Effect of an innovative pasta enriched with bioactive components and functional probiotics on HDL cholesterol efflux capacity (CEC)

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Cholesterol efflux capacity (CEC) is the primary atheroprotective function of high density lipoproteins (HDL) and represents their ability to accept cholesterol from macrophages, the first step of reverse cholesterol transport, a process whereby excess cholesterol is removed from peripheral tissues and excreted therefore counteracting foam-cell formation [1]. Cholesterol efflux to HDL mainly occurs through the activity of the membrane transporters Scavenger Receptor class B type I (SR-BI), ATP Binding Cassette A1 (ABCA1) and G1 (ABCG1), which is strictly dependent on HDL structure. Also the aqueous diffusion (AD) play an important role in this process. Interestingly, serum-HDL CEC has been inversely related to early atherosclerosis and cardiovascular risk, independently of HDL cholesterol (HDL-C) levels [2]. In particular, recent findings suggest that CEC, taken as a metric of HDL functionality, may be considered a more relevant, predictive parameter than HDL-C plasma concentrations for cardiovascular risk evaluation [3]. Epidemiological evidence indicate that high consumption of whole grains is associated with a reduced risk of chronic diseases related to diet such as cardiovascular disease, hypertension, type 2 diabetes, obesity and metabolic syndrome. The mechanisms underlying this protective effect have not been claryfied yet. The aim of this study was to evaluate the effect of consumption of a new kind of whole-wheat flour with added β -glucan from barley and spores of B. coagulans GBI-30, 6086, on HDL functionality, measured as CEC. To achieve this aim a radomized parallel study of 12 weeks duration has been conducted in 40 healthy volunteers. Recruited subjects were assigned to two treatments in randomized order: 1. Experimental pasta made with whole-wheat flour enriched in β-glucan from barley and spores of B. coagulans GBI-30, 6086, 2. Control pasta produced with the same technological process and with the same, but not integral, variety of wheat as the functional one. During the study, subjects were asked to eat a daily portion of the provided pasta by replacing the portion of pasta they usually consume and to maintain their eating habits and their usual level of physical activity. Patients included in this study underwent also clinical laboratory set analysis in order to completely define the inflammatory, lipidic and glucidic profile for each subject.

CEC measurement was performed ex vivo on whole plasma collected from subjects before and after treatment with the innovative pasta or with the control one. The individual cholesterol efflux pathways were evaluated by using specific, widely accepted cell-based radio isotopic assays [4]. AD- and ABCA1-mediated CEC remained unchanged between treated and controls subjects and did not show to be affected by the treatment with the new experimental pasta. Neverthless ABCG1-mediated CEC was significantly increased in subjects treated with the innovative pasta. Additionally ABCG1-mediated CEC was found to be slightly improved in the group of the treated subjects compared to the placebo group. On the base of these preliminary results, it seems that pasta treatment induces an increased in HDL-CEC mediated by ABCG1 transporter, which plays a fundamental role in cholesterol efflux process and which activity is importantly related to intracellular inflammatory pathways [5]. Further investigations on serum-HDL CEC in treated subjects, as well as its correlation with clinical indeces of inflammation, would be useful to better define the protective effects of this kind of innovative, whole-wheat made pasta, especially on cardiovascular disease.

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