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Endurance physical activity impact on heart type fatty acid binding protein of health individuals in Eastern Nigeria

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ABSTRACT

Background

Sedentary lifestyle is an issue of great concern because of its deleterious health implications in developed and developing countries. It is associated with limited physical activity thus exposed people to high risk of developing various health conditions. The objective of this study was to determine and compare results of moderate and vigorous exercises on heart-type fatty acid binding protein (HFABP) before exercise, four weeks after exercise, eight weeks after exercise and twelve weeks after exercise.

Methods

Serum concentration of HFABP of both vigorous exercise group (30 male individuals who played football for 40 minutes daily for 3 days/week) and moderate exercise group (30 male individuals who engaged in mild jogging for 30 minutes daily for 5 days/week) were determined using Enzyme Linked Immunosorbent Assay (ELISA) technique. All data were expressed as Mean ± Standard Deviation (SD) and analyzed with Analysis of Variance (ANOVA) while multiple comparisons were done using Post Hoc test. Pearson's correlation coefficient was used for correlational analysis.

Results

The mean age for subjects in moderate exercise group was 23.13 ± 2.11 years while mean age for subjects in vigorous exercise group was 22.63 ± 1.67 years, with the mean age of both groups not significantly different. In both moderate and vigorous exercise groups, the mean serum concentration of H-FABP was increased but not significant (P<0.05).

Conclusion

Cardiovascular exercise leads to non-significant increase in heart-type fatty acid binding protein, indicating that the extent or intensity of the endurance exercise does not have serious impact on the binding protein.

Keywords: Heart, Exercise, Endurance, Nigeria

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INTRODUCTION

Physical inactivity and preventable deaths continue to be on the rise in Nigeria especially in the urban centres where it has become a growing problem. Physical inactivity, which contributes mainly to the high prevalence of most non-communicable diseases (NCDs) that predominate in adults alongside their high mortality, has been reported to be a major and

leading risk factor for many chronic conditions and diseases.[1] Physical exercise is any bodily activity that enhances or maintains physical fitness and overall health and wellness. It improves mental health, helps prevent depression and promote positive self-esteem.[2]

The human body has evolved a defense mechanism in the form of small cytoplasmic proteins called fatty acid binding proteins (FABPs), which is a super-family of intracellular lipid-binding proteins that have roles in transport and storage of lipids. The most important FABPs are isolated from the liver, heart, intestine, brain, epidermis, adipocytes etc. Heart-type fatty acid binding protein (hFABP or FABP3), also called mammary-derived growth inhibitor, is a low-molecular weight protein that is abundant in the cytoplasm of myocardial cells with its special tissue distribution. It is expressed abundantly in cardiomyocytes, but, also in skeletal muscle, distal tubular cells of the kidney, brain, lactating mammary gland and placenta. It is known to be released from injured myocardium and detected within 20 minutes of cardiac damage, reaches peak level at 3 – 4 hours and returns to normal range in 24 hours.[3] Not much publication is available on this research however a publication on the effects of 8-weeks high intensity aerobic exercise on serum adipocyte fatty acid binding protein levels carried out in Iran reported that serum A-FABP levels were not affected by the 8-weeks high intensity aerobic exercise.[4] Also, a 2017 study on the serum levels of fatty acid binding protein 4 (FABP4) carried out in Japan showed that high intensity exercise significantly increased serum concentrations of FABP4.[5] The study was therefore carried out to determine and compare results of the effect of moderate and vigorous cardiovascular exercises on heart-type fatty acid binding protein (hFABP) before exercise, two weeks after exercise, eight weeks after exercise and twelve weeks after exercise.

MATERIAL AND METHODS

Study Site/Subject Selection/Study Design

The study was conducted at Okofia playing ground on the Nnamdi Azikiwe University, Okofia, Nnewi, Anambra State, Nigeria. Total study size of 60 subjects but 240 serum samples were used. They were divided into two groups: Group 1 (Vigorous Exercise) - This group consisted of 30 individuals who played football for 40 minutes per day (3 days/week). Group 2 (Moderate Exercise) -This group consisted of 30 individuals who engaged in mild jogging for 30 minutes daily (5 days/week). A baseline specimen was obtained from each subject before exercise. After four weeks, eight weeks and twelve weeks of respective training, fresh samples were collected from each subject.

Inclusion and Exclusion Criteria

Inclusion criteria for subjects were: physically healthy male individuals' ages 18-35 years, occasional or non-alcohol consumers, non-smokers, as well as, those not on drugs especially that will interfere with the parameter studied. Subjects physically unhealthy (males/females), outside the age range, regular alcohol consumers, smokers and those on drugs that will interfere with the parameter studied, were all excluded.

Sample Size

Sample size calculation was done using 95% confidence interval, 0.05 precision and prevalence rate. There seem to be no data available as regards the proportion of Anambra State residents that participate in various forms of physical exercise, but, high physical activity levels assessed in Ibadan, Western Nigeria, reported 1.7%.[6] The formula for sample size when population is more than 1000 is: $n = Z^2PQ/d^2$ [7]

$n = Z^2PQ/d^2$,
Where:
n= Sample Size,
d=degree of Precision (taken as 0.05),
Z= Standard Normal Deviation at 95% Confidence Interval which is 1.96,
P= Proportion of the Target Population (Estimated at 1.7% which is 1.7/100=0.017),
Q=Alternate Proportion (1-P), which is 1-0.017=0.983.

$$n = \frac{(1.96)^2 (0.017)(0.983)}{(0.05)^2} = 26$$

Sample Collection, Storage and Analysis

A 5ml fasting blood sample was aseptically collected into plain sample containers from each of the participating individuals by venipuncture on each of the three occasions sample was withdrawn between 7.30am and 10am. Blood samples were centrifuged at 4000 Revolution per Minute (RPM) for 10 minutes and the serum of each sample was extracted into fresh plain bottle for analysis. Serum samples were analyzed promptly after centrifugation while those not analyzed immediately analyzed were stored at -20 degree Celsius until analysis few days later. Serum cystatin C was analyzed by Enzyme Linked Immunosorbent Assay (ELISA) technique.

Principle of Enzyme Linked Immunosorbent Assay (ELISA)

The antigens or antibodies present in patient's sample are allowed to stick to a polyvinyl plate and then plate is washed to separate antigens or antibodies from remaining sample components. To this plate, a corresponding second antigen or antibody is added to get fixed to the already adhered first antigen in the plate. A tagged enzyme is added, then, a suitable substrate is added, the enzyme reacts with the substrate to produce a colour. This colour produced is measurable as a function of antigens or antibodies present in the given sample.

Ethical Consideration

Ethical approval was obtained from the Ethical Research Committee of the Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi, and Anambra State, Nigeria.

Statistical Analyses

Data was statistically analyzed using Statistical Package for the Social Sciences (SPSS) for windows version 23.0 software. Data were expressed as Mean ± Standard Deviation (SD). Statistical analysis of the data before exercise, four weeks after exercise, eight weeks after exercise and twelve weeks after exercise was performed by Analysis of Variance (ANOVA) while multiple comparisons were done using Post Hoc test. Significance was fixed at $P < 0.05$ and highly significant if $P < 0.01$. Pearson's correlation coefficient was used for correlational analysis of the test.

RESULTS

Physical and Biochemical Parameters

The mean age for subjects in moderate exercise group was 23.13 ± 2.11 years while mean age for subjects in vigorous exercise group was 22.63 ± 1.67 years, with the mean age of both groups not significantly different. In the moderate and vigorous exercise group, the mean serum concentration of Heart Fatty Acid Binding Protein (H-FABP) was increased but not significant ($P<0.05$).

Table 1 Comparison of Serum H-FABP Result for Moderate Exercise Group Before Exercise, 4-Weeks After Exercise, 8-Weeks After Exercise and 12-Weeks After Exercise

Groups	Parameters H-FABP (ng/mL)
Before exercise	3.03±0.97
4 weeks after exercise	3.16±0.87
8 weeks after exercise	3.28±0.97
12 weeks after exercise	3.37±0.81
F-value	0.802
P-value	0.495
POST HOC	
a/b	1.000
a/c	1.000
a/d	0.875
b/c	1.000

b/d	1.000
c/d	1.000

a – before exercise, b – 4 weeks after exercise, c – 8 weeks after exercise, d – 12 weeks after exercise
H-FABP – Heart Type Fatty Acid Binding Protein
** = Results compared are significantly different at P-value < 0.05 (P < 0.05).*

Table 2 Comparison of Serum H-FABP Result for Vigorous Exercise Group Before Exercise, 4-Weeks After Exercise, 8-Weeks After Exercise and 12-Weeks After Exercise

Groups	Parameters H-FABP (ng/mL)
Before exercise	2.90±0.95
4 weeks after exercise	2.96±0.81
8 weeks after exercise	3.11±0.79
12 weeks after exercise	3.37±0.66
F-value	2.006
P-value	0.117
POST HOC	
a/b	1.000
a/c	1.000
a/d	0.165
b/c	1.000
b/d	0.302
c/d	1.000

a – before exercise, b – 4 weeks after exercise, c – 8 weeks after exercise, d – 12 weeks after exercise
H-FABP – Heart Type Fatty Acid Binding Protein
** = Results compared are significantly different at P-value < 0.05 (P < 0.05).*

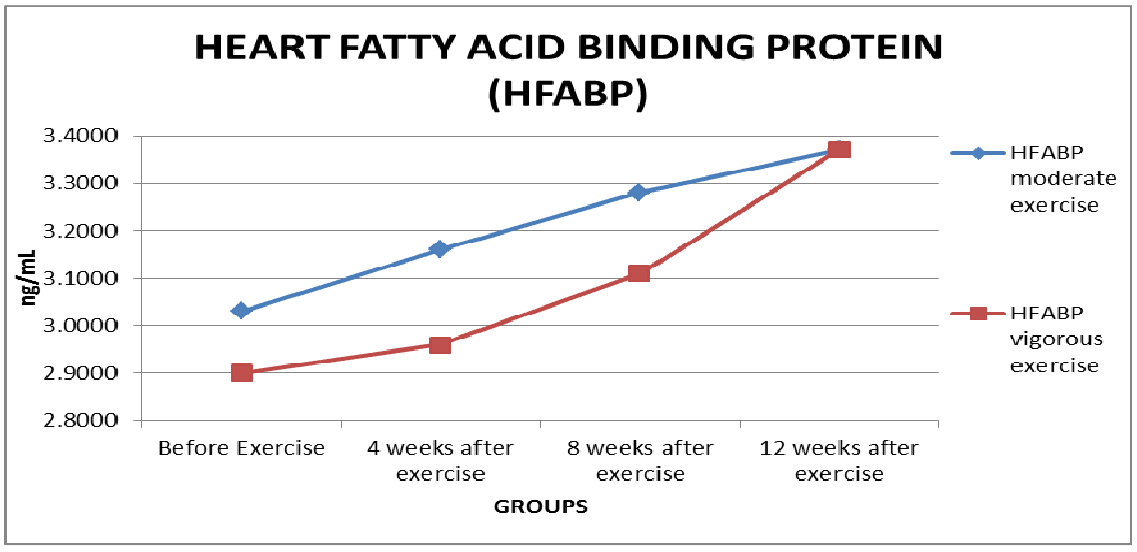

Fig 1 Graph Showing Mean Serum Concentration of Heart Fatty Acid Binding Protein (HFABP) for Both Moderate and Vigorous Exercise Groups

DISCUSSION

In the moderate and vigorous exercise group, the mean serum Heart Fatty Acid Binding Protein (H-FABP) was increased but not significant (P<0.05). This research outcome is not in agreement with some previous study that showed that high intensity exercise significantly increased serum concentrations of FABP4[5] but the outcomes are similar to that of another research work that revealed serum A-FABP levels were not affected by the 8-weeks high intensity aerobic exercise.[4] The non-significant increases in the H-FABP observed in this study might be that the extent of exercise did not necessarily affect the protein.[4, 8, 9] This may be as a result of the fact that H-FABP is expressed abundantly in cardiomyocytes, but, also in skeletal muscle, distal tubular cells of the kidney, brain, lactating mammary gland and placenta, hence the possible reason for the non-significant increase, as the H-FABP is a small cytoplasmic protein released from cardiac myocytes following an ischaemic episode or in response to myocardial injury. It is involved in fatty acid metabolism where it transports fatty acids from the cell membrane to mitochondria for oxidation, as excessive free fatty acids levels are toxic to cells. It is known to be released from injured myocardium and detected within 20 minutes of cardiac damage, reaches peak level at 3 – 4 hours and returns to normal range in 24 hours.

CONCLUSION

Cardiovascular exercise leads to non-significant increase in heart-type fatty acid binding protein, indicating that the extent or intensity of the endurance exercise does not have serious impact on the binding protein.

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