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Assessment of Serum Level of Highly Sensitive C-reactive Protein (Hs-CRP) and Uric Acid among Adult Athletes in Aba Metropolis

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Abstract

Purpose: The long-term positive effect of physical activity on the incidence of coronary artery disease, hypertension, dyslipidemia, obesity, and life expectancy are well known. This has led to many stressing the importance of exercising to promote optimal health. This study is therefore aimed at evaluating the effect of physical exercise on serum level of highly sensitive C-reactive protein (Hs-CRP) and Uric acid among adult athletes in Aba Metropolis of Abia State.

Methodology: Hundred adults were used for the study. Fifty subjects served as control and were randomly selected. The remaining fifty, twenty-five were males and twenty-five were females. Thirteen out of the twenty-five males and females exercise regularly while twelve exercises seldom. However, for inclusion criteria the person had to be an athlete and for exclusion criteria, persons with cardiovascular diseases, diabetes mellitus, stroke rheumatoid arthritis and those with chronic obstructive pulmonary diseases were excluded. Blood sample was collected by venipuncture and was used to determine Highly Sensitive C-Reactive protein (Hs-CRP) and Uric Acid using Enzyme Linked Immunoassay machine and Semi automated Analyzer respectively. Data generated were analyzed using Statistical Package for Social Sciences (SPSS Version 25), One-way Analysis of Variance (ANOVA) and student t-test. Significance level for analysis was set at P-value 0.05 (P=<0.05).

Findings: The result from the study revealed that regularly exercising athletes had significantly lower Hs-CRP values than the control group. Observed as well was that regularly exercising athletes had lower Hs-CRP values than seldom-exercising athletes. Conversely, the uric acid level of those that exercise regularly increased compared to those seldomly exercise. This study has yet added to the need and importance of exercise in order to stay in optimal health.

Recommendation: People without health issue should be encouraged to exercise regularly but this should not be outside consulting their health care giver.

Keywords: *C -reactive protein, Dyslipidemia, Hyperuricemia, Strenuous aerobic activity, exercise.*

INTRODUCTION

C–reactive protein (Hs-CRP) is an acute-phase protein of hepatic origin they increase following interleukin-6 secretion by macrophages and T cells. Physiological role is to bind to lysophospatidylcholine expressed on the surface of dead or dying cells (and some types of bacteria) in order to activate the complement system via C1q (Thompson et al., 2009). It is a highly sensitive and easily measured biomarker of inflammation, a state when the immune system uses its natural defenses to fight off invaders. However, inflammation plays a role in the development of myriad long-term health concerns from heart attack and macular degeneration to cancer. High level of CRP can essentially foretell health derangements that are likely to strike an individual in years to come. In fact, adults over age 50 who have a high level of CRP in their blood have a 50 percent greater chance of heart attack, stroke, and cardiac death than those with low CRP (all other risks factors considered). A CRP blood test can actually predict heart attack and stroke better than any other laboratory test available. C–reactive protein was the first pattern recognition receptor (PRR) to be identified (Mantovani *et al.*, 2018).

Uric acid is the end product of an exogenous pool of purines and endogenous purine metabolism. The exogenous pool varies significantly with diet, an animal protein contributes significantly to this purine pool. The endogenous production of Uric Acid is mainly from the liver, intestines and other tissues like muscles, kidneys and the vascular endothelium (Willson *et al.*, 2018). Uric acid concentrations in blood plasma above and below the normal range is known as, hyperuricemia and hypouricemia.

Exercise acutely increases oxidative metabolism and thereby induces oxidative stress and long-term physical activities increases antioxidant defenses through the up-regulation of antioxidant enzymes which has anti-inflammatory properties (Powers et al., 2017). Furthermore, this antioxidant effect of exercise reduces the susceptibility of low-density lipoprotein to oxidation which in turn helps prevent endothelial injury and inflammation (Berliner et al., 2013; Shern et al., 2017). It is likely that exercise reduces CRP both directly by reducing cytokine production in fat muscles and mononuclear cells and indirectly by increasing insulin sensitivity, improving endothelial function and reducing body weight (Witztum, 2017).

The aim of the study was, therefore, to evaluate the effect of physical exercise on serum level of High Sensitivity C-Reactive Protein (Hs-CRP) among male and female athletes in Aba metropolis.

MATERIALS AND METHOD

Hundred adults' athletes took part in the study. Fifty participants served as control and were randomly selected. The remaining fifty, twenty-five were males and twenty-five were females. Thirteen out of the twenty-five males and females exercise regularly, while twelve exercises seldom. This was based on sampling technique of (Cochran, 1977; Daniel, 1999). Blood sample was collected by venipuncture and was used to determine Highly Sensitive C-Reactive protein (Hs-CRP) and uric acid using Enzyme Linked Immunoassay machine and Semi automated Analyzer respectively. Data generated were analyzed using Statistical Package for Social Sciences (SPSS Version 25), One-Way Analysis of Variance (ANOVA) and student t-test. Significance level for analysis was set at P-value 0.05 ($P=<0.05$).

Determination of Uric Acid

Principle: Uricase acts on Uric acid to produce allantoin carbon dioxide and hydrogen peroxide. Hydrogen peroxide in the presence of peroxidase reacts with a chromogen (amino-antipyrin and dichloro-hydroxybenzen sulfate) to yield quinoneimine measured at 505nm which is proportional to the amount of Uric Acid in the specimen (Heining *& Johnson,* 2016).

Determination of CRP

Principle: C-reactive protein test is based on the principle of latex agglutination. When latex particles is complexed, human anti-CRP are mixed with a patient's serum containing C-Reactive proteins, a visible agglutination reaction will take place within 2 minutes (Heining *et al., 2016).*

Data Analysis

One-way analysis of variance (ANOVA) was used to test the significance of difference and the differences in means of different parameters in the subjects was compared using Students t-test. Statistically significant P values were set at $P<0.05$.

RESULTS AND DISCUSSSION

Table 1 showed that Hs-CRP and uric acid levels based on age groups. Hs-CRP level was highest in age group of 31-35. Also observed was that the uric acid concentration was increased in age grouped 36-40.

Table 1: Comparison of mean ± standard deviation of HsCrP and uric acid values of participants

Parameter	Age Groups (N)	Mean ± SD	*F*	*P*	Sig	w^2
Hs-CRP	16-20 (2)	0.45±0.21	0.216	0.928	ns	-
	21-25 (12)	0.38±0.26				
	26-30 (10)	0.39±0.17				
	31-35 (19)	0.34±0.16				
	36-40 (7)	0.34±0.18				
Uric Acid	16-20 (2)	0.49±0.01	2.79	0.037	sg	0.125
	21-25 (12)	0.45±0.11				
	26-30 (10)	0.46±0.01				
	31-35 (19)	0.52±0.08				
	36-40 (7)	0.58±0.09				

Table 2 showed that Hs – CRP was high in male while the level of uric acid was more in female.

Table 2: Mean ± standard deviation of HsCRP and uric acid values of male participants compared to those of female participants.

Parameter	Group (N)	Mean ± SD	*t*	*P*	Sig	Cohen's d
Hs-CRP	Female (15)	0.28±0.16				
	Male (15)	0.45±0.19	-3.43	0.001	Sg	-0.971
Uric Acid	Female (15)	0.48±0.05				
	Male (15)	0.51±0.13	-1.23	0.229	Ns	-0.347

Table 3 compared regular exercising males and seldom exercise showing increased in level of Hs – CRP in those who exercise regularly and high level of Uric acid in male that seldom exercise.

Table 3: Mean ± standard deviation of HsCRP and uric acid values of regularly exercising male participants compared to those of seldom exercising male participants

Parameter	Group (N)	Mean ± SD	*t*	*P*	Sig	Cohen's d
Hs-CRP	Regularly (13)	0.354±0.11	-3.21	0.004	Sg	-1.29
	Seldom (12)	0.558±0.2				
Uric Acid	Regularly (13)	0.587±0.07	3.53	0.002	Sg	1.41
	Seldom (12)	0.436±0.13				

Table 4 showed the effect of exercise on females who exercise regularly and those that seldom exercise which equally follow the same trend as in males. This indicate that female who exercise has high Hs-CRP compared to females who seldom exercise and the uric acid level of those female who seldom exercise have high uric acid level.

Table 4: Mean ± standard deviation of HsCRP and uric acid values of regularly exercising female participants comparing with female participants who seldom exercise

Parameter	Group (N)	Mean ± SD	*t*	*P*	Sig
Hs-CRP	Regularly (13)	0.323±0.17	1.31	0.202	Ns
	Seldom (12)	0.242±0.14			
Uric Acid	Regularly (13)	0.492±0.05	1.15	0.262	Ns
	Seldom (12)	0.468±0.05			

DISCUSSION

This study revealed that athletes have significantly lower Hs-CRP than the control group ($t(51.8) = -22.23$, $p<0.001$). This result conforms to the study of Mayer-Davis *et al.* (2015) which revealed that the physical activity could decrease resting levels of IL-6 and TNF-alpha and, ultimately, lessen CRP production. Incidentally, it was observed in the study that the uric acid level was higher in those that exercised than the control group. This result was in

agreement with previous study which reported that an increase in Uric Acid excretion occurred during the post exercise period, whereas during the actual period of exercise there was a decrease in acid excretion (Powers et al., 2017). Exercising acutely increases oxidative metabolism and thereby induces oxidative stress, long -term physical activities increases antioxidant defenses through the up-regulation of antioxidant enzymes (Powers et al., 2017). Furthermore, this antioxidant effect of exercise reduces the susceptibility of low-density lipoprotein to oxidation which in turn helps prevent endothelial injury and inflammation (Berliner et al., 2013; Shern et al., 2017).

Equally observed in the study was that, Highly Sensitive C-Reactive protein and uric acid values of male athletes when compared to those of female adult athletes showed that female athletes had significantly lower Hs-CRP values than the male athletes ($t(48) = -3.43$, $p = 0.001$). This contradicts research done by Albert *et al. (2017*), who noted that, among 1,732 men and 1,101 women, strenuous aerobic activity was associated with lower CRP values in men after but not in women. The reason for this gender-related discrepancy is unclear but may be related to less body mass and less cell death turnover physical activity in women. In further comparison of test conducted between regularly exercising adult male athletes to adult male who exercises seldom, the test showed that the regularly exercising adult athletes had significantly lower Hs-CRP values than seldom-exercising adult athletes (Febbraio & Pedersen, 2018).

Again, physical activity has anti-inflammatory properties, but psychological stress which may be more prevalent in athletes had also been shown to initiate an increase in pro-inflammatory cytokines (Powers *et al.,* 2014). Exercised-induced muscle injury and is the primary stimulus for interLeukin-6 (IL-6) response, which is independent of muscular damage. IL-6 is central to local and systemic inflammatory processes and its release activates the liver to secrete C-reactive protein (CRP). It also indicated that, long term exercise attenuates mononuclear cell production of atherogenic cytokines (IL-1-alpha, TNF-alpha, and interferon gamma) while augmenting the production of atheroprotective cytokines (IL-4, IL-10, and transform growth factor-beta-1). These multifocal effects of exercise drive the resulting cytokine balance to an "anti-inflammatory* state. (Albert *et al.,* 2017). The increase in Serum Uric Acid of regularly-exercising male adult athletes compared to seldom exercising male adult athletes was in agreement with the study of verdaet et al. (2017) which attributed the increase in uric acid level to decrease in uric acid excretion in conjunction with the increased turnover of adenosine and with the concomitant rise in serum uric acid with strenuous exercise.

In comparison with women who work out frequently or regularly from those who seldom workout, result showed that there was no significant difference between the Hs-CRP ($P > 0.05$). Regular physical activity reduces serum highly Sensitive C-Reactive protein levels by multiple mechanisms, including a decrease in cytokine production by adipose tissue, skeletal muscles, endothelial and blood mononuclear cells, improved endothelial function and insulin sensitivity, and possibly has antioxidant effect. Inversely, regular Physical activity increases serum Uric acid because, elevations of serum Uric Acid with regular exercise may result but only from a decrease in renal excretion or contraction of extracellular fluid volume, but increase in synthesis of Uric acid precursors liberated from active skeletal muscles during exercise as well (Febbraio et al., 2018).

RECOMMENDATION

This study has added to the call for the need for physical activity in order to stay in optimal health. And people should make out time to exercise.

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