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Activity of liver enzymes in multiple sclerosis patients with Hot-nature diet and co-supplemented hemp seed, evening primrose oils intervention

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Abbreviations: AA, arachidonic acid; ALA, alpha-linolenic acid; ALT, (SGPT)alanine-aminotransferase; AST, (SGOT)aspartate-aminotransferase; BBB, blood–brain barrier; CNS, central nervous system; DGLA, dihomo-gammalinolenic acid; EDSS, extended disability status score; EP, evening primrose; EPO, evening primrose oil; FA, fatty acid; FDA, food and drug administration; FR, food records; FSS, functional system scores; GGT, gamma-glutamyl transferase; GLA, gamma linoleic acid; HS, hemp seed; H-TAC, high-total antioxidant capacity; HSO, hemp seed oil; IFN, interferon (β 1b- β 1a- β); IFN- γ , interferon- γ ; IL, interleukin (IL-2-IL-4, IL-5, IL-10, IL-12, IL-13); LA, linoleic acid (omega-6 Family); LC-PUFA, long chain-polyunsaturated fatty acid; L-TAC, low-total antioxidant capacity; MS, multiple sclerosis; nqFFQ, non-quantitative food frequency questionnaires; PGE, prostaglandin (E1, E2, E3); PPMS, primary progressive multiple sclerosis; PRMS, progressive relapsing multiple sclerosis; PUFA, polyunsaturated fatty acid; RBCs, red blood cells; ROS, reactive oxygen species; RRMS, relapsing remitting multiple sclerosis; SDA(STA), stearidonic acid; SPMS, secondary progressive multiple sclerosis; TAC, total antioxidant capacity; Th, T helper (1-2-10-13); TIM, traditional Iranian medicine; TNF- α , tumor necrosis factor-alpha; USFA, unsaturated fatty acid; W/C, warmth/coldness.

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Inflammation;
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Total antioxidant
capacity

Summary

Background: It is unknown whether diets with a high dietary total antioxidant capacity (TAC) can modify oxidative stress, low-grade inflammation, or liver dysfunction, all of which are risk factors for multiple sclerosis disease. This study assesses alanine amino-transferase (ALT), aspartate-aminotransferase (AST) and gamma-glutamyl transferase (GGT) activities in MS patients treated with co-supplemented hemp seed and evening primrose oils as well as Hot-nature diet and the therapeutic potential this intervention.

Methods and materials: In this double blind, randomized trial, 100 MS patients with EDSS < 6 were allocated into 3 groups: "group A", who received co-supplemented *hemp seed* and *evening primrose* oils with advised Hot-nature diet; "group B", who received olive oil; and "group C", who received the co-supplemented oils. Clinically, EDSS as well as serum level of liver enzymes (GGT, AST, and ALT) were assessed at baseline and after 6 months.

Results: Mean follow-up was 180 ± 2.9 SD days ($N = 65$, 23 M and 42 F aged 34.25 ± 8.07 years with disease duration of 6.80 ± 4.33 years). There was no significant difference in the study parameters at baseline. Serum levels of liver enzymes (GGT, AST, and ALT) were serially monitored. Intervention was associated with liver function alteration in three groups. Significance decreased in EDSS score and the levels of liver enzymes were found in groups A and C, whereas elevated serum liver enzymes and EDSS score were observed in group B after the intervention.

Conclusion: Selecting foods according to their Total antioxidant capacity such as co-supplemented *hemp seed* and *evening primrose* oils with Hot-nature diet affects antioxidant intake and can have beneficial effects on improving EDSS score and activity of liver enzymes in RRMS patients.

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Introduction

Multiple sclerosis (MS) is a relatively common disease with an unknown etiology and with no cure which results in neurological disability in young adults. This condition affects over two million people worldwide.¹ Many of the current treatments are costly and limited in efficacy, and cause unpleasant side effects.² Although the exact etiology of developing MS is dependent on both genetic and environmental factors,³ pathological events such as impairment of T helpers (Th) are involved.⁴ The major types of Th cells are Th1 cells that produce interferon- γ (IFN- γ), Th2 cells that produce interleukin-4 (IL-4) and Th1/Th2 balance is considered as one of the risk factors in MS etiology.⁴⁻⁶ Interferon- β (IFN- β) treatment shifts the immune response from the Th1 to Th2 pattern by enhancing the production of anti-inflammatory Th2 cytokines (ex. IL-4) and decreasing the production of pro-inflammatory Th1 cytokines (ex. IFN- γ). Liver enzymes by treatment of interferon- β 1b cause elevation,⁷ because the liver is the organ responsible for plasma synthesis, drug detoxification and digestion.

Traditional Iranian Medicine (TIM) practiced in Iran and cold and hot natures have been believed to exist in TIM and in many other traditional medical theories.⁸ The study of Shahabi et al., on IL-4/IFN- γ ratio showed that the tendency of the Hot nature people was to deviate toward Th2-like immune responses to a greater extent than of the cold nature people.⁸ In this way, the consumption of Hot-nature foods in a person suffering from an autoimmune disease with a deviation toward Th1 immune responses (such as MS) may be useful because they can accelerate the warmth of nature and deviation toward Th2 immune responses. Evidence was found that ω 3-polyunsaturated fatty acids (ω 3-PUFAs) can suppress IFN- γ production in MS patients.⁹ It

seems that the combination of *virgin hemp seed oil (HSO)* and *virgin evening primrose oil (EPO)* [as co-supplemented oils] with Hot-nature diet causes effective reduction on pro-inflammatory cytokines and targets this key mechanism of disease and works like approved treatments. HSO has been used as a food/medicine in China for at least 3000 years. It contains over 80% in PUFAs, with omega 3/omega 6 (ω 3/ ω 6) ratio between 1:2 and 1:3, which is considered to be optimal for human health.¹⁰ HSO contains phytosterols, terpenes and kinds of tocopherol that not only exhibit potent antioxidative properties for scavenging free radicals but also may act on specific signaling pathways for regulating inflammatory responses.¹¹⁻¹³ EPO is being used in increasing amounts in nutritional and pharmaceutical preparations, and may alleviate various chronic disease states.¹⁴ Therefore, the co-supplemented oils with Hot-nature diet may appear to possess anti-inflammatory roles; and related to this treatment, liver enzymes assay is extremely helpful to understand the pathologic mechanisms in a disease like MS.

Material and methods

To test the above hypotheses, we conducted a double-blind, randomized clinical trial study on 100 relapsing–remitting multiple sclerosis (RRMS) patients to investigate the effects of Hot-nature diet and the co-supplemented oils compared with olive oil on liver dysfunction. Patients consumed a diet with high TAC (H-TAC) with or without Hot-nature diet compared with a diet with low TAC (L-TAC) such as olive oil. The study was approved by the Neurosciences Research Center (NSRC) and local ethics committee of Tabriz University of Medical Sciences. MS patients were contacted and recruited through the MS Society of Tabriz. Patients with a definite diagnosis of MS using the Kurtzke Extended

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