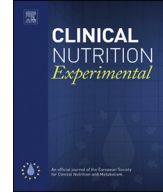




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The value of flavonoids for the human nutrition: Short review and perspectives

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SUMMARY

Flavonoids are phytochemicals and belong to the polyphenols. A wide variety of beneficial factors has been attributed to their mode of action. Some of their activities concerns the inhibition of inflammatory pathways and the down regulation of genes involved in chronic inflammatory disease states. These genes enhance the inflammatory signaling pathways leading to expression of inflammatory cytokines and chemokines. Flavonoids from fruits, vegetable and tea compounds can block many proinflammatory proteins and thus function as natural inhibitors of inflammation. Instead of using nonsteroidal anti-inflammatory drugs natural inhibitors could possibly be used to suppress the intensity of the inflammation in the chronically inflamed mucosa in patients with chronic inflammatory bowel disease. Natural inhibitors like flavonoids are xenobiotics which are metabolized by the cytochrome P-450 enzymes and conjugating protective enzymes. Flavonoids can induce these protective enzymes by upregulation and thereby could act as protective metabolic barrier within the intestinal mucosa. The nutritional value of flavonoids is probably related to their anti-inflammatory activity and through this mechanism responsible for prevention of neoplasia. The evidence for their clinical efficacy as essential compounds is still preliminary at best and limited but suggestive.

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1. Introduction

Vitamins are essential for the human nutrition. They cannot be synthesized in the body, they need to be taken up from exogenous sources in our nutrition and are essential for the health and the function of our body. Flavonoids are similar in that they cannot be synthesized, they are foreign compounds and are contained in our nutrition, but are they really essential for the human health? Could these phytochemicals play a role comparable to that of vitamins? To find out about this we have to explore their fate when they interact with the biology of the organism. Plant derived phytochemicals play an important role as protective factors against free radicals, reactive oxygen species and toxic chemical compounds. The concept of their role as natural inhibitors of inflammation has evolved recently [1,2] and their metabolism was clarified [3].

Flavonoids belong to the polyphenols and are widely distributed within the plant kingdom and are mainly contained in fruits, vegetables and teas [4]. There are more than 4000 flavonoid species and there are 6 major groups according to their chemical structure: Flavones, flavonols, flavanols, flavanones, anthocyanidins and isoflavonoids [5].

2. Physiology

The uptake and the absorption takes place in the small intestinal mucosa but only small amounts enter the central compartment of the body from where they reach the liver and the kidney. Phase 1 metabolism by cytochrome P-450 enzymes and phase 2 metabolism by conjugating enzymes are performed in the liver and the gut and the water-soluble products are excreted by the kidney and into the bile [3]. The mucosa is exposed to a much higher concentration than the other tissues and therefore here the biological activity is concentrated. A great fraction remains within the lumen of the gut and reaches the colon where the flavonoids are metabolized by the microbiota to small breakdown products among them butyrate and acetate which are the metabolic fuel of the mucosa.

3. Function

Flavonoids use the same xenobiotic metabolizing enzyme system which is used for the distribution and disposition of drugs but do they exercise drug related effects?

There is a wealth of clinical and laboratory studies and data that suggest that flavonoids have beneficial effects in a wide variety of clinical fields such as cardiovascular disorders [6], neurology, urology, immunology and last but not least gastroenterology (Table 1). It is difficult to find a common functional denominator that can explain all these findings. The most convincing factor which could explain the beneficial findings is that flavonoids act best in preventing medicine. Flavonoids need to be given before the pathophysiological event occurs. That could mean that a protective wall should be induced before the noxious factor comes into play. The mechanism which is used to build up the

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