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Effects of regular exercise on the liver function tests of male subjects in college of health sciences, Nnamdi Azikiwe University, Nnewi campus, Anambra state, Nigeria.

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Abstract

Background: Frequent and regular exercise boosts the immune system and prevents the disease of affluence and depression while promoting positive self-esteem. There is paucity of information on this study in Nnewi hence the research. **Objectives:** This study investigated the effects of regular exercise on the liver function tests of apparently healthy male subjects in College of Health Sciences, Nnamdi Azikiwe University, Nnewi campus, Anambra State, Nigeria. **Methods:** A total of 60 subjects were randomly recruited into the pre and post experimental design study. Thereafter, they were divided into two (2) groups consisting of 30 soccer players in each group. They were rested for a period of two weeks and thereafter subjected to vigorous exercise(30 minutes of football playing three times a week for 3 weeks). Five (5) mls each of baseline and post exercise (day21) samples were collected into a plain container for the estimation of biochemical parameters alkaline phosphatase (ALP), aspartate aminotransferase (AST), alanine transaminase (ALT), The gamma-glutamyl transferase (GGT) respectively using colorimetric methods. Data obtained were analyzed using unpaired Student t-test and Pearson correlation. **Results:** The mean serum activity of ALT(9.13±4.84 Vs6.08±2.96); ALP (260.23±21.50 Vs 179.51±110.28) and GGT(44.64±34.84 Vs 29.59±14.10) were significantly increased in the studied subjects post exercise when compared with the pre exercise stage ($P < 0.05$) whereas the mean serum AST activity did not differ significantly in the subjects post exercise when compared with the pre exercise stage ($P < 0.05$). **Conclusion:** This study showed that vigorous exercise increases ALT, ALP and GGT enzyme activity but do not have significant effect on AST. Therefore, vigorous exercise should be performed with caution to avoid exercise-induced hepatic cell damage.

Keywords: Exercise, Liver, Liver Function Tests, Football.

Introduction

The liver is the main organ for conversion of one chemical species to another and this inter conversion is the main route for preparing drugs for excretion from the body. The metabolism of drugs can lead to the formation of chemically reactive intermediates that may play a significant role in the induction ofhepatic injury. It is important that potentially hepatotoxic effects of new drugs are recognized early during drug development. Therefore, in Phase I clinical trials, monitoring of liver function parameters are mandatory (Nevell*et al*., 1989). The occurrence of asymptomatic elevations in liver function tests is a problem during all phases of drug development. An asymptomatic elevation of, for example, liver transaminases during clinical trials could be drug related, but other factors, such as exercise (Giboney, 2005) and diet (Purkins*et al.,* 2004), may also have had this effect.

The word exercise is derived from the latin word "EXERCITIUM" which means to train. Exercise is a process in which energy stored as chemical compound is transformed into mechanical and heat energy.
Exercises are generally grouped into three types depending on the overall effect they have on the human body:

1. Aerobic exercises; such as cycling, walking, running, hiking and playing tennis, football, volleyball, jogging, etc; focus on increasing cardiovascular endurance (Wilmore and Knuttgen, 2003).
2. Anerobic exercises; such as weight training, increase short term muscle strength (De vos *et al*., 2005).
3. Flexibility exercises; such as stretching, improve the range of motion of muscles and joints (O' Connor *et al*., 2006).

Frequent and regular exercise boosts the immune system and helps prevent the disease of affluence such as heart disease, cardiovascular disease, type 2diabetes and obesity. It also improves mental health, help prevent depression, promote or maintain positive self-esteem and can even augment an individual sex appeal or body image which is also found to be linked with higher level of self-esteem (Stampfer *et al.,* 2000). It is also beneficial for young women, since it increases cardiovascular fitness and reduces adiposity (Koutedakis *et al*., 1993; Medhat and Abdel, 2010). It has long been known that physical exercise results in transient elevations of liver function tests (Loll and Hilscher, 1958; Halonen and Konttinen, 1962). There is no consensus on what forms of exercise can cause changes in clinical chemistry parameters, which parameters may be affected, or to what extent. The effects of muscular exercise on clinical chemistry parameters may also vary depending on gender and on the fitness level of the individual (Koutedakis *et al*., 1993). People who reported at least 30 minutes of vigorous activity were more than twice as likely to maintain a stable body mass index (Slentz, 2014). However, physical exercise increases serum level of alanine aminotransferase (ALT) and aspartate aminotransferase (AST) (Mena *et al.,* 1996). It was also reported that high intensity, short duration exercise resulted in greater enzyme than low intensity, long term exercise and the longest increase corresponded with the perception of muscle soreness (Tiidus and Lanuzzo, 1983). Temporary elevations of the liver enzymes have been seen during and immediately after a routine exercise regimen. However, dehydration and heart strokes are the key word problems with over exercising (Mena *et al.,* 1996). Exercise increases serum alkaline phosphate bone isoform B1and B2 (Rudberg *et al*., 2000). Several studies have reported that exercise is linked with short-term as well as long-term metabolic, physiological and hemodynamic changes which can impart either positively or negatively to the health of the exercising subjects. Students in this locality are daily involved in physical activity, some of which have become part of their lifestyle (e.g. walking, etc) and some others are recreational activities (playing soccer, badminton, jogging). Essentially, soccer playing is an interesting sports of choice for both male and female students especially male students in our locality, however, no study has been done in this locality in this respect, to the best of our knowledge. Therefore, the results of

this study designed to assess the acute or short-term effect of soccer exercise on liver functions of these apparently healthy male students will provide an empirical evidence that will guide the use of physical exercise to improve the health of both apparently healthy as well as sick individuals in our community.

Materials and Methods

Subjects:

A total of 60 male subjects were randomly recruited for the study. The subjects' ages ranged from 18-30 years and were students of College of Health Sciences, NnamdiAzikiwe University, Nnewi Campus.

Study site

This research was conducted in College of Health Sciences and Technology, Nnamdi Azikiwe University, Nnewi Campus, Anambra State, Nigeria.

Ethical consideration

The ethical approval for this research was obtained from Ethics Committee of Faculty of Healthy Sciences and Technology, Nnamdi Azikiwe University, Nnewi Campus, Anambra State and Nnamdi Azikiwe University Teaching Hospital Nnewi, Anambra State in accordance with the Helsinki declaration by the World Medical Association (WMA) on the ethical principles for medical research involving human subjects *(Snežana and Bošnjak,2001;Levine and Robert, 2006).* Informed consent was obtained from the subjects before sample collection.

Research design

Sixty(60) randomly selected male subjects who consented to the study were recruited. They were divided into two (2) groups, each consisting of thirty (30) soccer players. They were rested for a period of two(2) weeks after which they were then subjected to football exercise for thirty(30) minutes (3 times) in a week for a period of three(3) weeks. Baseline samples were collected prior to the commencement of the exercise (day 0) and post-exercise blood samples were collected after the exercise (day 21)into plain containers and used for biochemical analysis. Serum Alanine aminotransferase and Aspartate aminotransferase activity was determined using colorimetric method as described by Reitman and Frankel (1957), ALP activity was determined using the colorimetric method as described by King and Armstrong (1937), while the spectrophotometric method as described by Mauro and Renze, (2013) was used for the determination of gamma glutamyltransferase activity.

Inclusion and exclusion criteria

Apparently healthy male students aged 18- 30 years who were willing to participate were recruited**,** whereas, Students younger than 18 or older than 30 years old; those suffering from hepatic disease (s), those who sustained any form of musculo-skeletal injury as well as Alcoholics and smokers were excluded from the study.

Statistical analysis

Statistical package for social science; (SPSS) version 20 was employed in the analysis of the result and the data obtained for different liver function parameters were expressed as mean± standard deviation. Liver function parameters were compared using student independent t-test. Level of significance was set at $P<0.05$.

Results

The mean levels of Plasma ALT, ALP and GGT were significantly higher in the post exercise group when compared with their baseline($P<0.05$).However the mean level of AST did not differ significantly in the post exercise group when compared with the baseline($P>0.05$), (See table 1).

Table 1: Serum Levels of parameters studied in subjects before and after exercise (Mean± SD; n=60)

Parameters	Baseline (n=60)	Post Exercise (n=60)	t-test	p-value
AST activity (U/L)	7.31±3.99	7.56±6.06	-0.266	0.792
ALT activity (U/L)	6.08±2.96	9.13±4.84	-3.598	0.001*
ALP activity (U/L)	179.51±110.28	260.23±121.50	-3.154	0.003*
GGT activity (U/L)	29.59±14.10	44.64±34.84	-2.560	0.015*

***Statistically significant at P<0.05.**

There was no significant correlation between age of the subjects with their various liver enzymes in baseline and post exercise sample (P>0.05), (see table 2).

Table 2: Correlation of age with liver enzymes activity in subjects studied before and after exercise.

	Baseline		Post exercise	
Parameters	R	p-value	R	p-value
Age vs AST	-0.277	0.092	0.089	0.597
Age vs ALT	-0.313	0.056	0.130	0.435
Age vs ALP	0.191	0.251	0.057	0.734
Age vs GGT	0.279	0.089	-0.044	0.794

***Statistically significant at P<0.05.**

Discussion

Different forms of exercise cause significant changes in the chemical constitution of the plasma (Ihim *et al.,* 2015). Controversy exists on the specific form of exercise, as well as the intensity, duration, and training intervals of the specific form of exercise chosen as a lifestyle intervention regimen (Usman *et al.,* 2015). However, longer duration of exercise is needed to elicit a significant change in some biochemical parameters (Ihim *et al.,* 2015). Asymptomatic elevations of liver function tests during clinical trials could be drug-related, but other factors, such as strenuous exercise, have resulted in increased serum transaminase levels (Malinoski, 1992).There was altered liver function tests (elevations of AST, ALT) in intensive weightlifting healthy subjects during clinical trials; (Kaplowitz, 2005).However, other types of strenuous physical exercise, such as marathon running, are known to affect liver function tests (Smith *et al.,* 2004).

In this study, there were significant increase in the mean serum concentration of ALT(9.13±4.84 Vs 6.08±2.96), ALP (260.23±121.50 Vs 179.51±110.28) and GGT (44.64±34.84 Vs 29.59±14.10)of the subjects after exercise when compared with before exercise(Table 4.1)(P<0.05). These findings are in agreement with other previous studies (Mena *et al.*,1996; Roberg and Landwaler, 2007; Petterson *et al.*,2008). Again Amah *et al. (*2017) reported a significant increase in the mean plasma activity of ALP in subjects after short-term aerobic exercise. Moreso, Usman *et al.* (2015) who studied the effects of moderate and vigorous physical exercise on Liver function tests of healthy male individuals in Anambra State, also reported a significant increase in the mean serum activity of ALP, ALT and GGT both after moderate and vigorous exercise which is in agreement with our findings.

The increase in the mean serum activities of the aminotransferases in the subjects after exercise could be due to persistent physical exercise leading to slight leakage of these enzymes from the tissues resulting in their passing into the bloodstream probably due to muscle cell injury or damage (Usman *et al.,* 2015).

Importantly, ALT is a better indicator of Liver disease according to the position standing by American Association of the study of Liver Disease. This could be explained by the widely distribution of AST in the body, that is, they are not restricted to the liver, as is the case of ALT which is chiefly found in the liver whereas AST is found mainly in the liver, heart and skeletal muscle (Usman *et al.*,2015). Other similar studies also reported ALT as a better indicator of chronic liver disease than AST because of its longer half-life (Knapen *et al.,* 1998; Dajani *et al.,* 2001).

Likewise higher mean serum concentration of ALP (260.23±121.50 Vs 179.51±110.28)was observed in the subjects after exercise when compare with the pre-exercised values ($P<0.05$). The increase in the mean serum ALP activity in the subjects after the exercise could be as a result of haemoconcentration that occurred during the exercise due to increased sweating, increase body temperature or splenic contraction (Rudberg *et al.,* 2000). Again, it may be associated with leaking out of ALP from mechanically damaged muscle cells (Mena *et al.,* 1996; Amacher *et al.,* 1998; Latourn *et al.,* 1999) or increased bone mass in physically active subjects (Rowell *et al.,* 1964). More so, it has been reported that physical exercise increases the blood flow in working skeletal muscles, while it decreases blood supply to the liver (Ohnishi *et al.*,1985) and portal vein (Praphatsorn *et al.,* 2010).

Interestingly, there was no significant difference in the mean serum activity of AST in the subjects after exercise than before exercise ($P>0.005$). This is in contrast with the report of Petterson *et al.* (2008) and Amah *et al.* (2017) who reported an increase in the mean serum activity of AST after a muscular exercise in men and after short term aerobic exercise respectively.

However, there was no significant correlation of age with the mean serum activity of the ALT, AST, ALP and GGT in the subjects studied ($P<0.05$).

Conclusion

From the study, it could be concluded that exercise increases the mean Serum concentrations of ALT, ALP and GGT while AST remain significantly unchanged after exercise. Therefore the result of liver enzyme investigations in patient who have been exercising should be interpreted with caution on the part of the Medical Laboratory Scientists and Physicians in the diagnosis and management of patients respectively.

Recommendation

Based on our findings, we recommend that further study be carried out in this regard, in which anthropometric data would be included in the study to correlate both anthropometric data and liver enzyme activity in exercised subjects. It is also recommended that a similar study be carried out in which the liver enzymes will be estimated immediately after the exercise and weeks or/and months later to ascertain whether the changes in the liver enzymes are short term or long term based so as to aid the laboratory personnel as well as the clinicians in diagnosis, interpretations of the patients result and management of patients.

Limitation of study

This study was limited by our inability to collect the anthropometric data of the subjects which could have given a better interpretation of the results.

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