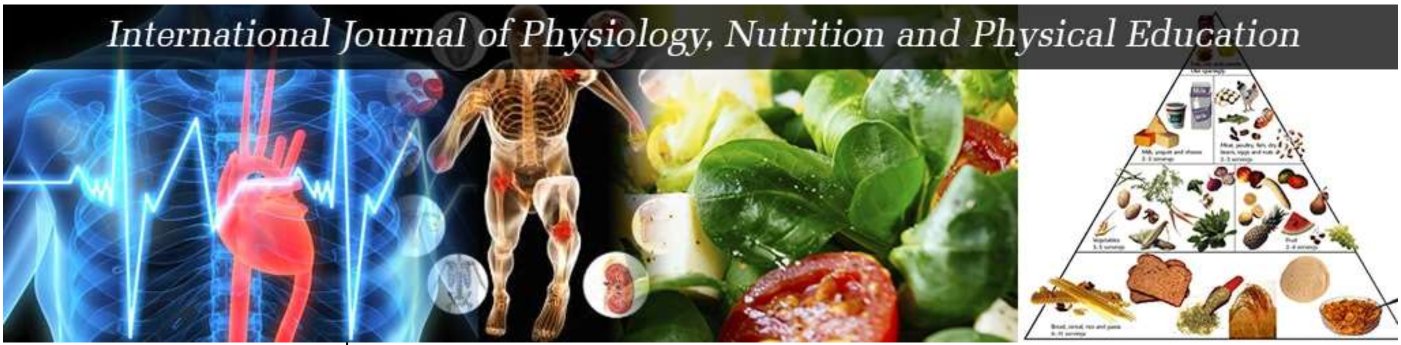

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Effect training on inflammatory variables of female boxers

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Abstract
This study aims to ascertain the effect of moderate intensity physical exercise on changes in liver function characterized by variations in AST and ALT levels. National female boxers aged 18 to 23 years were volunteered to participate in the study. Participants were informed about the purpose of the study, consent forms, and questionnaires on their readiness to engage in physical exercise. The study assessed physiological and biochemical factors for all participants twice: once at baseline and once at the end of the training program. Biochemical parameters were measured using adequate blood sample taken immediately after cessation of the complete boxing training. The SAI Pithoragarh coach designed an 8-week training program with the help of researcher, which included 48 sessions total (≈53 hours). The researchers separated the programme into three stages: developing physical fitness components, developing specific physical fitness components and advanced technical skills, and adjusting technical performance, training for the main competition, and stressing tactical and competition experience. The study found that there was a significant increase in AST and ALT values after 8 week BOXING training. Exercise type, duration, and intensity all affect liver enzyme levels and muscle damage. In conclusion, the study highlights the importance of understanding the impact of 8 week boxing training on liver enzyme levels and muscle damage in boxers. Further research is needed to understand the effects of boxing training on liver enzyme levels and muscle damage.

Keywords: ALT, AST, lever enzymes, biochemical factors

Introduction

Boxing is a martial art in which two persons compete against one another using strikes while wearing gloves in two different styles: amateur and professional (El-Ashker & Nasr, n.d.) (2012) [20]. Millions of people watches this sport, and its popularity is growing every day due to its excellent viewing quality. In contrast, during practice and competition, boxers are struck in the head or liver by punches (Kelestimur *et al.*, 2004) [23]. It is known that these blows disclose a wide spectrum of causes, from numerous fractures, injuries, permanent injuries, and even to fatalities owing to their acute or chronic consequences. These strokes have frequently forced boxers to give up on their training and competition. The boxers' overall health is impacted by this circumstance, which has a detrimental effect on their ability to compete in sports (Kaynar, 2019; Tanriverdi *et al.*, 2008) [22, 26]. Indeed, it has been documented that boxers have passed away from liver failure brought on by the repeated blows to the liver region (Risfandi *et al.*, 2019) [25]. The enzymes that are frequently utilised in the identification of liver injury include gamma glutamyl transpeptidase (GGT), alkaline phosphatase (ALP), aspartate aminotransferase (AST), and alanine amino transferase (ALT) (Cardoso Saldaña *et al.*, 1995; Tanriverdi *et al.*, 2008) [7, 26]. Muscle fatigue, loss of function, weakness, and soreness following unusually intense activity are symptoms of muscle damage. Lactate dehydrogenase (LDH) and creatine kinase (CK) are thought to be particular markers of muscle injury and breakdown. High-intensity exercise has been linked to increased liver enzyme levels and muscle injury, according to several research (Lippi *et al.*, 2004) [24]. Particularly after intense physical activity demanding a lot of power, the liver's AST and ALT levels rise, while the blood's CK and LDH levels rise. Numerous biochemical indicators including liver enzymes and muscle injury in boxers were examined in literature research both before and after training (Baygutalp *et al*., 2016; Tanriverdi *et al*., 2008) [4, 26]. Nevertheless, no research has been discovered to look at the immediate impact of punches delivered to the liver region at a particular time and force. In terms of an athlete's performance and health, it is crucial to understand the potential effects of repeated punches to the liver in a short amount of time, as well as the potential long-term harm these punches may produce. This is the reason this first study in the literature looks into the acute effects on liver enzymes and muscle injury in boxers of a sparring training model that is particular to the liver region.

The liver, which occupies the majority of the right upper quadrant of the belly and is the body's metabolic centre with a very complicated function, is the biggest organ in the abdominal cavity, weighing between 1.2 and 1.8 kg, or about 25% of an adult's total weight (Ağgön *et al*., 2020) [14]. The liver is particularly vulnerable to harm since it is the organ that is exposed to hazardous substances following the digestive tract. Toxic substances will be detoxified by the liver's metabolic process; however this process can also result in metabolites that are more harmful to the liver. Numerous enzymes are present in liver cells, some of which are crucial for identifying liver function impairment. Liver disease can be detected by measuring the level of enzyme activity in the blood. Serum Aspartate Amino Transferase (AST), also known as Serum Glutamic Oxaloacetic Transaminase (SGOT), and serum Alanine Amino Transferase (ALT), also known as Serum Glutamic Pyruvic Transaminase (SGPT), are two liver enzymes that can be utilised as indicators of liver impairment. Elevated liver function or elevated liver enzymes are indicative of liver damage. While drugs may be the cause of increased liver function during clinical trials, other variables including nutrition and exercise may also have a role (*ALT (Alanine Aminotransferase) Test: Purpose, Procedure, and Results*, n.d.; Gioldasis, 2016) [21]. The length, intensity, kind, and manner of exercise training modifications all affect plasma liver enzyme activity (Deemer *et al*., 2018) [18]. According to Bompa, 1994 Exercise that is moderate to moderately intense and should be done at a dosage between 40 and 60 percent of one's maximal work capacity has been shown to improve health status. This study intends to ascertain the effect of moderate intensity physical exercise on changes in liver function characterised by variations in AST, ALT levels.

Materials and Methods

Participants- National female boxers (age range 18 ~ 23 yr) volunteered to participate. Subject characteristics (Mean ± SD) are located in Table 1. All of them were registered in the boxing federation of india, with a minimum of 4 years of national boxing participation. The purpose of the study was explained to the participants. The boxers that are chosen are volunteers, and they are free to leave at any time. Before being approved as a subject, every participant was given a consent form and a questionnaire on their readiness to engage in physical exercise. Participants were questioned about any health conditions or other situations that would preclude them from taking part in the study in the permission form. The education was given to the participants in pleasant circumstances, and they were also given meals that they are accustomed to.

Table 1: Baseline characteristics of the study subjects (n= 7).
Variable (Mean ± SD) Range

Variable	(Mean ± SD)	Range
Age (years)	19.47±1.26	18.0-22.6
Height (m)	150.3±5.15	1.50-1.60
Body mass (kg)	50.8±7.1	50.0-70.2
Body Fat	14.4±1.9	11.8-17.54
Training age (years)	5.1±1.27	3.6 - 7.5

Procedure- In order to assess the physiological and biochemical factors, participants arrived in the lab comfortably, having had at least one day off since their previous training session. The physiological and biochemical measures for all participants were obtained twice: once at baseline and once at the end of the training programme. The biochemical measures included ALT AST. Information gathered utilising a precise data collection form. Physiological and biochemical measurements were recorded by research assistants both at baseline and after eight weeks. On the day when their physiological and biochemical parameters were to be measured, participants were instructed not to use tobacco products or narcotics. They were also told not to practise any exercises for 48 hours prior to taking any assessments.

Biochemical parameters Measurement- using adequate blood sample amount of finger pricking taken immediately after cessation of complete boxing match. Ten millilitres of a blood sample were taken from an antecubital vein under the influence of fasting conditions early in the morning, in complete comfort for a period of not less than 6-8 hours prior to tests under research. Samples were cooled and stocked at -20 °C until analyses. Specialists from the medical laboratories at Pithoragarh Hospital helped the researchers take blood samples, and carry out the biochemical Measurements.

Training programme- The SAI pithoragarh coach designed the 8-week training programme, which included 48 sessions total (≈53 hours). The researchers separated the programme into three stages (refer to Table 2). The first stage focused on developing physical fitness components (e.g., strength, mobility, endurance) and fundamental motor skills; the second phase targeted the development of specific physical fitness components and advanced technical skills in conjunction with competition experience; the third phase suggested adjusting technical performance, training for the main competition, and stressing tactical and competition experience.

Table 2: Boxing training programme, phases and variables during the training period.

Phases/Variables	1st phase (Basic)	2nd phase (Specific)	3rd phase (Taper)
Weeks	3	2	3
Workouts per week	2	3	3
Resting days per week	2	2	2
Workout duration per min	110	100	90
Intensity	70 %	80 %	90 %

Data Analysis

Data were collected from participants and then were collated and inserted in the statistical software package, IBM SPSS-STATISTICS 26. Descriptive statistics were determined for all variables. Values are presented as Mean ± Standard deviation. Student's (T) test was followed out to examine pre- and post-test results. For all statistics, the level of significance was set at $p<0.05$.

Descriptive statistics of sporters' demographical characteriscs before and after training and the significance of changes are given in Table 3.

Paired diference

Table 4: Paired Samples Test

		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		P-value
					lower	Upper	
Pair1	ALTpre - ALTpost	-8.14286	15.2908	5.77939	-22.2845	5.99880	< 0.05
Pair2	ALTpre - ALTpost	-5.85714	1.06904	.40406	-6.84584	-4.86844	< 0.05

Note - AST= aspirate transaminase (U/L) ALT= alanine aminotransferase (U/L)

The mean age of sporters was 20±3 years (range 17-23) and the mean duration of boxing was 3,42±1,5 years (range 1-10). According to Kolmogrov Smirnov normality test all parameters were normally distributed ($p>0.05$). To analyze the differences between the groups, paired samples t-test was used. There were significant differences between pre-training and post-training levels of ALT and AST ($p<0.05$ for each parameter).

Discussion

The study focuses on the impact of 8 week boxing training on liver enzyme levels and muscle damage in boxers. It found that there is a significant increase in AST and ALT values after 8 week BOXING training. Exercise type, duration, and intensity all affect liver enzyme levels and muscle damage. In conclusion, the study highlights the importance of understanding the impact of 8 week boxing training on liver enzyme levels and muscle damage. Further research is needed to determine the extent of damage inflicted by punches to the liver region. Exercise can raise ALT and AST levels, which caused of damaged muscles. Athletes in marathons have shown increases in AST values during competition AST levels grow even 24 hours later [1].

Several studies have shown that intense exercise raises liver enzyme levels and damages muscles. In a study conducted on wrestlers, a significant rise in CK and LDH enzyme activity has been reported. In a two-minute training competition simulated a tactical and match environment, it was suggested that wrestlers' hard falls during practice or competition, as well as the 'gut wrench technique' pressure on the abdomen, may raise liver enzyme levels (Kaynar, 2019) [22]. In a research on top volleyball players Ji-Qing (2013) [5], blood samples obtained prior to a 3000 m test run and after 1.4 and 24 hours were compared in a research conducted on distance runners (Demirhan *et al.*, 2020) [19]. One hour after the 3000 m test run, LDH and GGT were considerably raised, and four hours later, AST and ALT levels were found to be significantly elevated. Within 24 hours of the test, all parameters have been seen to return to their pre-exercise values [2]. The damage in the liver and muscles varies depending on the kind and level of exercise performed, which is consistent with the study's findings. It is believed that punches to the liver region cause damage to the muscle and liver, which in turn causes an increase in enzyme activities. This theory explains why AST, ALT, enzymes are elevated in both the liver and muscle. Another study by Kaynar (2016) [4] found that after a 3-minute training match equivalent to a wrestling match made up of two sets (30 seconds of rest at halftime), followed by 30 minutes of mild running, warm-up, and gymnastic movements, and 25 minutes of technical wrestling practices applied to wrestlers, there was a significant increase in AST and ALP values but no significant difference in ALT values [3]. Professional cyclists' AST and ALT levels have been found to significantly increase after 234 kilometers of racing. Long-distance runners and weightlifters' liver enzymes have also been found to significantly increase after intense training. Intense exercise raises liver enzyme levels and damages muscles. Studies have reported a significant rise in CK and LDH enzyme activity in wrestlers, while others found no significant difference in GGT and ALT values [4]. In a study by *et al*. (2016), kickboxers underwent 50 minutes of technical and tactical training, 40 minutes of warm-up exercises, and one minute of break during halftime before engaging in a training match lasting two minutes. After the training, there was a considerable rise in the values of AST, ALT, ALP, and GGT, possibly due to the impact of punches or kicks to the abdomen area during the match [5]. Wrestlers' hard falls during practice or competition, as well as the 'gut wrench technique' pressure on the abdomen, may raise liver enzyme levels [6]. It is well recognised that prolonged exercise alters liver enzyme levels, causes oxidative stress, and impacts an athlete's cellular metabolism through biochemical and hormonal changes [7, 8, 9, 10, 11]. Hemoglobin's catabolic byproduct bilirubin functions as a potent lipid antioxidant, and the extent, rigor and length of training activities cause variations in the organism's bilirubin levels. Studies have shown that bilirubin levels decrease following endurance training, while acute training causes an increase in bilirubin levels in the blood that damages liver cells. Alanine aminotransferase (ALT) is typically exclusive to the liver, while aspartate aminotransferase (AST) is both a mitochondrial and cytoscopic enzyme found in various organs such as the liver, striated muscles, brain, pancreas, and blood cells. The elevated levels of liver enzymes lactate dehydrogenase (LDH), aspartate aminotransferase (AST), and alanine aminotransferase (ALT) are indicators for tissue injury. Regular training sessions result in a decrease in the levels of Aspartate aminotransferase (AST), Alanin aminotransferase (ALT), and Lactate dehydrogenase (LDH). Research has shown that the intensity of C-reactive protein (CRP) levels varies according to the intensity and duration of the training [12]. Studies have shown that acute training increases the markers of liver and tissue damage, while chronic training decreases these markers [13]. The type and extent of exercise can lead to metabolic alterations, which can impact an athlete's performance if training sessions are planned with their conditions in mind [14]. In conclusion, prolonged exercise can alter liver enzyme levels, cause oxidative stress, and impact an athlete's cellular metabolism through biochemical and hormonal changes. Bilirubin, an enzyme involved in cytosis, is typically exclusive to the liver, while aspartate aminotransferase (AST) is present in various organs. Chronic training can decrease the markers of liver and tissue damage, while acute training can increase them.

Therefore, it is crucial to plan training sessions with athletes' conditions in mind to ensure optimal performance.

Based on the type and extent of exercise, we believe that the body's metabolic alterations are what caused these effects. Based on this statistics, we believe that the athletes' performance will be impacted if the training sessions are planned with their conditions in mind.

Favourably and will have an impact on averting any metabolic issues in the body.

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