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To cite this article: Mohammad Karimi & Ali Yazdani Noori (2015) Serotonin and Mood State Changes in Response to a Period of Yoga Training in Well-Trained Wrestlers, International Journal of Wrestling Science, 5:2, 89-92, DOI: [10.1080/21615667.2015.1116647](https://doi.org/10.1080/21615667.2015.1116647)

To link to this article: <https://doi.org/10.1080/21615667.2015.1116647>



Published online: 15 Mar 2016.



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Serotonin and Mood State Changes in Response to a Period of Yoga Training in Well-Trained Wrestlers

Mohammad Karimi¹ and Ali Yazdani Noori¹

ABSTRACT. Overtraining syndrome is accompanied by changes of some neurotransmitters and an increase in mood disturbances. This study aimed to describe changes of plasma levels of serotonin and mood state, after a period of yoga training in well-trained wrestlers. Twenty-four volunteered well-trained wrestlers divided randomly into 2 equal groups: control and experimental. The experimental group completed 8 weeks of yoga training concurrent with wrestling training, 3 sessions per week, with each session lasting 60–75 min. Blood samples were collected from all participants, before and after yoga training. Plasma levels of serotonin and mood state were evaluated using standard commercial ELISA kits and Brunel questionnaire (BRUMS), respectively. Statistical comparisons were made using covariance analysis and Pearson correlation coefficient ($p < .05$). There is a significant difference between groups in serotonin levels ($p = .0001$) and mood disturbance scores ($p = .0001$), although there is no significant relation between serotonin levels and mood disturbance scores ($r = 0.19$; $p = .54$). It seems that doing yoga training concurrent with heavy wrestling training in the precompetition phase of competition season may be affected some psychological indices contributed with overtraining syndrome. Yoga as a safe intervention during heavy wrestling training may lead to prevention of overtraining syndrome.

Keywords: overtraining, mood state, serotonin, yoga

Most athletes look to increase or improve athletic performance, especially in main competitions. Furthermore, so many factors contribute to peak performance including training (Flynn et al., 1994; Gleeson, 2002; Gordon et al., 2008). There are varieties of indices related to training that have key role in adaptations resulting from training such as duration, intensity, volume, and frequency. An excessive increase in each of these indices can lead to conditions that are known as overtraining syndrome, the state in which performance and a sense of well-being may be influenced for several months (Gordon et al., 2008; Talbott, Talbott, & Wood, 2007). Pathophysiology of overtraining consists of muscle soreness and weakness, hematological and hormonal changes, change in mood states, depression, and nutritional problems such as a decrease in appetite (Gordon et al., 2008; Pedersen & Hoffman-Goetz, 2000).

Regarding the profile of mood state of athletes, it has been observed that heavy and prolonged exercise leads to mood disturbances and performance decline (O'Connor, Morgan, & Raglin, 1991). Exhaustive and prolonged exercises have negative effects on mood state of athletes and consist of some biochemical changes such as a change in some neurotransmitters, immune suppression, and an increase in mood disturbances (Talbott et al., 2007). One of these neurotransmitters is serotonin. Serotonin [or 5-hydroxytryptamine (5-HT)] is monoamine neurotransmitter that is biochemically derived from tryptophan. Serotonin is primarily found in the gastrointestinal tract, blood platelets, and the central nervous system (Yang, 2007). This hormone has an effective role in the regulation of the neurohormonal system, mood regulation, appetite, sleep, and physiological and cognitive function, including memory and learning (Bergero et al., 2005). Previous studies have shown that a deficiency or imbalance in neurotransmitters may be created as a result of severe and prolonged stress (Conlay, Sabounjian, & Wurtman, 1992). Imbalance in brain neurotransmitters, especially decreasing in serotonin levels, can be a sign of prolonged fatigue (Schatzberg, 1998). Some investiga-

¹*Qom University of Technology, Qom, Iran*

Correspondence should be addressed to Mohammad Karimi, Qom University of Technology, Martyred Brigadier Khodakaram Blvd, Old Qom-Tehran, road, Qom, Iran. E-mail: m.karimi2203@gmail.com

tions have indicated that exercise and physical activity can modulate some of these kinds of disorders (Petersen & Pedersen, 2005; Wilund, 2007).

Considering the mentioned subjects, it seems that athletic performance is influenced by different factors, and management of these factors is very important to achieve peak performance. Various studies have been done to survey the effective approaches in prevention of overtraining syndrome (Gibala, Macdougall, & Sale, 1994). Overtraining accompanied with physiological, immunological, and psychological changes eventually leads to performance decline (Mujika, Padilla, Pyne, & Busso, 2004).

Probably yoga exercises as a preventive plan can be effective in overtraining manifestation. Yoga is an ancient mind-body discipline that is increasingly popular in the world (Barnes, Bloom, & Nahin, 2009). It may represent a particularly promising nonpharmacologic therapy for some diseases. Accumulating evidence from controlled trials suggests that yoga can reduce blood pressure (Yang, 2007); improve glucose tolerance (Gordon et al., 2008; Innes & Vincent, 2007; Yang, 2007), lipid profiles (Innes, Selfe, & Taylor, 2008; Ross & Thomas, 2010; Yang, 2007), body composition (Innes, Selfe, & Taylor, 2008; Yang, 2007), and autonomic function (Innes, Selfe, & Taylor, 2008; Innes & Vincent, 2007; Yang, 2007); enhance mood (Butler et al., 2008; Chen et al., 2010; Innes, Selfe & Vishnu, 2010; Khalsa, Shorter, Cope, Wyshak, & Sklar, 2009); and improve sleep (Chen et al., 2010). The practice of yoga originates from 5000 BCE in India to combine specific posture (*asana*), breathing techniques (*pranayama*), meditative techniques (*dhyana*) chants (*mantras*) and wisdom teachings (*sutras*) to encourage union with body and mind (Sengupta, 2012). Brynzak and Burko (2013) reported that the use of exercises yoga pose directly impacts the physical indicators of preparedness among young basketball players (Brynzak & Burko, 2013).

Wrestlers, because of heavy and prolonged training, are more susceptible for overtraining. Therefore, use of new strategies in contrast with overtraining can help coaches and wrestlers to organize perfect planning so that wrestlers can achieve peak performance. The present study aims to study the effect of a period of yoga exercises concurrent with wrestling training on serotonin concentration and mood state in well-trained wrestlers.

MATERIALS AND METHODS

In this semi-experimental research, 24 Iranian male well-trained wrestlers (freestyle wrestlers, age 21.7 years \pm 2.3 years; weight 69.2 kg \pm 6.8 kg and fat 11.3% \pm 1.4%) were selected as participants. All wrestlers had at least 4 years of training experience. Before participating, all subjects read and signed informed, voluntary consent forms.

To create a realistic reduced-training scenario, 24 well-trained wrestlers who were fully trained as if preparing for a competition season, were selected as subjects. The training status of every subject over the preceding 8 weeks and the training history were obtained by questionnaire, training log, and personal interview.

Before intervention, participants were divided randomly into two equal groups: control (regular training) and experimental (yoga training concomitant with regular training). The experimental group completed 8 weeks of yoga training concurrent with wrestling training (in separate sessions), three sessions per week, with each session lasting 60–75 min. Yoga exercises consist of about a 15-min warm-up and then use stable postures—*asana*—and breath control—*pranayama* (Butler et al., 2008). Blood samples were collected from all participants, before and after yoga training. Plasma levels of serotonin and mood state were evaluated using standard commercial ELISA kits and Brunel questionnaire (BRUMS) respectively. Statistical analyses were made using covariance analysis and Pearson relationship coefficient. The level of significance was set at $p < .05$. SPSS 18 was used to statistical analysis.

RESULTS

In Table 1, descriptive value of serotonin and mood disturbance scores of wrestlers, before and after intervention were indicated.

Covariance analysis results show that there is significant difference between control and experimental groups in serotonin levels ($p = .0001$) and mood disturbance scores ($p = .0001$) at posttest.

Results show that there is significant difference between groups in serotonin levels ($p = .0001$) and mood disturbance scores ($p = .0001$). In contrast, 8 weeks of yoga exercises

TABLE 1 Serotonin and Mood Scores of Wrestlers at Different Phases of Measurement

Group	Serotonin (ng/ml)		Mood scores	
	Pretest	Posttest	Pretest	Posttest
Control	147.08 \pm 28.36	226.50 \pm 38.69	17.58 \pm 3.91	24.66 \pm 3.02
Experimental	152.83 \pm 31.92	193.50 \pm 30.26	16.33 \pm 2.70	11.41 \pm 3.08

Note. Data are means (\pm SD).

lead to a 26.6% increase in serotonin level and a 30.1% decrease in mood disturbance scores. Although there is no significant relation between serotonin levels and mood disturbance scores ($r = 0.19$; $p = .54$).

DISCUSSION AND CONCLUSIONS

Our findings revealed that 8 weeks of yoga exercises lead to significant increase in serotonin levels. Numerous studies have shown that enhanced physical load can result in an overtraining syndrome, with a decreased capacity for physical exercise and behavioral disturbances. One of the main side effects of overtraining is hormonal changes such as a decrease in gonadal steroids or in the hypothalamo-pituitary-adrenal axis. Metabolic and hormonal influences lead to change in brain neuromediator activity, such as reduced monoamines and increased serotonin levels. Experimental data indicate that these neuromediator changes are responsible more for behavioral changes than for decreased physical performance. Furthermore, fatigue is an integrated phenomenon, with complex interaction among central and peripheral factors. When prolonged and excessive training happens, concurrent with other stressors and insufficient recovery, performance decrements can result in chronic maladaptations that can lead to the overtraining syndrome. The exact mechanism of the OTS has been difficult to explain. There may be no “sole cause,” and it is probable that the stress caused by an excessive training load, interacts with other stressors, triggering multiple “defense mechanisms” from the immunological, neuroendocrine, and other physiological systems that all interact. Yoga exercises have physiological and psychological effects. According to the results of the present study, serotonin levels increased in control group. Perhaps this increment in serotonin levels is due to yoga exercises.

Results of this study indicated that mood disturbance scores decrease significantly in experimental group. In many studies, the pattern of mood changes is an important predictor for athletic performance. In this study, the yoga intervention was associated with greater improvements in mood. Yoga should be considered as a complementary exercise or alternative method for management of stress, anxiety, depression, and other mood disorders.

PRACTICAL APPLICATIONS

Overtraining is an important challenge that coaches and wrestlers are encountering with it. Yoga exercises may be a perfect strategy to counteract with performance decline as a result of overtraining. Using *asana* and *pranayama* practices and relaxation/meditation techniques recommend as a yoga program during heavy and prolong wrestling training.

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