Food as a Basis for Good Health and Well-Being

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Abstract. Healthy food is a result of huge efforts to produce safe products. This starts with the supply of safe raw materials which are handled with the support of a series of safety protocols. These include the use of low storage temperatures, clean working environment, sufficiently high cooking temperatures, and safe and hygienic logistic measures. The consumer himself can contribute to the safety by a few simple measures to keep the food at home safe. However, there are more points that have to be considered with safe foods. These include the presence of inherent toxic substances that might be present in the raw materials (e.g. arsenic in drinking water, alkaloids in plant foods, carcinogenic substances formed during heating). In addition to these basic food related issues the uptake of food – which is also a social event – can contribute to the well-being which is also part of a healthy life.

1. Introduction

Besides many socio-economic factors high quality food is of highest importance for good development and prolonged maintenance of health. In the discussion of quality issues of foods, it is the safety which has the most impact on health. Both, the chemical and the biological risks can have acute effects or long term chronic effects.

During the first years of life of children a good supply with nutrients is important since the basic programming and development of the body – meaning all organs including the complete nervous system – is defined in this period. A balanced diet to achieve a sufficient supply with energy and nutrients is recommended by practically all nutrition societies. This diet comprises the food groups of vegetables and legumes (beans), fruit, grains and cereals, lean meat, poultry, fish, eggs, legumes (beans) tofu, nuts, seeds, milk, cheese, yoghurt or alternatives, and water. This balanced diet provides a sufficient supply with protein, fat, carbohydrates, vitamins, minerals, and trace elements. In addition, other compounds which are not digested could contribute to a healthy life which are e.g. dietary fiber, secondary plant metabolites. So, the primary aim of high quality food is to supply all macro- and micro-nutrients adequately. The bioavailability of the nutrients has to be sufficiently high and the food should not be contaminated by toxic degradation product which can arise during processing or cooking [1].

Related to the safety of foods it is the absence of pathogenic microorganisms that could contaminate the foods. Especially the presence of salmonella, campylobacter, listeria, Escherichia coli, noroviruses, and several others is problematic and the food has to be heated properly to reduce or eliminate these pathogens. The situation is different if chemical risks are present. In this case the possibility of elimination is limited since most of these compounds are resistant to heating. On one hand environmental contaminants (of natural or anthropogenic origin) and on the other hand substances of microbiological mycotoxins.
2. Result and Discussion

2.1. Heating of Foods

Primary target of heating is to improve safety i.e. to eliminate pathogenic micro-organisms like listeria, salmonella, *E. coli* etc. In addition, spoiling bacteria that degrade the foods are also eliminated. For cooking, the heating intensity varies from mild heating (pasteurization) to very intensive high temperature heating (grilling). To eliminate the pathogens a minimum core temperature of 65 °C has to be reached.

Other changes during heating comprise the chemical and physical changes that are associated with cooking. Aroma is formed and the texture changes depending on the foods – to softer or crispier textures. The proteins denature and become more digestible. The result is a food that has a better palatability with higher bioavailability of the nutrients.

Besides the improvement of nutritional quality, a series of chemical reactions are occurring that degrade the nutrients (e.g. essential amino acids and fatty acids, vitamins, other secondary plant metabolites like polyphenols) or form carcinogenic compounds. These are heterocyclic amines in meat and fish, acrylamide in asparagine containing foods, furan and derivatives, peroxides in unsaturated fats. These reactions are occurring at temperatures of above 150 °C. Especially the frying/grilling/roasting of meat induces the formation of heterocyclic amines. This group of compounds comprises the most carcinogenic food associated compounds that are known [2][3][4].

For the formation of these carcinogenic compounds some pre-conditions are necessary. Besides the high temperature these are the presence of chemical precursors. In the case of heterocyclic amines, the precursors are free amino acids, creatinine, and sugars. When applying high temperatures these compounds react and form the carcinogenic compounds. However, the concentrations are in the low ng/g-range. Although these compounds are extremely carcinogenic due to the low concentration the risk is low. This risk has been evaluated in several studies like [2]. The European Prospective Investigation into Cancer and Nutrition (EPIC) the observed relation was between intake of processed meat (salted, cured, fermented, smoked) and increased risk of death from cancer as well as cardiovascular diseases [5].

2.2. Food Related Diseases

A series of food related diseases is described in literature. Several these diseases are not a direct result of the food consumption it is only the risk that is increased to fall ill. These diseases can develop because of an oversupply with food in general (e.g. obesity from an oversupply with energy) or it is related to the uptake of specific foods or nutrients (diabetes – related to fat and sugar uptake; dental decay – related to sugar uptake; gout – related to meat and fish consumption). In this type of diseases other factors (e.g. genetic and inherited factors) play an important role in addition to food. This is also known for hyperlipidemia or the development of cancer.

In contrast, food intolerances are a direct response to specific food components. These comprise the histamine or lactose intolerance which are concentration dependent. Other intolerances – like allergies – are more or less independent of the amount to which an individual is exposed. Commonly, allergies can develop against peanuts, soy, milk, shrimps, fishes, and others. Typical allergies are described for peanuts, soy, milk, shrimps, fishes, and many more. The allergic response is mostly mediated via immunoglobulin E (Ig E) which is also used for diagnostic purposes [6].

Acute toxic effects can arise from the consumption of specific contaminants. The most problematic are of microbiological origin (e.g. campylobacter, salmonella, listeria, *E. coli*, *Vibrio cholerae*, noroviruses, parasites, and prions). Exposure to chemical contaminants like mycotoxins, aquatic biotoxins, cyanogenic glycosides, furocoumarins, and pyrrolizidine alkaloids can also be problematic. The mycotoxins are omnipresent and it is only a question of the concentration whether these have an effect on the human health or not. Aflatoxins are mainly present in foods originating from warm and humid regions. They are mainly present on nuts and cereals which are not manufactured and stored properly in dry conditions. Aflatoxin B1 is the most toxic mycotoxin of this group [7].

Of the inorganic contaminants, arsenic is the element of concern. It can be present in ground water and was found in many countries around the world. Arsenic can contaminate other foods by irrigation. It is possible to eliminate arsenic by appropriate water treatment [8].
2.3. Safer Food

The world health organization (WHO) has published concepts for consumers and producers to reduce the health risk of foods. A series of food related diseases is described in literature. Several of these diseases are not a direct result of the food consumption it is only the risk that is increased to fall ill. These diseases can develop because of an oversupply with food in general (e.g. obesity from an oversupply with energy) or it is related to the uptake of specific foods or nutrients (diabetes – related to fat and sugar uptake; dental decay – related to sugar uptake; gout – related to meat and fish consumption). In this type of diseases other factors (e.g. genetic and inherited factors) play an important role in addition to food. This is also known for hyperlipidemia or the development of cancer.

The WHO has published a document for promoting safe food handling. This includes “five keys to safer food” [9]:

a. Keep clean (wash your hands before handling food and often during food preparation; wash your hands after going to the toilet; wash and sanitize all surfaces and equipment used for food preparation; protect kitchen areas and food from insects, pests and other animals),
b. Separate raw and cooked (separate raw meat, poultry, and seafood from other foods; use separate equipment and utensils such as knives and cutting boards for handling raw foods; store food in containers to avoid contact between raw and prepared foods),
c. Cook thoroughly (cook food thoroughly, especially meat, poultry, eggs, and seafood; bring foods like soups and stews to boiling and make sure that they have reached 70 °C. For meat and poultry, make sure that juices are clear, not pink. Ideally, use a thermometer; reheat cooked food thoroughly),
d. Keep food at safe temperatures (do not leave cooked food at room temperature for more than 2 h; refrigerate promptly all cooked and perishable food (preferably below 5 °C); do not store food too long even in the refrigerator; do not thaw frozen food at room temperature),
e. Use sage water and raw materials (use safe water or treat it to make it safe; select fresh and wholesome foods, choose foods processed for safety, such as pasteurized milk; wash fruits and vegetables, especially if eaten raw; do not use food beyond its expiry date).

2.4. Food and Well-Being

Part of well-being is the food that gives us pleasure. This is a combination of pleasant aroma, taste, and colour combinations. The texture is important for the chewing experience. During chewing the aroma is released which is trapped inside the structures like fat globules or water inclusions. The volatile compounds that are released are experienced retronasally meaning that the aroma active volatiles are transferred to the olfactory mucosa which is located in the nasal cavity. It is the combination of all the receptors which are related to food result in a concentrated sensation. These are the taste receptors (sweet, sour, salty, bitter, umami), the olfactory receptors (interaction with odorants), the proprioceptors (location of tongue, cheeks, and lips), periodontal receptors (respond to the loading of teeth and provide information about the direction in which the forces are applied), nociceptors (sensation of pain, protection of biting our own tongues, cheeks, and lips and burn our mouth), thermal receptors (sensitive discrimination of temperatures from 17 °C to 48 °C). Both, positive and negative (good/bad) sensations are transmitted by these receptors and experienced in the brain [10].

3. Conclusion

Food as one of the primary contributions to healthy living has – of course – the function of providing energy and nutrients for a proper functioning of the body. However, with an oversupply of the food a series of diseases can be the consequence. This includes the oversupply as well as the exposure to toxic constituents which might be present in the food inherently or which are contaminating the food from natural sources or of anthropogenic origin.

In addition to the essential supply the food can give us some pleasure contributing to the well-being of the individuals. This might be the social event of common eating or the positive experience of all
senses associated with food uptake. It is the combination of high quality and safe food and the experience of eating the results in a healthy life.

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