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# Effect of 10 weeks aquatic training on serum Cytokines in the women with multiple sclerosis

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**Abstract**

Aquatic exercise can refer to pool therapy, hydrotherapy, or balneotherapy. Hydrotherapy is frequently applied to patients with painful neurological or musculoskeletal alterations, because the heat and floatability of the water can block nociceptors by acting on thermal receptors and mechanoreceptors and exert a positive effect on spinal segmental mechanisms[4]. Warm water can also increase the blood flow, helping to dissipate allogeneic chemicals and enhance muscle relaxation. The present study aims to explore the effect of 10 weeks hydrotherapy on EDSS, ,TNF_α and IFNγ in female MS patients. The statistical population consists of 30 MS patients whose MS has been confirmed by a neurologist. They were divided into two groups based on inclusion criteria. Experimental group consisted of 15 and the control group consisted of 15 people with ages ranging from 22 to 51 and the weight of 58.9 ± 9.3 kg - Height of 153.5 ± 15.6 cm. Hydrotherapy program for the experimental group was implemented for 10 weeks, 3 sessions per week. Control group participated in none activity program in this period.According to the descriptive statistics, EDSS decreased in the experimental group after 10 weeks hydrotherapy. But no significant difference was seen in TNF_α and IFNγ in two groups.Results showed that endocrine and proinflammatory immune responses to physical exercise are not significantly altered in MS. So EDSS decreased in experimental group. On the other hand, participation in hydrotherapy programs led to benefit in the MS patients.

**Keyword:** Multiple sclerosis, Hydrotherapy, TNF_α, IFNγ, EDSS, women.

Multiple sclerosis (MS) is a complex neuron-generative autoimmune disease, characterizedby dissemination of inflammatory lesions in thecentral nervous system (CNS).

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The localization and severity of MS lesions within the brain and spinal cord is unpredictable and, therefore, a wide range of body systems can be adversely affected to a variable degree. Consequently, there are myriad of symptoms and comorbidities associated with MS that can impact negatively on patient quality of life. Several theories of the symptom experience have identified symptoms as direct and indirect influences on performance and behavioral outcomes in persons with chronic diseases[2,31]. Indeed, symptoms have been inversely associated with activities of daily living (*e.g.*, work, personal care, and social interaction) in individuals with MS[1,17]. For example,motor symptoms (*e.g.*, arm and leg weakness, spasms, and balance problems) were moderately and inversely correlated with activities of daily living associated with fine and gross motor tasks (*e.g.*, eating, dressing, bathing,and walking) in individuals with MS[13]. Secondary analysis of data from 686 persons with MS indicated that emotional symptoms exhibited a moderate and inverse relationship with over-all activities of daily living, and the effect was partially mediated by personal attributes and social support[13]. Recent guidelines from the National Institute of Health and Clinical excellence[22] affirmed that MS patients should be informed of findings on the benefits of certain approaches but declared that insufficient evidence is available to make a firmer recom-mendation[22]. Named techniques include reflexology, massage, fish oils, magnetic field therapy, neural therapy, massage plus body work, Tai-Chi, and multi-modal therapy[7]. MS patients also report the therapeutic use of exercise, vitamins, herbal and mineral supplements, relaxation techniques, acupuncture, *Cannabis*, and massage, mainly for the treatment of pain, fatigue, and stress[24]. Maloni[21] reported that Tai-Chi, meditation, and hypnotherapy may improve the quality of life and re duce pain in MS patients by interfering with pain conduction, producing analgesia through nociceptive pathways. Aquatic exercise can refer to pool therapy, hydrotherapy, or balneotherapy[20]. Hydrotherapy is frequently applied to patients with painful neurological or musculoskeletal alterations,[14] because the heat and floatability of the water can block nociceptors by acting on thermal receptors and mechanoreceptors and exert a positive effect on spinal segmental mechanisms[4]. Warm water can also increase the blood flow, helping to dissipate allogeneic chemicals and enhance muscle relaxation. Finally, the hydrostatic effect of water can alleviate pain by reducing peripheral edema and sympathetic nervous system activity[11]. A systematic review on crenobalneotherapy in patients with limb osteoarthritis found that it reduced pain and improved function and quality of life[9]. CAM is frequently used in spa therapy *in situ* without exercise for various chronic diseases, with highly positive effects in middle-aged and elderly patients[10]. Recently, endocrine and immune responses to experimental psychological stress have been investigated showing no clear-cut regulatory changes in MS patients[1,16]. However, the perception of experimental psy-chological stressors varies considerably between individuals. One study[8] did not find correlations with IL-1, IL-6, and TNF levels in serum and CSF. Taken together, these studies indicate that hypothalamo–pituitary–adrenal (HPA) axis dysregulation is rather a secondary phenomenon than primarily involved in the disease pathogenesis. Alterations have also been described in the sympathetic nervous system regulation of immune function including increased b-adrenoreceptor expression on peripheral blood lymphocytes[32], altered catecholamine levels[5,28], and decreased sensitivity of cytokine production after terbutaline administration[15]. Our intention was to investigate whether MS patients show alterations during moderate physical stress in water as part of a hydrotherapy. We hypothesize that MS patients would show an altered stress response with attenuated immune response in comparison to healthy individuals. Against the back-ground of the beneficial effect of exercise training reported in MS, we further hypothesize that training might partially normalize this dysregulation.

The present study aims to explore the effect of 10 weeks hydrotherapy on EDSS, TNF_α and IFNγ in female MS patients. The type of research is applied research, and the methodology is semi-experimental, which is due to the limitations. The research plan included testing the experimental and control groups before and after the tests the results of which were analyzed. The statistical population consists of 30 MS patients whose MS has been confirmed by a neurologist. They were divided into two groups based on inclusion criteria. Experimental group also consisted of 15 and the control group consisted of 15 people with ages ranging from 22 to 51 and the weight of 58.9 ± 9.3 kg - Height of 153.5 ± 15.6 cm. Patients had no Cardiovascular disease history-final diagnosis of MS confirmed by a neurologist-no history of epilepsy, metabolic diseases - not pregnant and no history of regular exercise during the past three months - All participants had physical disability scale (EDSS) between 1-5. One day before starting the hydrotherapy program the patients involved in the study came together in the desired location and were briefed on how to do the exercise – the intensity of exercise - the number of repetitions in each session and then the experimental and control groups participated in the pretest and at this stage, physical disability scale test developed by a specialist neurologist, and gave blood sample for analyzing IFNγ and TNF_α. Hydrotherapy program for the experimental group was implemented for 10 weeks, 3 sessions per week. Control group participated in none activity program in this period. After completing the training the program both groups were given tests and the results were analyzed.

The main purpose of this research was to investigate the effect of 10 weeks hydrotherapy on TNF_α, IFNγ, and EDSS in MS patients. This study found that ten weeks of hydrotherapy had a significant impact on the EDSS among M.S patients. According to the descriptive statistics, EDSS decreased in the experimental group after 10 weeks hydrotherapy (table 1). But no significant difference was seen in TNF_α and IFNγ in two groups (tables 2 and 3).

Table 1. Statistical indices of EDSS in the experimental and control groups.

| F | Control | | Experimental | | Variable |
|---|---|---|---|---|---|
| | Post-test | Pre-test | Post-test | Pre-test | |
| 19.63* | 3.5 ± 0.6 | 3.4 ± 0.3 | 3.1 ± 0.2 | 3.8 ± 0.8 | EDSS |

Table 2. Statistical indices of TNF- $\alpha$ in the experimental and control groups.

| Control | | Experimental | | Variable |
|---|---|---|---|---|
| Post-test | Pre-test | Post-test | Pre-test | |
| 33.8±12.6 | 33.73±12.1 | 33.70±10.1 | 33.75±9.6 | TNF-$\alpha$ |

Table 3. Statistical indices of IFN$\gamma$ in the experimental and control groups.

| Control | | Experimental | | Variable |
|---|---|---|---|---|
| Post-test | Pre-test | Post-test | Pre-test | |
| 39.1±8.6 | 38.2±8.9 | 38.2±9.9 | 37.3±10.1 | IFN$\gamma$ |

In this study we found that endocrine and proinflammatory immune responses to physical exercise are not significantly altered in MS. Cytokines findings (TNF- $\alpha$ and INF$\gamma$) were consistent in experimental group in this research as well as in asanother investigation also[26]. Stepkard showed that after the exercise IFN$\gamma$ was strongly induced in all 2 groups (experimental and control). Data on IFN $\gamma$ indicate elevations in response to suppression after exhausting exercise (Stepkard and Skek, 1997). But we found no significant difference in our study because the exercise in this study was very mild. IFN$\gamma$ is a crucial cytokine to control infection. On the other hand it governs counter regulatory immunosuppression and endotoxin tolerance[23]. Thus its modulation might explain the differential effects on the immune system during moderate and exhausting exercise, a protective effect of moderate training and an increased rate of infection after exhaustive training. The moderate correlation of IFN$\gamma$ production with disease duration might indicate that in later disease stages MS patients may produce a stronger IFN$\gamma$ response to exercise. TNF$\alpha$ and INF$\gamma$ were not significantly induced during the hydrotherapy in any group. Baseline values in experimental group did not differ to controls in this study. The discrepancy of these findings to other studies might be explained by the different exercise intensity and sampling time and the different patient characteristics[27]. Studies on TNF$\alpha$ levels during and after exercise in healthy individuals have led to conflicting results[26,29]. Elevated glucocorticoid levels are thought to mediate the suppressive effects of exercise on TNF[29]. Cortisol induction has been demonstrated mainly during prolonged exercise (Howlett, 1987). This might explain divergent TNF a results of studies with different exercise paradigms. Differences in cytokine production might be explained by a genetically determined ability to respond to mitogen challenge which varies strongly even in healthy individuals[30]. This fact leads to large standard variations which make it difficult to obtain significant outcome. Several authors have shown that changes of immune parameters might occur hours after the exercise[6]. Sampling times differed largely between studies which further complicates the search for consistent results on immune alterations during exercise.Another variable in this investigation was EDSS. Result showed that EDSS decreased in experimental group. On the other hand, participation in hydrotherapy programs led to benefit in the MS patients.

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