

PROMOTING CHILDREN NUTRITION WITH POSITIVE EFFECTS ON HEALTH. THE HEALING FOODS



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1. The Mediterranean diet in paediatrics. Beneficial effects of tomato enriched with natural antioxidants in the treatment of hepatic steatosis associated with childhood obesity

Background

Nutritional research at “omics” level unveiled that in addition to supplying energy and macronutrients, food also plays a more subtle role in health and disease. Food is loaded of complex, biologically active molecules, so is not surprising that it impacts on health. In the last 20 years the advantages of the Mediterranean diet (MD) both for the protection of health, from birth to senescence, and for the prevention of common degenerative diseases have been largely shown. Only recently, with the rise of nutrigenomics, we started to understand the interaction between the molecular components of typical items of the MD and the receptors expressed from the tongue all through the intestinal tract. So the beneficial effect of olive oil, tomato, fish, aromatic herbs, traditionally used in Mediterranean cooking, now have a clearer explanation at molecular level. Tomato, a cornerstone food of the MD, is an optimal source of bioactive compounds as carotenoids, polyphenols and vitamins. Lycopene, the main carotenoid component of tomato, has a strong antioxidant effect in vivo, protecting biomolecules from the oxidative stress. In obese children, where Nonalcoholic Fatty Liver Disease (NAFLD) is the most common cause of liver dysfunction, lifestyle interventions, including diet, are considered the primary therapy. In rat models of NAFLD, the addition of tomato juice significantly improves the metabolic profile.

Main achievements

We performed a randomized crossover trial on obese children with NAFLD, putting them on calorie-controlled regimen alone or with a daily supplementation of a lycopene-rich tomato sauce with oregano and basil extracts. We observed that the calorie-controlled diet improves the body parameters as well as the glucose and lipid balance, the oxidative state and the inflammatory markers of obese children with liver steatosis, but the addition of a tomato supplement, greatly potentiates these effects. A reduction in fat thickness, liver size and steatosis was observed in both groups, more profound in tomato-supplemented group. Interestingly we observed that beneficial effects of tomato supplementation were not limited to the metabolic control but also extended to immunological profile. Indeed supplementation with tomato resulted in the maintenance over time of the physiological engagement of glycolytic metabolism in T cells after activation, despite the caloric restriction. The metabolic activation of T cells has to be associated with the maintenance of a proper immune surveillance, likely protecting the individual from the constraints of the energy restriction in a growing organism.

Future perspectives

To further study molecular mechanisms involved in the beneficial effect of tomato on NAFLD we compared transcriptome profiles of children lymphocytes between the two groups and between the baseline and the treatments in each group. We identified differentially expressed inflammation-related genes that are targets for the current investigation.

2. Non-nutritional effects of (breast) milk

Background

Besides supplying all nutrients needful to support growth and development, human milk has a key role in preventing overweight and obesity and in providing immunoregulatory components. The rate of cow milk consumption, as a substitute food in the early months of life, is very high in Western countries, so it was suggested as a factor contributing to the increasing burden of obesity and related disorders. Recently donkey milk has been proposed as the best substitute for the human one. To evaluate the physiological effects of different milks, we compared in an animal model the intake of human milk (HM) with equicaloric supplementation of donkey milk (DM), and cow milk (CM).

Main achievements

We observed that dietary supplementation with HM or DM is associated with a decrease of inflammatory status, coupled with the improvement of lipid and glucose metabolism. The beneficial effects elicited by HM and DM are, at least in part, mediated by their ability to modulate mitochondrial function and efficiency, ROS homeostasis and Nrf2-FGF21 pathways. Moreover, specific gut microbes and metabolites were increased upon HM and DM. We found that DM and HM affected the gut microbiota in favour of two genera linked with anti-inflammatory properties: *Bacteroides* and *Parabacteroides*. Notably, these bacterial species are known to produce short-chain fatty acids (SCFAs), which can reach host tissues to act as metabolic regulators and to control energy metabolism and inflammatory state. It is worth noting that we found an increased level of faecal SCFAs in animals fed with DM and HM. We also evaluated the levels of endocannabinoids and N-acyl ethanolamines in liver and skeletal muscle, proving that DM or HM administration reduces inflammation status, improves glucose disposal and insulin resistance and reduces lipid accumulation in skeletal muscle. Moreover, HM or DM administration increases redox status and mitochondrial uncoupling, affecting mitochondrial dynamics in the skeletal muscle. Interestingly, HM and DM supplementation increases liver and muscle levels of the N-oleoylethanolamine (OEA), a key regulator of lipid metabolism and inflammation. Altogether, our study adds further support to the exceptional qualities of HM and DM compared to CM. Thus, the impact of milk from ruminants differs from that of monogastric species on gut microbes and host metabolism at different levels (energy storage, energy expenditure, mitochondrial function, metabolism and inflammation). Nevertheless, by displaying novel mechanisms linking gut microbes and mitochondrial function with cellular metabolic responses according to the milk used, this study adds novel significant perspectives and suggests that selected milks may provide protection against specific metabolic disorders.

Publications

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