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Nutrition and food for health and longevity

There is a much enhanced scientific and social interest in the real and potential power of food in improving health, preventing diseases, and extending the lifespan. In scientific research and experimentation, often little or no distinction is made between nutrition and food, which is a gross omission in a social context. Nutrition is the amalgamation of various components, such as proteins, carbohydrates, fats, and minerals, which are needed for the survival, growth, and development of a biological system. However, food is what, why, and how we eat for survival, health, and longevity. This distinction between nutrition and food is a very important variable for humans, and may be equally important for other animal models used in research where the appearance, smell, texture, and taste of food matter.

None of the nutritional components is by itself good or bad, and none of the foodstuffs is either healthy or unhealthy. Nutrition can lead to either good effects or bad effects, and food can have consequences, making us either healthy or unhealthy. It is the quantity, quality, frequency, and emotional satisfaction that determine whether any particular food can help us achieve the aim of maintaining and improving health, and delaying, preventing, or treating a disease.

Some food components in the diet of human beings do not have any nutritional value in the normal sense of providing material for the structure, function, and energy requirements of the body. Such non-nutritional food components (NNFC) usually come from spices, herbs, and the so-called vegetables and fruits, for example, onion, garlic, ginger, shallot, chive, and chillies. Different combinations of NNFC form an integral part of different food cultures in different social setups, and carry a wide range of claims for promoting health and longevity. Not all such claims of NNFC have been scientifically tested and confirmed, and often very little is known about

their biochemical mode of action. However, recent research in the field of hormesis is unraveling some of the mechanistic bases for the effects of NNFC.

Hormesis is the positive relationship between low-level stress and health. While uncontrolled, severe, and chronic stress is recognized as being harmful to health, single- or multiple-exposures to mild stress are generally beneficial to health. Moderate exercise is the best example of such a phenomenon of mild stress-induced physiological hormesis. Exercise initially increases the production of free radicals, acids, and other potentially harmful biochemicals in the body, but the cellular responses to stress, in increasing defense and repair processes, protect and strengthen the body. Such conditions, which induce hormesis, are called hormetins, and are categorized as physical-, mental-, and nutritional-hormetins.

Several NNFC and their constituent chemical entities, such as flavonoids or bioflavonoids, are nutritional hormetins. This is because they directly or indirectly induce one or more stress responses, such as Nrf2 activation, heat shock response, unfolded protein response, and sirtuin response. After the initial recognition of disturbance or damage caused by a stressor, numerous downstream biochemical processes come into play, including the synthesis and activation of chaperones, stimulation of protein turnover, induction of autophagy, and an increase in antioxidant enzymes. Not all stress response pathways respond to every stressor, and although there may be some overlap, generally these pathways are quite specific. Since such NNFC are almost always used in the food as a combination of several components, it is important to study their effects in the context in which they are consumed. Scientific research on nutrition must incorporate the analysis of NNFC hormetins for their role as a part of food for health and longevity.

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