Serum Protein adjustments consequent to a 10-Week Calisthenic-Circuit Training Programme among University of Benin Student Athletes

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Abstract
The measurement of serum protein is an important diagnostic tool for the detection, diagnosis, and monitoring of various diseases and pathological processes as well as evaluation of athletes in sport situation. This study evaluated adjustments in serum levels of total protein, albumin and globulin of the University of Benin student athlete's consequent to a 10-week Calisthenic-Circuit Training (CCT) programme. The pre-test, post-test randomized control experimental design was used for the study. The population of the study comprised five hundred and twenty-two (522) student athletes and a total of fifty-four (54) student athletes made up the study sample. Proportionate sampling technique was used to select participants for this study. Blood samples were obtained from the participants before and after a 10-week Calisthenic-Circuit training programme to assess biochemical adjustments to serum total protein, albumin and globulin. Descriptive statistics of mean, range and standard deviation were used to answer the research questions raised, while inferential statistics of Independent t-Test was employed to determine differences between the experimental and control group. The results obtained indicated that of all serum protein parameters studied, albumin (t=-2.802, p=0.015) was found to have statistically significant increase to a level of 4.53±0.44mg/ml following CCT programme. Serum globulin (t=-0.524, p=0.871) and total protein (t=1.103, p=0.096) were not statistically significant but portrayed an increase to a level of 2.95±0.53mmg/ml and 7.62±0.97mg/ml respectively. It was therefore concluded that CCT programme substantially potentiated serum protein adjustments and statistical differences specifically on serum albumin of the University of Benin student athletes. CCT programme should be considered as a key element in eliciting serum protein adjustments for growth and repair of body tissues.

Keywords: Serum Protein, Calisthenic-Circuit Training (CCT) & Adjustments.

Introduction

Physical exercise is any bodily activity that enhances or maintains physical fitness, overall health and wellness status of an individual. Athletes regularly indulge in physical activity to increase growth and development, prevent aging, strengthen the muscles and cardiovascular system, hone athletic skills, lose weight or to maintain weight and also for enjoyment. Exercise training provides the body a stimulus to adapt thereby increasing the capacity of the various systems to perform increased workloads. However, the magnitude of the stress must be large enough to induce the synthesis of new enzymes, tissues, and yet not so large that the biochemical and physiological processes of recovery are depressed (Agbonlahor & Agbonlahor, 2016). As each individual undergoes this process at a different rate, objective evaluation of the level of fatigue and adaptation is of enormous value in directing the training programme of an athlete (Giuseppe, Giorgio, Massimo, Federico &Giancesare, 2004).

Calisthenics is a form of exercise consisting of variety of movements without the use of equipment or apparatus, but mainly using the individual's own body weight. It is intended to increase body strength and flexibility with movements (Lundergreen, 2012). Calisthenics has proven to be advantageous in increasing human mental and physical performance for thousands of years (Rajeev, 2016). Thus, Calisthenic-Circuit training refers to series of exercises performed at various stations arranged in circuit form, set up to exercise various body parts at a quick, high repetition pace, during a short period of time with little or no rest interval between sets (Agwubike, 2016).

Protein is an organic compound formed from amino acids. It is a basic food stuff which forms muscle tissue, hormones and enzymes (Rajeev, 2016). Proteins are used as auxiliary fuels during muscular work. Some stored amino acids link with fats and form lipoproteins. These proteins are more essential for growth and repair of body tissues (Mariakutikan, 2003). In order to maintain repair and grow the tissues, proteins are essential. The measurement of protein is done on serum, which is the fluid that remains after plasma has clotted, thus removing fibrinogen and most of the clotting factors. Protein status is usually assessed by measuring levels of total serum proteins, globulin, albumin, or plasma non-essential and essential amino acid ratio (Opara, Adebola, Oguzor&Abere, 2011). Changes in the levels of protein fractions provide early and useful diagnostic and prognostic information for defense, systemic response to acute inflammation, malignancy, trauma, necrosis, infarction, burns, and chemical injury (O'Connell, Horita&Kasravi, 2005; Atherton, Braceland, Burchmore, Eadle, Eckersall, Harvie & Morris, 2013). Variations in the level of serum proteins occur between racial groups and under physiological and pathological conditions (Adedeji, Olawoye&Osotimehin, 2004).

Some physiological markers, although measured in an invasive manner, are the most accurate parameters to investigate the acute and chronic effects of exercise (Meneguelo& Rosa, 2002). The chronic adaptation of serum protein related measures to yoga practice and aerobic exercises (Uthirapathy& Chandrasekaran, 2007) and assessment of serum profiles of sportsmen using Differential Scanning Calorimetry (Anna,Zofia, Stanisław, Miłosz, Katarzyna &Ewa, 2013) have been studied. To the best of the researchers' knowledge, there are little known research efforts geared towards determining serum protein adjustments among student athletes in Nigeria and in the University of Benin in particular. This study was therefore undertaken to provide empirical information on the benefits of using a 10-week calisthenic-circuit training programme to elicit serum protein adjustments among student athletes.

Hypotheses

The following hypotheses were formulated to guide the study.

1. There will be no significant difference in total protein between the experimental and control participants prior to a ten (10)-week calisthenic-circuit training programme among University of Benin student athletes.
2. There will be no significant difference in globulin between the experimental and control participants prior to and following a ten (10)-week calisthenic-circuit training programme among University of Benin student athletes.

3. There will be no significant difference in albumin between the experimental and control participants prior to and following a ten (10)-week calisthenic-circuit training programme among University of Benin student athletes.

Methodology

The pretest – posttest randomized control group experimental research design was adopted for this study. A sample size of fifty four (54) participants from a population of five hundred and twenty two (522) student athletes for the 2016/2017 academic session were selected. This represents 10% of the entire population of student athletes. The selection was done through proportionate sampling technique involving 10% of their respective sports. The sampled students were then assigned to the training groups comprising the Experimental and Control groups through the systematic random sample technique. This involved serializing the 54 selected student athletes and respectively assigning athlete number one and every other one to the two groups, which yielded 27 student athletes per group.

The recommended protocol of Calisthenic-Circuit Training (CCT) as validated by Jordan Hill (2016) was used in the study devices. The biochemical instrument used for this study were validated by Medical Laboratory Scientists and re-validated by two experts in Exercise Physiology and found to be valid devices for data collection for the present study. An ethical clearance was obtained from the Ethics Committee of the University of Benin.

To determine the reliability of the present research instrument, a pilot study was carried out using a sample of twelve (12) student athletes, six (6) each for both the experimental and the control groups. The selected 12 student athletes were not included in the study sample. The test re-test method of reliability was employed using Computeranalysis-Statistical Package for Social Sciences (SPSS) – IBM version 20 to obtain the correlation coefficient. An "r" of 0.76 was obtained for total protein, 0.62 for albumin and 0.71 for globulin. These results were suitable reliability values for data collection for the present study.

The data from table 1 was analyzed using descriptive statistics of mean, standard deviation and range for all the variables, Table 2 was analyzed using an inferential statistic of Independent t-Test. The statistical software package IBM Statistics SPSS 20 for windows was used for the statistical analysis. The level of significance was set at $p < 0.05$.

Results and Discussion

The results are presented in Tables 1 and 2.

Table 1: Descriptive Statistics showing the Serum Protein of the experimental and control participants

	PRE-TEST VALUES				POST TEST VALUES			
	PRE-EXPERIMENTAL		PRE-CONTROL		POST-EXPERIMENTAL		POST-CONTROL	
Variables	Mean ±SD	Range	Mean ±SD	Range	Mean ±SD	Range	Mean ±SD	Range
Total protein	6.90±0.46	1.45	7.29±0.74	2.90	7.62±0.97	3.03	7.35±0.79	3.19
Albumin	4.02±0.42	1.30	4.82±0.6	1.89	4.53±0.44	1.51	4.97±0.68	2.18
Globulin	2.81±0.66	1.85	2.76±0.46	1.18	2.95±0.53	1.58	2.87±0.49	1.70

Table 1 reflects that for pre-test values, the experimental group had a mean total protein of 6.90±0.46 with a range of 1.45; a mean albumin of 4.02±0.42 with a range of 1.30 and a mean globulin of 2.81±0.66 with a range of 1.85, while the control group had a mean total protein of 7.29±0.74 with a range of 2.90; a mean albumin of 4.82±0.6 with a range of 1.89 and a mean globulin of 2.76±0.46 with a range of 1.18. For Post-Test values, the experimental group had a mean total protein of 7.62±0.97 with a range of 3.03; a mean albumin of 4.53±0.44 with a range of 1.51 and a mean globulin of 2.95±0.53 with a range of 1.58, on the other hand, the control group had a mean total protein of 7.35±0.79 with a range of 3.19; a mean albumin of 4.97±0.68 with a range of 2.18 and a mean globulin of 2.87±0.49 with a range of 1.70. In order to ascertain if the increased difference is significant or not, the need to probe into hypothesis testing became necessary.

Table 2: Independent t-Test Showing Difference in the Serum Protein of the experimental and control participants

Variables	Group	Pre-Test	t	p	Post Test	t	P
Total Protein	**Experimental**	6.90	-2.303	0.133	7.62	1.103	0.096
	Control	7.29			7.35		
Albumin	**Experimental**	4.02	-5.669	0.329	4.53	-2.802	0.015
	Control	4.81			4.97		
Globulin	**Experimental**	2.81	0.346	0.166	2.95	0.524	0.871
	Control	2.76			2.87		

From Table 2, differences in the serum protein comprising of total protein, albumin and globulin prior to and following a 10-week Calisthenic-Circuit Training (CCT) programme was determined using an Independent t-Test. The Pre-Test measurements for the experimental and control group portrayed a t-value of -2.303 and p value of 0.133 for total protein, a t-value of -5.669 and p value of 0.329 for albumin as well as a t-value of 0.346 and p value of 0.166 for globulin respectively, which was found not to be

statistically significant. A covariate was not observed between the Pre-Test measurements for both groups and hence did not necessitate the application of Analysis of Covariate (ANCOVA). Post-Test measurements for the experimental and control group portrayed a t-value of -2.802 and p value of 0.015 for albumin which was found to be statistically significant. In contrast, a t-value of 0.524 and p value of 0.871 for globulin as well as a t-value of 1.103 and p value of 0.096 for total protein was found not to be statistically significant.

In light of the above, a significant difference in albumin was recorded while there was no significant difference in globulin and total protein among University of Benin student athletes prior to and following a 10-week calisthenic-circuit training programme.

Discussion

The outcome of this study indicated that albumin had significant adjustments following CCT programme while serum total protein and globulin had insignificant adjustments to CCT programme. Similar findings were obtained in the studies of Adedeji, Adedosu, Afolabi, Badmus, Ehigie, Fatoki, and Adelusi (2012) and that of Felipe, Helder, Jose, Sandra, and Victor (2014). This is in contrast with the studies of Anna, Zofia, Stanisław, Miłosz, Katarzyna and Sadowska-Kre (2013) who reported an insignificant improvement in serum albumin of the participants. This disagreement is not a surprise because serum albumin is never the same across communities in the same country, neither are they the same across countries.

The changes in albumin concentration have been found statistically significant. The elevated level of albumin in serum after exercise is probably connected with dehydration due to very intense perspiration during the exercise. There are no significant differences between determined mean levels of globulins in pre- and post-exercise serum as well as after the 1 h and 2 h rest. However, for all types of globulins the tendency to increase after an effort has been observed.

The result obtained from this study is also agreed with the study of Giuseppe, Giorgio, Massimo, Federico, and Giancesare (2004) who reported an insignificant improvement in serum protein. This disparity may be due to population studied which involved professional (elite) endurance athletes and it is conceivable that some preanalytical variables, such as environmental conditions, postural changes, feeding, dehydration and muscular injury, might have influenced their biochemical measurements. Furthermore, amino acids combine with one another to form proteins. The quantity of amino acids present at any given moment is the sum total of the absorbed amino acids and those derived from thebreakdown of tissue protein. It is observed that CCT programme enhanced the protein level in the blood because the athletes after exercise are in post absorptive state, that is the amino acids absorbed by the intestine are taken up by blood to the various tissues for proper utilization. Meanwhile the tissue proteins are broken down in order to give energy,but the amino acids liberated by themuscle, during exercisearenotusedas fuels instead they are stored in blood as protein (Rama Rao, 1998 & Udupa,1996).

Conclusion

Based on the effects of a 10-week CCT programme on serum protein among University of Benin student athletes, the following conclusions were made:

- That CCT programme substantially potentiated serum adjustments on the serum protein levels of the University of Benin student athletes.
- That CCT programme potentiated significant differences in albumin and none found in the serum globulin and total protein level of University of Benin student athletes.
- That CCT programme provides a potential method of accomplishing more work in less time and with less equipment through a design targeted at multiple components of fitness.

Recommendations

Based on the findings, the following recommendations were made:

- CCT programme should be considered as a key element in eliciting serum protein adjustments for growth and repair of body tissues.
- Student athletes should be sensitized on the various benefits of CCT programme as it plays a role towards improving the general health and well-being of individuals.
- CCT programme should be used as an alternative method when athletes have become bored with the daily rigor of regular training as it allows rest intervals.

Conflict of Interest

None

References

Adedeji, A.L., Adedosu, O.T., Afolabi, O.K., Badmus, J.A., Ehigie, L.O., Fatoki, J.O., & Adelusi, T.I. (2012). Serum protein profile in Nigerian women: An analysis by gestation age. *Researcher, 4*(11),38-42. http://www.sciencepub.net/researcher.

Adedeji, A.L., Olawoye, T.L., &Osotimehin, B.O. (2004). Electrophoretic pattern of serum proteins in Human Immunodeficiency Virus Type 1 (HIV-1) Infection. *NJBMB 19,* 93-96.

Agbonlahor, E, I., & Agbonlahor, L N. (2016). *Applied physiology of exercise and sports: The kpim of exercise physiology.* Benin City: Ogie Printing Services.

Agwubike, E.O. (2016). *Physiology of Muscular Activities: Theory through Question and Answer Approach.* Benin City: Ambik Press.

Anna, M., Zofia, D., Stanisław, P., Miłosz, C.,Katarzyna, K., & Ewa, S. (2013). Serum profiles of sportsmen. *J. Therm Anal Calorim. 113,* 365–370.

Atherton, M. J., Braceland, M., Burchmore, R. J., Eadle, S., Eckersall, P. D., Harvie, J., & Morris, J. (2013). Characterization of the normal canine serum proteome using a novel electrophoretic technique combined with mass spectrometry. *The Veterinary Journal, 196,* 315–319.

Felipe, B., Helder, M. F., Jose, V.A., Sandra, F., & Victor, M.R. (2014). Hematological and biochemical markers after a Brazilian Jiu-Jitsu tournament in world-class athletes. *Rev. Bras CineantropomDesempenho Hum. 16*(2), 144-151.

Giuseppe, L., Giorgio, B., Massimo, F., Federico, S., & Giancesare, G. (2004). Comparison of serum creatinine, uric acid, albumin and glucose in male professional endurance athletes compared with healthy controls. *Clin. Chem. Lab. Med. 42*(6), 644–647.

Lundergreen, M. (2012). Humana natural: Calisthenics. Retrieved 6thAugust, 2018 from www.humanannatural.org.

Mariakuttikan, A., & Arumugam, N. (2003). *Animal physiology*. Tamil Nadu: Saras Publication. 2, 13-16.

Meneguelo, M.O., & Rosa, L. (2002). Effect of caloric restriction and aerobic exercise on lymphocytes and macrophages of aged mice. *Rev. Paul EducFis. 16,* 16-26.

O'Connell, T., Horita, T., &Kasravi, B. (2005). Understanding and interpreting serum protein electrophoresis. *America Family Physician, 71,* 105–112.

Opara, J.A., Adebola, H.E., Oguzor, H.S., & Abere, S.A. (2011). Malnutrition during pregnancy among child bearing mothers in Mbaitolu of South-Eastern Nigeria. *Advances in Biological Research. 2,* 111-115.

Rajeev, S. (2016). *Effect of pilates, calisthenics and combined exercises on selected physical motor fitness*. New Delhi: Isara Publications.

RamaRao, A.V.S.S. (1998). A textbook of Biochemistry. New Delhi: UBS Publishers Distributors Ltd.

Udupa, K.N. (1996).Stress and its management byYoga, Motilal Banarsidass. Delhi: Publishers Pvt. Ltd.

Uthirapathy, A., & Chandrasekaran, K. (2007). Influence of yogic practices and aerobic exercises on serum protein level.*Journal of Exercise Science and Physiotherapy, 3*(2), 153-156.