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Oil and Proteins of Sardine (Sardina Pilchardus) Compared with Casein or Mixture of Vegetable Oils Improves Dyslipidemia and Reduces Inflammation and Oxidative Stress in Hypercholesterolemic and Obese Rats

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Abstract : Background: Obesity results from a prolonged imbalance between energy intake and energy expenditure, as depending on basal metabolic rate. Oils and proteins from sea have important therapeutic (such as obesity and hypercholesterolemia) and antioxidant effects. Sardine are a widely consumed fish in the Mediterranean region. Its consumption provides humans with various nutrients such as oils (rich in omega 3 plyunsaturated fatty acids)) and proteins. Methods: Sardine oil (SO) and sardine proteins (SP) were extracted and purified. Mixture of vegetable oils (olive-walnut-sunflower) were prepared from oils produced in Algeria. Eighteen wistar rats are fed a high fat diet enriched with 1% cholesterol for 30 days to induce obesity and hypercholesterolemia. The rats are divided into 3 groups. The first group consumes 20% sardine protein combined with 5% sardine oil (38% SFA (saturated fatty acids), 31% MIFA (monounsaturated fatty acids) and 31% PIFA (polyunsaturated fatty acids)) (SPso). The second group consumes 20% sardine protein combined with 5% of a mixture of vegetable oils (VO) containing 13% SFA, 58% MIFA and 29% PIFA (PSvo), and the third group consuming 20% casein combined with 5% of the mixture of vegetable oils and serves as a semi-synthetic reference (CASvo). Body weights and glycaemia are measured weekly After 28 days of experimentation, the rats are sacrificed, the blood and the liver removed. Serum assays of total cholesterol (TC) and triglycerides (TG) were performed by enzymatic colorimetric methods. Evaluation of lipid peroxidation was performed by assaying thiobarbituric acid reactive species (TBARS) and hydroperoxides values. The protein oxidation was performed by assaying carbonyl derivatives values. Finally, evaluation of antioxidant defense is made by measuring the activity of antioxidant enzymes, the superoxide dismutase (SOD) and the catalase (CAT).Results: After 28 days, the body weight (BW) of the rats increased significantly in SPso and SPvo groups compared to CAS group, by +11% and 7%, respectively. Cholesterolemia (TC) increased significantly in the SPso and SPvo groups compared to the CAS group ($P<0.01$), while triglyceridemia (TG) decreased significantly in the SPso group compared to SPvo and CAS groups ($P<0.01$). Albumin (marker of inflammation) increased in the PSs group compared to SPvo and CAS groups by +35% and +13%, respectively. The serum TBARS levels are -40% lower in SPso group compared to SPvo group, and they are -80% and -76% lower in SPso compared to SPvo and CAS groups, respectively. The level of carbonyls derivatives in the serum and liver are significantly reduced in the SPso group compared to the SPvo and CAS groups. Superoxide dismutase (SOD) activity decreased in liver of SPso group compared to SPvo group ($P<0.01$). While that of CAT is increased in liver tissue of SPso group compared to SPvo group ($P<0.01$). Conclusion: Sardine oil combined with sardine protein has a hypotriglyceridemic effect, reduces body weight, attenuates inflammation and seems to protect against lipid peroxidation and protein oxidation and increases antioxidant defense in hypercholesterolemic and obese rats. This could be in favor of a protective effect against obesity and cardiovascular diseases.

Keywords : rat, obesity, hypercholesterolemia, sardine protein, sardine oil, vegetable oils mixture, lipid peroxidation, protein oxidation, antioxidant defense
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