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DEBUNKING MISINFORMATION ABOUT FOOD

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Abstract

Not only the general public, but particularly also politicians and opinion makers judge the safety and desirability of technologies on information that comes free from many media, often provided by self-proclaimed experts. Few people take the time and effort to check the facts. The result is often that beneficial technologies are dismissed while these benefits have the potential of increasing the standards of living. While in some parts of the world the benefits are seen and the technologies accepted and applied, on other parts they are not, even in cases where these technologies have the potential of solving huge problems. The use of genetically modified (GM) food and the use of irradiation to preserve food for example, are heavily emotionalised and in parts of the world antis tend to win the battles.

Key words*: irradiation, food technology, genetic modification, misinformation, safety.*

INTRODUCTION

Why misinformation is believed, even trusted, by so many.

The book "Before you know it: The unconscious reasons we do what we do" has been written by John Bargh, PhD, a reputable psychologist working at Yale University, a top university in the USA (Bargh J., 2017). He summarises the evidence that demonstrates that most of what we do in our life is decided by our unconscious mind. The unconscious mind has knowledge from human history (that is why even babies shy away from danger) and is learning continuously by experience. Try to think of every step you take when you walk or even better, when you descent the stairs. If you consciously want to decide where to place your feet with every step, you either go very slowly or you would fall. Healthy people need not to think about where to put your spoon or what to do when confronted with a sudden danger. When awake, the unconscious brain is constantly deciding what you need to do, your conscious brain is too slow and busy with other things. As a consequence most of the energy spent by the brain is for its unconscious tasks. While 100,000 years ago a man would jump away when a ferocious animal wais approaching him at high speed, today when suddenly a car races at you, you would do the same, without thinking about it. Thinking would have killed you.

Ancient mechanisms and fears are used by antis to influence public opinion, similar to shameless liars like many politicians and contemporary presidents. They tell you what bad things may happen if you do not follow them or their advises. Because of their positions, their appearance (they may be good looking, be friendly, seem to care or be tough), or because they are frequently seen on television, many automatically follow them, even if they know that they are lying.

Misinformation finds its way in popular publications and is hard to be countered by peer-reviewed scientific publications. Most people have the feeling that there is no smoke without a fire. Publications like "Horrible chemicals in our food" (Thomson, C.K., 2014) and "Don't eat cancer" (Cohen, S.D., 2014) sell well. Barbara H. Peterson, an activist with a Bachelor's degree in Business, leads a personal revolution against GM food. On her website she writes (Peterson, B.H., 2010):

> *"We are already having to deal with food that is injected with foreign genes (GMOs), blasted with pesticides, irradiated beyond recognition, pasteurized, homogenized, scraped off a slaughterhouse floor, and making us sicker by the minute, and now Codex guidelines are about to set the minimum and maximum levels of so-called "nutrients" we are allowed to have. If it doesn't meet the minimum NRV guideline, just add a little more GMO such as golden*

rice, chock full of artificial inserted "vitamins" to the food supply and force feed it to the public via stealth, free trade sanctions and the SPS agreement, and by all means make sure that the upper nutrient level wouldn't keep a hamster alive. And if a company or nation doesn't meet Codex guidelines? Then it is creating a barrier to free trade and can be prosecuted under the law.

And we just go along with it. Better to run to the corner store and get more of those genetically engineered foods and vitamins designed to strip us of our humanity and alter our DNA so that big pharma can keep us in its death grip and suck the remaining life out of our bones by "treating" the diseases created by our "new and improved" lifestyles with even more "new and improved" designer drugs."

On the photograph shown on the website, Barbara Peterson looks distinguished and convincing. She possibly believes what she writes and that believe made her an apostle for the cause. She, however, clearly lacks the scientific background to judge what she has picked up from the media.

Critics

Not all antis are liars, some have good reasons to be critical and may provide valid arguments supported by good data. Being critical is a fundamental requirement for scientific development. That is why evidence is so important and why food scientists need be aware of facts and know where to find the scientific information to debunk or support opinions. If critics have valid questions and they cannot or not yet be answered, further research should be done. If anything has been shown to be wrong, people need to know and want to know and measures to counter the wrongness should be taken.

Irradiation

Energy can be transferred by electromagnetic waves, the shorter the wavelengths (or the higher the frequency) the higher the power of the waves and thus the more energy can be transmitted in a certain time. Wavelengths (λ) between 400-700 nm does not have power enough to cause serious harm, unless the exposure is very long. UV light, however, with λ between 10 and 400 nm, has enough power to cause significant chemical changes, reason why exposure to sunlight does change the colour of the human skin. The shorter λ, the more energy is transferred and therefore the more damage can be done. Below 10 nm we talk about x-ray and γ-radiation, such radiation frees electrons from atoms and molecules and is therefore called ionising radiation. In particular γ-radiation (having the shortest wavelength and therefore the highest power) can deliver enough energy to ionise atoms and molecules, produce radicals and make significant changes to the irradiated substance. For a clear picture of the differences between radiations, see https://upload.wikimedia.org/wikipedia/commons/9/99/EM_Spectrum3-new.jpg (accessed 15 July 2019).

For λ-radiation usually either Cobalt 60 or Cesium 137 are used. These materials are radiating continually and therefore require expensive safety measures to protect operators. Electron beam (e-beam) radiation is also ionising and therefore can also be used but the technology is different. While λ-radiation is electromagnetic radiation, e-beam uses high-speed electrons and can deliver the same energy as the Cobalt and Cesium isotopes. The important difference is that an e-beam is produced by an electronic device that can be switched on and off. When off, there is no radiation. The isotopes cannot be switched off and when not in use must be stored and protected in a dedicated space. Therefore, although installations for both methods can be operated safely, from an occupational point of view, e-beam technology is more attractive.

Irradiation of food

Food irradiation is the exposure of food to ionising radiation to cause chemical changes that harm microorganisms, including viruses and parasites, as well as insects, to the extent that they cannot reproduce anymore. The same irradiation also causes chemical changes in food that may result in slowing down ripening and does prevents sprouting of some vegetables. That way irradiation can be used to increase shelf life of food.

The quantity of chemicals resulting from the radiation treatment, however, is very small and mostly less than the chemical changes caused by heat treatments aimed at prolongation of

shelf life. The safety of the consumption of food treated with radiation has been thoroughly investigated for decades (Smith and Pillai, 2004). The only chemicals that rose concern were benzene and its derivatives, and 2-alkylcyclobutanones (2-ACBs). Extensive research, however, showed that the amounts formed, compared with the consumption from other food, were too low to be of concern (McNeal et al., 1993).

Similar to chemicals, radiation may harmful, depending on the dose. Too much radiation like too much of a chemical such as Vitamin A will do harm and thus must be avoided. Irradiated food, however, is not radioactive food, contrary to what anti-irradiation activists state, such as in "Zapped! Irradiation and the death of food" (Worth and Hauter, 2008). A customer wrote a review:

> *"Everybody is focused on GMO and pesticides, and meanwhile government (or those behind it to be exact) quietly give orders to irradiate our food. If some of us still manage to find out and ask, they just say it is safe and not radioactive. We are talking about amounts of radiation, that are equal to 5 billion times more of the chest x-ray. And no, they are not safe. They are changing our DNA in as little as 2 weeks. Studies with animals showed, that first generation eating those foods was sicker, but somewhat okay, second was very sick, and ...you guessed it -there was no third generation." (https://www.amazon.in/Zapped-Irradiation-Death-Mark-Worth/dp/1567513689; accessed 16 July 2019).*

Radiation and radioactivity

Food irradiation dose not make food radioactive. Similar to that fruit exposed to sunlight (= sun radiation) will not cause sunburn (does not make the fruit radiate sunlight) (Figure 1).

Another misconception is that many consumers often see in the Radura symbol (Figure 2, left) a warning that the product is radioactive while the symbol is meant to show that the product has been irradiated to make it safe (Ehlermann, D.A.E., 2009). Antis persist in telling the public that the Radura symbol just replaces the Radioactivity warning symbol (Figure 2, right) and that the Radura one has been developed to hide the danger.

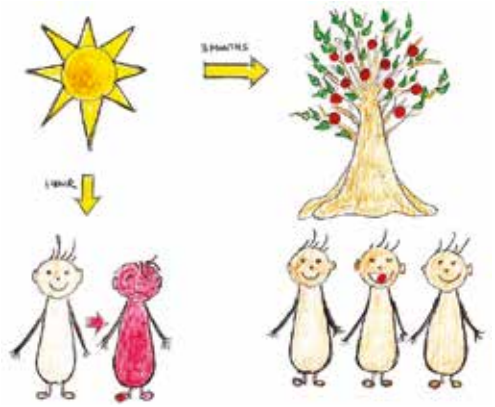

Figure 1. Exposure to sunlight for just one hour may cause sunburn. The consumption of fruit exposed to the same sunlight for months does not cause sunburn

Figure 2. Radura symbol (left) used on packaging of irradiated food and the radioactivity warning symbol (created in 2006 by Cary Bass; https://commons.wikimedia.org/wiki/File:Radioactive.svg (accessed 16 July 2019)

Bevelacqua and Mortazavi (2019) illustrated in a very clear way the influence of the environment and history on the thinking of people. If society applied the radiophobia logic to cooking food, it would be viewed as a negative technology. A hypothetical example illustrates applying the radiophobia mindset to cooking food with thermal radiation:

> *"Scientists have developed a new technology called thermal radiation (e.g., infrared radiation) as a method that is alleged to improve the taste and edibility of foods. Thermal radiation proponents claim that it kills known pathogens and prolongs the food's shelf life. Unfortunately, thermal radiation has a number of negative side effects that suggest its use is potentially harmful. Thermal technology produces carcinogenic materials in meat, reduces the vitamin content of fruits and vegetables, and produces hazardous chemical compounds in eggs. Therefore, cooking foods with thermal radiation should be avoided and restricted by regulations until detailed research proves that it is not harmful to human health."*

Irradiation of food or food ingredients is practised in many but by far not all countries and nowhere for all food. In many countries a permission is still required. Countries where irradiation of food is at least partially approved: Australia, China, European Union (28 countries), India, Indonesia, Japan, Malaysia, Mexico, South Africa, Thailand, USA, Vietnam. If occupational safety requirements are met and the applied dose is in accordance with the levels proven to be safe, based on scientific data irradiation could be allowed everywhere. There is global scientific consensus that irradiated food is safe to consume; nutritionally adequate and has the same sensory properties as non-irradiated food (Koutchma et al., 2018).

The bottom line is that irradiation is a technology that is suitable to prevent insects and microorganisms to make food unfit for consumption, reducing food wastage. It may do so in particular where other technologies cannot be applied.

GM food

Definition of GMOs

WHO: Genetically modified organisms (GMOs) can be defined as organisms (i.e. plants, animals or microorganisms) in which the genetic material (DNA) has been altered in a way that does not occur naturally by mating and/or natural recombination (https://www.who.int/foodsafety/areas_work/food-technology/faq-genetically-modified-food/en/; accessed 16 July 2019).

Why GMOs?

There always have been parts in the world where people were starving. Technology has helped mankind to improve the production of food and successfully such that in the western world there is no shortage of food. In many other parts of the world it the production of food has been and still is insufficient to feed the ever growing population. The global food production in the world is enough to feed everyone, if that food would be in the right places. Much of the staple food today actually is GM food and already for decades although most people do not know. Without this, probably there would not be enough food and certainly not everywhere.

Potential benefits of GMOs

Resistance to diseases

By changing tiny bits of the genetic makeup of plants, they can be made and have been made resistant to herbicides, insects and microorganisms. Corn (maize), staple food in South Africa used to be infested by insects causing damage to the skin of the corn and thereby facilitating the growth of moulds that produced mycotoxins and made about 50% of the corn toxic. Today, 85% of the maize and also 95% of the soy in South-Africa is produced with genetically modified species (Groenewald, 2019). Central and eastern Africa depend largely on banana as a staple food. In Uganda the government supported the development of banana that are resistant to the mould *Mycosphaerella fijiensis* that otherwise causes black Sigatoka, a disease that can decrease the yield of banana by up to 50% (Namanya, 2019).

Essential nutrients

Many people in developing countries suffer from vitamin A deficiency (VAD), causing blindness of hundred thousands of children every year and killing millions of people. In many developing countries rice is the staple food, but rice does not contain ß-carotene, the precursor that the body converts to vitamin A. The successful insertion of genes for the production of ß-carotene into wild rice makes it possible to alleviate the problem. Because of the orange colour of ß-carotene, the GM rice too is orange and has the nickname "Golden Rice". Research in underway to make staple food also producing other essential nutrients that many people are lacking due to a very one-sided availability of food (Hefferon, 2015).

Stress resistance

There are many areas in the world where growing food is impossible, due to lack of or too much water; too high or too low temperatures; too salty or too acid soil. There is, however, vegetation in these areas, specialised to cope with the prevailing situation. Obviously, modification of staple food crops to make them resistant to stresses where such crops are important has the potential of solving hunger problems. This probably can be done by using genes from stress resistant plants. Work is done on making crops drought resistant is reviewed by Liang et al. (2016).

There are many more possibilities and if they have the potential to solve serious problems, they should be investigated and tested for safety. If safe their use should not be prevented by activists who simply are "against", whatever the product or technology, because being against can be profitable and that whole populations are deprived from badly needed solutions is not their problem.

Can GM food be unsafe and cause diseases?

The public is incessantly bombarded with by activists and activist organisations claiming to know with certainty that GMO food is bad and dangerous to eat. Hundreds of examples of how they do this can be found on https://nl.pinterest.com/pin/344666177711821774/. Because every knew technology and every new product may have undesired and even dangerous properties, before being allowed on the market the safety of new products should be thoroughly investigated. A potential danger of GM food that has been made resistant to microorganisms to which there originally was no resistance, might result in microorganisms resistant to antimicrobials, including antibiotics. That will be undesirable and hence this should be very carefully investigated. If GM food produces proteins that have not been part of the modified food, it must be investigated if that protein may cause allergy although thorough review of research in this did not indicate that GM food is more allergenic than their conventional counterparts (Dunn et al., 2017). Although GM food has now been on the market in many countries for more than a decade and probably at least a billion (1000 million) consumers eat GM food daily, there have been no indications that there is a difference in the incidence and types of cancer between people who do and those who do not eat GM food regularly.

Safety of GMOs

The EU funded many projects to investigate whether there is any indication that GM food would be less safe that non-GM food and 10 years of research did not find any evidence that it would (European Commission, 2010).

The National Academies of Sciences, Engineering, and Medicine established a Committee on genetically engineered crops: past experience and future prospects, with the task to examine evidence regarding potential negative effects and benefits of genetically engineered crops as well as the potential benefits and negative effects of future GE crops. The findings have been reported in 2016. Twenty experts reviewed more than 1,000 studies, concluding, based on epidemiological data on incidence of cancers and other human-health problems, that there is no evidence that foods from GE crops are less safe than foods from non-GE crops (National Academies of Sciences, Engineering and Medicine, 2016).

GENERA is a project of Biology Fortified, Inc. (BFI), an independent non-profit organization incorporated in Middleton, Wisconsin, USA. In 2017 they reported that currently there are near 2000 peer-reviewed reports in the scientific literature that document the general safety and nutritional wholesomeness of GM foods and feeds (Nicolia et al., 2014).

The most recent review is that of Delaney (2018), who concluded that "Decades of testing food and feed products from insect resistant, herbicide tolerant and stacked traits of previously approved single traits, and other types of GE crops in laboratory and livestock animals have shown that the technology used to produce them is not inherently hazardous. No adverse effects have been observed to date".

The success of activists and activist organisations - people die needlessly

Activist organisations go very far with their actions, among which are the destruction of and experimental fields of genetically modified Golden Rice in the Philippines in 2013 (https://slate.com/technology/2013/08/golden-rice-attack-in-philippines-anti-gmo-activists-lie-about-protest-and-safety.html; accessed 16 July 2019); GM wheat in the UK in 2012 (https://www.independent.co.uk/hei-fi/news/scientists-plead-with-anti-gm-protesters-not-to-destroy-crop-7788322.html; accessed 16 July 2019) and of corn in Hungary in 2013. It is claimed that the destruction in Hungary was strongly supported by Hungary's Minister of Rural Development (https://www.abcplus.biz/GMO_6-26-13_Hungary_Torches_GM_Corn; accessed 16 July 2019). The Hungarian government is one of those that are blindly following anti-GM

activists. Greenpeace claim to know that GM food is dangerous. They never provide evidence, obviously because such evidence does not exist, but they also do not need to, because their claim is that they know that they are right and moreover that all scientists should know too. By frequent and persistent repetition of their claims they successfully convince a large part of the general public well as many politicians. There are many books about the dangers of GM food, blaming governments to approve GM food only to help the food industry to increase profit and that at the expense of the misled consumer/taxpayer. An example of such s book is "Altered genes, twisted truth" (Druker, 2015). The subtitle summarises the contents: "How the venture to genetically engineer our food has subverted science, corrupted government, and systematically deceived the public". In the book "Genetic Roulette: The documented health risks of genetically engineered foods" (Smith, 2007) 65 claims are presented that GM food causes harm in many ways. Academics Review debunked each of the claims based on peer-reviewed evidence and provides all the references (http://academicsreview.org/reviewed-content/genetic-roulette/; accessed 17 July 2019). Academics Review is an association of academic professors, researchers, teachers and credentialed authors from around the world who are committed to the unsurpassed value of the peer review in establishing sound science (http://academicsreview.org/about-academic-review/purpose/; accessed 17 July 2019).

NGO's in rich countries, where they have enough food, have successfully convinced the governments in poor countries that GM food is unsafe. These organisations, lead by GreenPeace, can be held responsible for the death of millions of people, annually. They lie to the officials in the suffering countries, who generally lack the capacity to deal with the scientific information and trust the large international organisations from the developed rich countries.

The NGOs cleverly do not refer to the reports of the scientific organisations in the those countries that have repeatedly and clearly described that GM food is not less safe than non-GM food (Paarlberg, 2014).

During the massive famine in Southern Africa, in 2001, several governments in the region objected to genetically modified (GM) grain, especially Zambia and Zimbabwe, the countries hardest hit by the drought. Citing health and environmental concerns, Zimbabwe blocked the GM food aid from entering the country. In Zambia, where some GM grain had already arrived, the government placed it under lock and key, banned its distribution and then blocked another 40,000 tonnes that were in the pipeline. Source: Africa Renewal, Vol.16 #4 (February 2003), page 5 . This is the result of overwhelming activities of antis, in particular in Europe, who claim with no evidence that GM food is dangerous. The reality is that hundreds of millions of people consume GM food daily and there is not a single report of a health incident related to GM food. The local governments choose to let their citizens starve to death rather than giving them GM food.

Letter of Nobel Laureates to Greenpeace:

On the 29th of June 2016 Nobel Laureates in medicine, chemistry, physics and economics sent a letter to Greenpeace, the UN and Governments around the world. They ask Greenpeace to cease and desist in its campaign against Golden Rice specifically, and crops and foods improved through biotechnology in general. They ask governments to reject Greenpeace's campaign against Golden Rice specifically, and crops and foods improved through biotechnology in general; and to do everything in their power to oppose Greenpeace's actions and accelerate the access of farmers to all the tools of modern biology, especially seeds improved through biotechnology. Opposition based on emotion and dogma contradicted by data must be stopped. The concluding question is "How many poor people in the world must die before we consider this a 'crime against humanity'?" (Nobel Laureates, 2016).

Essential knowledge for everybody

What everybody should be made to realise - and here education at all levels could play an important role - is that genetic modification is done by nature, since life started. Nature does so now and will continue do so in the future. Nature, however, does not do it for the benefit

of mankind. To survive, everything living in nature tries to kill competing living things, including man. Mankind has evolved and survived using gathered knowledge.
Why would "natural" be better than “modified by man”? Farmers explored - be it unknowingly - mutations by cross-breeding, trying and selecting crops with improved traits. They did so long before Gregor Mendel found out how it worked. Since scientists do it, based on knowledge and experience, enormous hurdles have been created.
The most recent developments, using CRISPR-Cas9 enzymes (and similar) can make desired DNA changes very accurately, eliminating the chances that the results can be harmful, moreover this is done with much less effort than before (Lemay and Moineau, 2019).
Many countries are exploring this technology but amazingly, thanks again to the efforts of the activist organisations, it is not allowed in the EU without going through the same time-consuming and expensive procedures that apply to the methods of the decades past.

Labelling

What information is useful on a label?

The answer is that it should have what consumers *need* to know about the product and thus *should want to know* and what many of them would ask if they would have sufficient reliable information about food.
In the past decade self-proclaimed experts have told that food has become a great risk and one must be very careful because food today contains chemicals and chemicals are dangerous.
After the European commission had decided that the safety of chemicals added to food should have been proven safe and that to help consumers to find out about these additions, E-numbers had been introduced, making it easier to look the information up.
One would not need to type in "ethyl ester of beta-apo-8'-carotenic acid" but just E160f to find all information about the substance. Promptly you are told that E-numbers have been invented to hide that there are chemicals in the food. When as a response manufacturers went back to using the chemical names, the message became that chemical names are used to hide E-numbers.
In "Swallow This: Serving Up the Food Industry's Darkest Secrets " (Blythman, 2015) you may read:

> *"How clean is your label? Pick up some rustic-looking salami and even the most guarded shoppers might relax when they notice rosemary extract on the ingredients list. But rosemary extracts are clean label substitutes for old guard of techie-sounding antioxidants. Manufacturers use them to slow down the rate at which food go rancid. Rosemary extracts do have an E number (E392) but manufacturers prefer to label them more poetically as ‘extract of rosemary’, and loose off ending E. because that way they sound like lovingly made Slow Food ingredients."*

or

> *"Not sure what to have for dinner? How about a chicken noodle dish? If you noticed that it contained an amino acid such as L-cysteine E910, your enthusiasm might wane."*

Toxicity of chemicals

It is time that children already in the Kindergarten learn that everything is chemical and that chemicals need not scare them. They need to know that water and air are chemical and become resistant to scary misinformation. At the basic school they may be shown nice labels developed by James Kennedy, a chemistry teacher in Melbourne, Australia (Figure 3). His intention is to demonstrate that “natural” products are usually more com-plicated than anything created in a laboratory. And he omitted the thousands of minority ingredients, including DNA.
What everybody should know is that chemicals as such are not toxic, but that it is the amount of a chemical that may make it toxic, as discovered and explained a few hundreds years ago by Paracelsus (Bombastus ab Hohenheim, 1658): *"Poison is in everything, and no thing is without poison. The dosage makes it either a poison or a remedy"*. For many substances the situation is as Paracelsus discovered: if the dose is too high, damage is done. However, too low a dose of the substance may also be a health risk, as is the case with vitamins and minerals. Without them we get ill and may die, but too high a dose has the same result (Figure 4; from GHI, 2016).

Figure 3. All the ingredients on this list are 100% natural in a non-GM banana. None of them are pesticides, fertilisers, insecticides or other contaminant and the label is not complete, there are also another thousands of minority ingredients

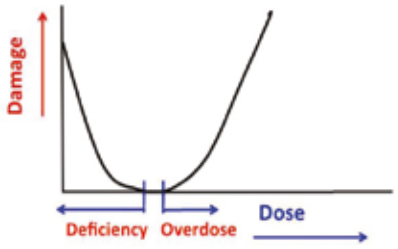

Figure 4. This graph illustrates what applies to most chemicals in our food. Not enough may lead to damage, such as blindness in the case of vitamine A, but too much will also do damage, the amount will make even vitamins toxic

The message is that all food contains potentially toxic substances, substances that like any substance, will become toxic if the amount consumed is larger that the body can handle. In many cases the body needs these substances, but not in excess. With not enough vitamin A you may turn blind and eventually die if it lasts too long. With too much vitamin A you will die too. Here is a short list of examples of chemicals present in normal food, harmless, unless consumed in excess.

- Caffeine, theobromine, theophyline (coffee, chocolate, tea)
- Coumarin (cinnamon, peppermint, green tea, chicory, blueberries)
- Cyanogenic glycosides, such as amygdalin (almond, laurel) and linamarin (cassave)
- Enzyme inhibitors (soy, peas, beet, cereals)
- Glucosinolates such as sinigrin, progoitrin (cabbage, broccoli, brussels sprouts, cauliflower, turnip, radish, horseradish, mustard, rapeseed)
- Lectins (or hemaglutinins) (pulses)
- Oxalates (rhubarb, spinach, parsley, chives, purslane, cassava, amaranth, chard, taro leaves, radish, kale, monstera fruit)
- Piperidines (black pepper)
- Saponins (peanut, soy, spinach, broccoli, potato, apple)
- Solanine (potatoes, tomatoes, aubergines)
- Tomatine (tomatoes)

The good news is that, at least in developed countries, with normal but not monotonous eating habits it is unlikely that any component of food will be consumed in too high or too low quantities, perhaps with the exception of vitamin D in winter or in case of adverse medical conditions.

Organic food

All food is organic, people that market "organic food" provide misleading information, suggesting that other food is not organic. The food that is labelled "organic" would be of

better quality and healthier. There is, however, again no evidence that "organic food" is any better than other food. Insects are as keen as humans to eat, therefore insects need to be kept away from the food intended for humans. For food grown in greenhouses this is possible to a large degree but for food grown in the open, this is not possible. For that reason insecticides are used, also on so-called organic food. The difference is that, while the synthetic ones used on normal food have been thoroughly tested for safety, those used on organic food are not, because they are organic. When plants are stressed or damaged, such as during a pest attack, they may greatly increase their natural pesticide levels, sometimes even to levels that can be toxic to humans. Americans consume with their food about 10,000 times more pesticides than synthetic pesticide residues (Ames et al., 1990). Although if properly applied the amount of pesticides, natural or synthetic, in or on food products is so low that they will not make the food unsafe, it would in principle be safer to eat food with the thoroughly tested synthetic pesticides than the not tested organic ones. For more and detailed information on this topic, consult Swirsky et al. (1997).

Knowledge that should be on the label

Based on the information discussed above, it is concluded that what is needed, in addition to information about storage and preparation, a declaration of constituents that

- may be harmful if too much is consumed (such as sugar and oxalic acid)
- are essential nutrients and may be lacking in a monotonous diet (such as vitamins)
- may give allergic reactions
- may be unsuitable for a significant part of the population (such as gluten and lactose)

This will already occupy much space and more information will not be helpful while shopping. For more information the manufacturer should provide an internet link or QR-code.

Diets

Unless there are medical disorders, by sticking to a decent varied diet, you may have control over your weight and stay healthy. The wheel of five, shown in Figure 5, is a good guide (Brink et al., 2017). Diets that cut out food groups may result in deficiencies and that obviously is not healthy.

A gluten-free diet makes sense only for people with celiac disease or gluten sensitivity (Van Buul and Broun, 2013) and that are not as many people as the many who believe they suffer from these disorders (Capannolo et al., 2015).

Vegetarian diets are healthy provided sufficient protein is consumed from vegetarian sources. Vegan diets are also healthy provided care is taken that in addition sufficient essential nutrients are consumed.

Claims that probiotics are good for health are at least doubtful (Zmora, 2018).

Figure 5. The wheel of five, developed by the Netherlands Nutrition Centre

Varying menus will provide all nutrients needed for healthy people. The recommendation is to pay attention to the wheel of five; not to eat too much; not to add more than a little salt; not to add sugar; consume 2 litre of water per day (but that is including the water present in the food) and last but not least: enough physical activity. In case of weight problems that cannot be solved by these points: consult a reliable nutritionist.

Recommendation

To fight misinformation, it is recommended to use the information in this article to teach students, discuss with colleagues, management, politicians and whoever else you may be able to influence.

If surprising information about food, food safety and food security is encountered, always

look for peer-reviewed scientific evidence. Also, in meetings with officials and politicians, address regulations that are morally and scientifically wrong and harm people.

Books that provide peer-reviewed scientific information

Genetically Modified and Irradiated Food - Controversial Issues: Facts versus Perceptions Editor: Veslemøy Andersen. Elsevier, 2019. ISBN: 9780128172407

Ensuring Global Food Safety - Exploring Global Harmonization. Editors: Christine Boisrobert, Aleksandra Stjepanovic, Sangsuk Oh and Huub Lelieveld. Elsevier/Academic Press, 2009. ISBN: 9780080889306

Regulating Safety of Traditional and Ethnic Foods. Editors: V. Prakash, Olga Martin-Belloso, Larry Keener, Siân Astley, Susanne Braun, Helena McMahon and Huub Lelieveld. Elsevier/Academic Press, 2016. ISBN: 978-0-12-800605-4

Nutritional and Health Aspects of Food in Nordic Countries. Editors: Veslemøy Andersen, Eirin Bar and Gun Wirtanen. Elsevier/Academic Press, 2018. ISBN: 978-0-12-809456-3

Global Food Legislation: An Overview. Editors: Evelyn Kirchsteiger-Meier and Tobias Baumgartner. Wiley, 2014. ISBN: 978-3-527-33555-8

EU Food Law Handbook. Editor: Bernd van der Meulen. Wageningen University Press, 2014. ISBN: 978-90-8686-246-7

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