutes to print, followed by a microwave drying process, this technology may help in customizing food according to the individuals' requirements.

New and innovative techniques are being used to assess and manage risks. Statistics, for instance, is being used for predictive modelling of microbiological outcomes. *Predictive microbiology* now offers risk managers scientific tools to estimate the consequences of different food handling and processing conditions on growth, survival and inactivation of pathogenic microorganisms. They will for instance, be able to predict if the food product is still safe after being transported at a particular temperature for a specified length of time, or if the power outage during its journey would have led to the spoilage. The United States Department of Agriculture (USDA) uses predictive microbiology to manage risks across the food chain using computational resources and sophisticated statistical packages (https://portal.errc.ars.usda.gov/). Databases like ComBase are now available for big and small food companies providing information on how microbes respond to different environmental conditions and how the microbe levels change over the course of time. Initiatives to develop microbiological modelling programs have been ongoing in the United States, the United Kingdom, Denmark, France, Australia and other countries for a number of years. These programs have resulted in the development of a wide range of microbiological modelling software packages

Nutrigenomics

Nutritional genomics is a new discipline which has been formed by the integration of the study of nutrition, molecular biology and genomics. It is the science of how nutrients affect the activities of genes (nutrigenomics) and how genes affect the interactions between diet and disease (nutrigenetics). This new science teaches us what specific foods tell our genes to do. Every protein which is synthesized by the cell is a product of gene expression. Nutrients and phytochemicals can interact with genomes causing changes in their expression. At the same time, deficiency of a nutrient can hamper DNA repair and hence normal function. If we learn how our genes operate, the instructions that the genes give to the body and its metabolism, we can radically change how food interacts with our body. This information can be used to lose weight and optimise health by preventing development of diseases.

Individuals may respond differently to the same diet- whereas one individual may put on weight if given a dessert daily, another may not gain an ounce. These varied responses to diet have been attributed to differences in genetic make-up. An exploration of nutrient-gene interactions is important for determining what will be healthful for an individual and

what could result in increasing the risk of diet-related diseases. Nutrigenomics will ultimately one day help to tailor diets based on individual's genetic make-up. Nutrigenomics can be used in the future for development of customized nutraceuticals based on specific genetic profiles.

New food science

Food companies are also experimenting with *plant-based meat* to prepare burgers, sausages, etc. thereby reducing carbon footprint. In addition, scientists are producing *Cultured/Lab Grown Meat.* Such meat eliminates the need to sacrifice animals by growing muscle tissue in culture from animal stem cells. Cultured/in-vitro meat can be constructed and produced faster than the traditional meat with desired characteristics. Although appreciable progress has been made during recent years, important issues, including safety, characterization of social and ethical conditions, and the development of cost-effective culture media needs to be resolved. Consumer acceptance and confidence in cultured meat might be an important obstacle that might hinder the marketing process (Kadim et al., 2015).

In the interest of reducing chemicals used in foods for preservation, the search for natural antimicrobials has proposed the use of bacteriophages (viruses) which attack and kill disease causing bacteria. Studies have also proposed a cocktail of viruses to be consumed to tackle foodborne illness. This alternative approach uses lytic bacteriophages for managing bacterial infections. Although, antibiotics are an important way to manage diseases caused by pathogens, they kill beneficial microbes in the human gut system. Also, many bacteria are developing resistance to antibiotics, which makes the treatment more complicated (Moye et al, 2018).

Gastronomic tourism

Gastronomic tourism has become a major and rapidly growing component of the attractiveness of tourist destinations. People wishing to experience the local tastes in other countries or different states of their country, travel just for the gastronomic experience. The tourism industry is also rising to the expectations of tourists by organising gastronomic tours for experiencing the local cuisine. Such tours consist not only of food guides taking people to restaurants, but also organising cooking demonstrations, cooking classes, visits to vineyards, local food manufacturers and other kinds of culinary experiences. With the growth in this kind of tourism comes the immense responsibility of all stakeholders in providing safe and wholesome food to tourists. With street foods being a major attraction in most cities, creation of Street Food Hubs which provide safe food is an important step in promoting gastronomic tourism. These hubs have been certified by FSSAI after imparting vendors with the necessary training and capacity building.

While special efforts are being made to promote traditional cuisines and revive ancestral recipes, equal strides are being made in exploring new tastes and enhancing flavours of existing dishes. *Molecular gastronomy* is a scientific discipline which looks at the science behind food preparation- the physical and chemical transformations which take place during cooking of food. The knowledge is now being used to create new dishes and culinary techniques. Various new recipes have made their way to restaurant menus using

new ingredients or processing methods for preparation and food service. For instance, ice creams and cocktails served with liquid nitrogen are increasing becoming popular. While these foods are very attractive to look at and tickle the palates with new taste sensations, this experimentation needs to be done with great care and diligence. The dish shouldn't turn into a chemical experiment which is unmindful of the safety or the wholesomeness of the food (Cousins et al., 2010; Gheorgheet al 2014; This, 2013).

Fake news and role of media

Need a question to be answered? The internet offers opportunities to access a lot of information. Although there is a lot of good quality nutrition information available, there is abundance of misleading or inaccurate information as well. Social as well as other forms of media are also full of information. You may often find it difficult to distinguish valid nutrition information from misinformation. A good way to know is to look at the source of information – can the source be trusted? The person/body providing the nutrition information should be qualified to do so. Box 2 lists some pointers for you to discern whether a website is reliable.

Box 2: Is this website reliable? Questions to ask

To determine whether a website is reliable to offer nutrition information, ask the following questions:

1. **Where is the information coming from?** The web address generally gives a clue. Web addresses ending in 'gov' usually belong to the government, 'edu' are associated with educational institutes and 'org' belong to organizations. These are generally reliable. The ones ending in 'com' represent businesses and one would need to check on their credentials.
2. **Who is giving the information?** Is the author a qualified professional? Has the information been reviewed by experts in the field or is it just someone's blog or personal view on the subject?
3. **When was the website last updated?** The website could have out-dated information. Nutrition is an ever-changing science, what is valid today may not be applicable a few years later.
4. **Why is the website providing this information?** Is the information there for public good or does the organization/business have a commercial interest like selling a product?
5. **What is the message?** Read beyond the headline/caption and see the details of the article. Is the information in agreement with other reliable sources of information or contradicting common knowledge? If it goes against the existing knowledge, then it is advisable to cross-check with other resources as well.

Hazard of fake news

Fake news consists of deliberate misinformation spread through traditional news media or social media. Digital media has increased the spread of fake news. Fake news is written and published usually with the intent to mislead in order to damage an agency, entity, or person, and/or gain financially or politically, often using sensationalist, dishonest, or outright fabricated headlines to increase readership. For media outlets, the ability to attract viewers to their websites is necessary to generate online advertising revenue. Publishing a story with false content that attracts users, benefits the advertisers and improves their ratings.

Some news items tell a lopsided story, basing it on results of a single research study or without a balance of expert opinions. As a result, the news item may become controversial. Tight deadlines and limited understanding of the scientific aspects of research studies may lead to inaccurate reporting which misleads the consumer and creates confusion. Box 3 highlights some red flags for identifying fake news on social media.

Box 3: Red flags for Fake News/Information on Social Media

These are some pointers to look for to know that the information circulated on social media is fake news:

- News is sensational and you have never heard about it from reliable sources. For instance, miracle cures attributed to a food product or claims that a food product in circulation has been made from non-edible harmful substances
- The sender asks you to 'Forward to all the people you know'
- The message is forwarded, and you don't have a clue as to who is the original sender and whether they are a subject expert.
- The message has been debunked on websites.

Responsibility of media

The media is a very powerful entity as it moulds public opinion. Fake news in any kind of media whether mass media or social media has in the past triggered riots and violence. Fabricated and exaggerated claims in the media are not just related to politics but from time to time one has come across news related to public health and nutrition. Such kind of news or claims are not just misleading but also damaging to health. They create a lot of mistrust and erode the trust placed in media.

In 2018, several newspapers reported of a WHO advisory that 'if adulteration of milk and milk products is not checked immediately, 87% of citizens would be suffering from serious diseases like cancer by the year 2025 (in India)'. FSSAI had ascertained that no such advisory was issued by the WHO at all and FSSAI or WHO were not even approached for clarifications.

It is hence the responsibility of the media houses and social media platforms to clamp down on fake news. Media needs to increase coverage on aspects of food safety and nutrition which educate the public about eating safe and healthy food. However, there have been many instances of circulation of false and malicious videos on various social media platforms on safety and quality of food available in the country. It is a matter of serious concern as it leads people to believe that most of the food available in the country is unsafe (see box 4).

Box 4: Some Media Reports which were Debunked by FSSAI

There have been several social media messages and videos in circulation claiming that the rice/eggs/snacks available in the markets are made of plastic!

1. **Plastic Eggs:** Egg production is economically viable and thus is available in plenty. The thicker the eggshell, the fresher the egg. When the egg is fresh, there is not enough time for evaporation to separate the 2 membranes (outer and inner layers) causing it to stick to each other. This makes it look thicker and stronger when it is peeled. Also, the inner shell membrane of the eggs may become harder and elastic when it is older than 15 days, which is a natural ageing process. The reason why eggs differ from each other is because of difference in quality of feed, breed of bird, ageing of eggs and the handling of eggs. As the egg ages, the egg white changes its consistency, becomes thin and runny and finally egg yolk and white dissolve into each other and this mixing is aggravated by temperature abuse and not because egg is made artificially.
2. **Plastic Rice:** Rice is a carbohydrate with ~ 80 per cent starch. When the starch is cooked, it gelatinizes and becomes sticky. Air gets trapped while rolling it into a ball and as a result it may get bouncy. This does not mean that it contains plastic.
3. **Plastic Snacks:** The snacks such as namkeens and potato chips are mainly made of cereals spices and oil and the carbohydrate and fat have a natural characteristic of burning when exposed to fire. Thus, it should be ruled out that they contain plastic.

False propaganda is neither good for citizens nor for food businesses. It also erodes global trust in our food system and food businesses, and potentially has far reaching public health, social and trade implications. Press Council of India has issued an advisory to all the media houses, to verify all facts before publishing any news related to food safety.

Summary

- Changes in the food consumption behaviour, globalization, new technologies of food production, increasing mobility of population, climate change and a greater strain on the public health infrastructure have led to the emergence of newer food safety issues.
- Emerging pathogens of concern are those pathogens which are either causing a new illness or the number of cases is now increasing sharply, or they are spreading the disease over a wider geographical area.
- Multidrug resistant microbes like Salmonella, Brucella, etc. are causing major problems. Outbreaks due to Listeria are increasing in recent years. Cryptosporidium parvum, Cyclospora cayetanensis, Campylobacter jejuni, Non-typhoidal strains of Salmonella, avian influenza viruses, Toxoplasma gondii, Shigella, Vibrio parahaemolyticus, Yersinia enterocolitica, etc. are some emerging biological hazards.

- Uncontrolled use of growth hormones and antibiotics, environmental contaminants such as Persistent bioaccumulative toxins, chemicals leaching from plastics, newspapers, packaging materials etc. are some examples of emerging chemical hazards.

- In an attempt to stave off diet-related chronic diseases, people are looking for quick solutions like fad diets or superfoods. Unless coupled with healthy lifestyle changes and balanced and wholesome diets, these trends can result in adverse health effects.

- Advancements in technology have helped tackle some challenges related to the food sector. Improved processing technologies, better methods of transporting, storing and packaging have led to safer food with better shelf life.

- Radiofrequency Identification (RIFD) Technology is increasingly being used to trace products in the supply chain. Thermochromic labelling which uses a special ink are used for products which need to be kept at certain temperatures during storage. Block chain technology is a decentralized accounting system in which entries are recorded in sequence in multiple identical "ledgers" stored on computers in multiple locations. This makes tampering with any one ledger futile, creating a highly trusted record of transactions.

- Advancements in techniques and instruments for detecting hazards has greatly contributed to management of hazards.

- Predictive microbiology is used as a scientific tool to estimate the consequences of different food handling and processing conditions on growth, survival and inactivation of pathogenic microorganisms.

- Nutrigenomics as a science can one day help to tailor diets based on individual's genetic make-up and for development of customized nutraceuticals based on specific genetic profiles.

- Gastronomic tourism has become a major and rapidly growing component of the attractiveness of tourist destinations.

- With advancement of technology and strides being made in the field of food science we can look forward to new food products which are safer and more wholesome. Science based solutions which make efficient use of resources is the thrust of all innovations in the food sector.

- Fake news consists of deliberate misinformation spread through traditional news media or social media. False propaganda is neither good for citizens nor for food businesses. It also erodes global trust in our food system and food businesses, and potentially has far reaching public health, social and trade implications.

Key Terms

Gastronomic tourism - food guides taking people to restaurants, but also organising cooking demonstrations, cooking classes, visits to vineyards, local food manufacturers and other kinds of culinary experiences.

Microplastics – extremely small pieces of plastic debris in the environment

Molecular gastronomy - is a scientific discipline which looks at the science behind food preparation- the physical and chemical transformations which take place during cooking of food.

Nutrigenomics - as a science can one day help to tailor diets based on individual's genetic make-up and for development of customized nutraceuticals based on specific genetic profiles.

Predictive microbiology -is used as a scientific tool to estimate the consequences of different food handling and processing conditions on growth, survival and inactivation of pathogenic microorganisms

Exercises

1. Define emerging food safety issues and discuss factors responsible for their emergence.
2. Describe the important emerging microbial and chemical hazards giving suitable examples.
3. Define Antimicrobial Resistance. Why is resistance to antibiotics a problem in India?
4. What is Radiofrequency Identification (RIFD) Technology? How is it useful in Food traceability?
5. Define Nutrigenomics and discuss its role in personalized nutrition.
6. What do you understand by Gastronomic Tourism?
7. Define role and responsibilities of media in addressing the problem of fake news.
8. Describe some advancements which have been made in food safety testing.

Activity

Do a literature review and list some breakthroughs in food processing/ packaging/ food testing technology.

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