Journal of Natural Sciences Research www.iiste.org
ISSN 2224-3186 (Paper) ISSN 2225-0921 (Online)
Vol.3, No.5, 2013

Effects of a 12-Week Structured Fitness Exercise on the Red Blood Cells of College Students in Ikere-Ekiti, Ekiti State, Nigeria.

Ajayi-Vincent, Olusesi B[1*]., Adesina, Modupe O[2]., Babalola, Olubukola O.[3]
1. Dept. of Human Kinetics & Health Educ. Ekiti State University, PMB 5363 Ado Ekiti, Nigeria.
2. Dept. of Sports Science. Ibrahim Badamosi Babangida University. Lappai, Nigeria.
3. Dept. of Science Technology. Federal Polytechnic, Ado Ekiti, Nigeria.
*Email of corresponding author – ajayivincent2006@yahoo.com

Abstract
This study investigated and determined the effects of a 12-week structured fitness training programme on the Red Blood cells of College Students. The structured exercise/ training programme consisted of graded physical activities lasting for about fifty (50) minutes and administered three times a week, The pre-test, post-test control group - design was used for the study. Sixty (60) College Students were used comprising thirty (30) subjects each for both the experimental and the control groups. Statistical procedure employed included the descriptive statistics of mean, range and standard deviation, inferential statistics of Analysis of Covariance (ANCOVA) was used to determine significance of adaptation. A post-hoc analysis of Multiple Classification Analysis (MCA) was also applied to find out the magnitude of the adaptation. Graphical illustration was also used to pictorially display the pattern of changes in the variable. The result of the findings showed a rejection of the hypothesis which stated that there will be no significant effect of a 12-week fitness training programme on the Red blood cells of College Students in Ekiti State. Based on the findings of this study, it was therefore concluded that a structured exercise training programme of 12 weeks duration is capable of reducing the red blood cells of college students in Ikere Ekiti. It was recommended that such fitness training programme be encouraged among the youths.
Keywords: Resistance exercise, hematological variables, college students.

1. Introduction

Physical activities, performance and physiological functioning improve rapidly from early childhood to a peak somewhere between twenty and thirty years of age. Thereafter, in most cases, a slow decline in physiological functioning begins during adulthood and becomes more rapid with increasing age. This decline in physiological functioning is associated with age-related decreases in physical activity. However, the rates of decline in physical performance are more highly related to the decreased habitual activity than the age itself. In essence, the regular physical activity throughout life can decrease the rate of decline in physiological functioning and physical performance (Hurley and Hag berg, 1998).

Today, few would debate the benefits of physical activity to personal health. With the plethora of literature available, it appears that individuals, who choose to be more physically active in both their leisure and work activities, lower their risk for developing certain degenerative diseases. Many organizations have realized the importance of regular exercise and have published major policy statements. Harris, Casperson and DeFriese (1989) made a report for the United States Preventive Services Task Force and concluded that the evidence linking exercise and health was strong enough to issue recommendations so that physicians could better counsel their patients.

According to Robergs and Robergs (1997), resistance training is the muscle contractions performed against a resistance, typically in the form of external loads like those used in weight lifting. This definition is also corroborated by the words of Faigenbaum (2003), that resistance training refers to a specialized method of conditioning that involves the progressive use of wide range of resistive loads and a variety of training modalities (e.g. free weight, barbells and dumbbells, weight machine and body weight).

The effects of resistive type of exercise (strength training) on health status have been largely overlooked, traditionally, strength training has been seen as a means of improving muscular strength and endurance (muscle mass) and power, but not as a means of improving health. There is now increasing evidence that strength training plays a significant role in health factors. The American College of Sports Medicine (ACSM) (1990, 1995), American Heart Association (AHA) (1995), and the United States Department of Health and Human Services in Surgeon General's Report on Physical Activity and Health (1996), all have recognized the importance of strength training as an important component of health.

It seems somewhat surprising, therefore, that highly trained athletes are commonly observed to have lower blood haemoglobin concentrations than their sedentary counterparts. However, Maugham, Gleeson and Greenhaff (1997) believed that this arises, at least in part, from an increase in the total blood volume, with a greater relative increase in plasma volume compared with the red cell mass (and hence a dilution decrease in red cell count per liter of blood). Even so, total blood haemoglobin content is increased in athletes, and the decrease

in blood haemoglobin concentration is compensated for by an increase in red cell 2, 3-diphosphoglycerate (2, 3, DPG) content. They then concluded that, the lower red cell count of the athlete's

blood reduces the viscosity of the blood, reducing resistance to blood flow and that the delivery of oxygen to the working muscles is increased as a result of resistance training.

Maugham, et al (1997) reported that blood volume tends to fall slightly during exercise due mainly to a loss of plasma volume, which can be up to about 20% during intense exercise. They then concluded that the overall effect of a net loss of plasma volume is an increase in the red blood cell count and Haemoglobin concentration, increasing the oxygen-carrying capacity per litre of blood, but at the expense of a reduction in total, blood volume and an increase in blood viscosity. This paper therefore, discussed the effects of a 12-week structured fitness exercises on the red blood cells of youths of College of Education, Ikere Ekiti.

2. Hypothesis

The research hypothesis for this study was that there will be no significant effect of a 12-week fitness training programme on the Red blood cell of College of Education Students in Ekiti State.

3. Methods

The subjects for this study comprised Sixty (60) certified healthy College Students in College of Education Ikere, Ekiti State. They were selected by purposive sampling technique; the subjects were randomly assigned to two groups - the experimental group and the control group. Each group comprised 15 males and 15 females. Subjects in the experimental group trained in the fitness exercises thrice a week for twelve weeks, and for 50 minutes each day. The researchers were assisted by two of the physical education teachers in the school. They were familiarized with the training programme before assisting with the training of the subjects. However a pilot study was carried out on ten subjects who were not included in the main study, to perfect training procedures and instructions.

3.1 Training Procedure

A 5 - 10 minutes calisthenics exercises were administered on all the subjects of the study before the treatment programme was administered on the experimental group while the control group was not placed on any treatment programme. The experimental group performed 10 different exercises with 3 sets in a workout which lasted for 50 minutes following the procedures described by Sale (1989).

3.2 Tests Locations

Blood sample collection was carried out at the Medical Laboratory department of the Health Center of College of Education Ikere, Ekiti State. The fitness training exercises were performed at the Sports Complex of the College.

3.3 Procedure for Data Collection

All efforts were made to ensure that the collection of data was done under standardized and hygienic conditions. Qualified, professional medical laboratory scientists were used in the collection of the blood samples. All subjects were adequately informed about the nature, purpose and importance of the test verbally and they all filled informed consent forms before the commencement of the test. Likewise, instructions and adequate demonstrations of the various fitness exercises were given prior to the commencement of the tests.

Resistance Exercises

Resistance exercises that were used included the following:

1. **Isotonic Exercises**
   - i. Step-up.
   - ii. Push-up.
   - iii. Arm curl.
   - iv. Modified push-up.
2. **Isometric Exercises**
   - i. Abdominal crunch and bent leg curl-up.
   - ii. Pull-up.
   - iii. Leg abduction and adduction.
   - iv. Rowing torso.
   - v. Heel raise.

4. Data Analysis

Both descriptive and inferential statistical procedures were employed for the treatment of the data gathered for this study. The descriptive statistics of mean, range and standard deviation were used to compute each of the data for the variables. Inferential statistics of Analysis of Covariance (ANCOVA) was also used (using

the pretest as covariate) to determine the significance of the adaptations resulting from the 12-week structured resistance exercise training programme, at 0.05 level of significance. A post-hoc analysis was applied on significant variables using the Multiple Classification Analysis (MCA) to find out the magnitude of the adaptation which was accounted for by the 12-week structured resistance exercise training programme (Nie, Hull, Jenkins, Steinbrenner and Bent, 1975). The pattern of changes was studied from the results of measurements taken every six (6) weeks. This was also illustrated in a graph for each of the variables studied.

Red Blood Cell Count (RBC) (mmol/L)

Table 2 below showed a reduction of red blood cell in the experimental group after the resistance training programme. The mean red blood cell decreased from 4.25 mmol/L ± 0.46 at the pre-test to 4.18 mmol/L ±0.58 at the mid-test, and at the post-test to 3.90 mmol/L ± 0.51, showing a reduced mean difference of 0.35 mmol/L between the pre- and post-test values. The experimental group showed a higher decrease at the latter six weeks (0.28 mmol/L), than the earlier six weeks 0.07 mmol/L. While the control group present a mild increase in their red blood cell count from 4.21 mmol/L ± 0.65 in the pre-test to 4.33 mmol/L ± 0.71 in the mid-test and a post-test of 4.47 mmol/L ± 0.68 was detected. The mean difference in the pre- and post-training of the red blood cell count of the control group was 0.26mmol/L.

4. Results and Discussions

The Analysis of Covariance (ANCOVA) results in Table 3 showed that the calculated F ratio of 57.749 mmol/L for red blood cell were greater than the critical value of 4.03 at 0.05 significant level. Therefore, the hypothesis which stated that there would be no significant effect of a 12-week resistance training programme on the Red blood cell variables of college students in Ekiti state was rejected.

A further analysis using the Multiple Classification Analysis (MCA) in table 4 showed an observed decrease of changes in red blood cell (51.91%). The pattern of changes in Figure 1 representing red blood cell was similar between the two groups, however, the experimental group exhibited decreases which were higher between the 6^{th} and the 12^{th} week. Figure 1 (red blood cell) showed a higher basal mean value in the experimental group than in the control group but dropped sharply between the 6^{th} and the 12^{th} week, while the control group had a constant increase throughout the 12 weeks.

5. Discussion

Resistance training programme employed in this study demonstrated a positive effect on the red blood cell parameters of the experimental group. This is evident in the mean decreases of red blood cell count (0.35 ml./cc) of the experimental group compared with increases of 0.26 ml./cc in the control group.

The findings of this study compared favourably with the findings of Olatunji (1991) who in his study observed a reduction of 29.63% in the red blood cell count which is in line with the 57.91% of this study. Having observed reduced value of red blood cell of the subjects, Olatunji (1991) attributed the causes to increased haemolysis due to mechanical trauma resulting from rigorous exertion, causing increased rate of red blood cell destruction. The variance in the percentage reduction might be due to the subjects used and their basal activity level.

Reduced values of the red blood cell count in this study further supported the findings of Karakoc et al (2005) who reported a significant decrease in red blood cell count in footballers who trained regularly. They attributed the changes here to be in response to the increase in shear rate that occurs at the end of training as well as haemodilution.

6. Conclusions

Based on the findings of this study, it was therefore concluded that structured exercise training programme is beneficial and capable of causing a significant reduction in the red blood cells of the college students in Ekiti State. It is however noteworthy that the subjects definitely gained some experiences in learning and performing the physical activities which also helped them to know their fitness level and improvements were made on them. The findings of this study may be useful in improving the functions of the heart and preventing degenerating diseases.

7. Recommendations

Based on the findings of this study, the following recommendations were made:

1. Further studies on a longer training programme at higher work intensity are needed to evoke more significant changes in crucial parameters.
2. For the beneficial effect in maintaining interest and increasing diversity, additional study is required in the routine application of resistance training in youths, and they should be guided cautiously in the course of the training programme.
3. However, care must be taken by the coaches, trainers and exercise physiologists in progression in order to prevent overtraining and possible injuries.

References

American College of Sports Medicine [1990]: The recommended quantity and quality of exercise for developing and maintaining cardio respiratory and muscular fitness in healthy adults. *Medicine and Science in Sports and Exercise,* 22, 265 - 274.

American College of Sports Medicine [1995]: *Guidelines for exercise testing and prescription.* Philadelphia: Williams and Wilkins, 173-193.

American Heart Association, (1995) Heart and stroke facts: 1996 Statistical Supplement. Dallas: Author

Faigenbaum, A., [2003] Youth resistance training. President's Council on Physical fitness and Sports. *Readers Digest***,** Series 4, No. 3.

Harris, S.S., Casperson, C.J., & DeFriese, G.H., [1989]. Physical activity counseling for healthy adults as a primary prevention intervention in the clinical setting: Report for the U.S. Preventive Services task force, *Journal of American Medical Association,* 261: 3590 - 3608.

Hurley, B.F., Hag berg, J. M. [1998]. Optimizing health in Older Persons: Aerobic or strength training? *In Exercise and Sport Sciences Reviews***,** ed. J. O. Holloszy. Baltimore: Williams and Wilkins pp. 61 - 89.

Karakoc, Y., Duzova, H., Polat, A., Emre, M.H., & Arabaci, I. [2005]. Effects of training period on hematological variables in regularly trained footballers. *BJSM.* 39.

Maugham, R., Gleeson, M., & Greenhaff, P. L., [1997]. *Biochemistry of Exercise and Training.* New York, Oxford University Press.

Nie, N. H., Hull, C. H., Jenkins, J. G., Steinbrenner, K., & Bent, D. H., [1975]. *Statistical packages for the Social Sciences, 2nd ed***;** New York, McGraw. Hill Book Company.

Olatunji, O. O. [1991], Alterations in selected Hematological parameters of University Male Athletes involved in Aerobic and Anaerobic exercise Training Programmes. *An unpublished PhD thesis.* Ibadan. University of Ibadan.

Robergs, R. A., & Robergs, S.O., [1997] *Exercise Physiology: Exercise, performance, and clinical Applications.* St Louis, Mosby Year Book Inc.

Sale, D.G., [1989] Strength training in children. In C.V. Gisolfi and D.R. Lamb [Eds], *Perspectives in Exercise Science and Sports Medicine***,** [2] Youth, Exercise and sport. Indianapolis, Benchmark Press. Pp 165-216.

U. S. Department of Health and Human Services [1996] *Physical Activity and Health:* A report of the Surgeon General. Atlanta, [GA]: U. S. Department of Health and Human Services, Centers for Disease Control and prevention, National Center for Chronic Disease Prevention and Health Promotion. 1.

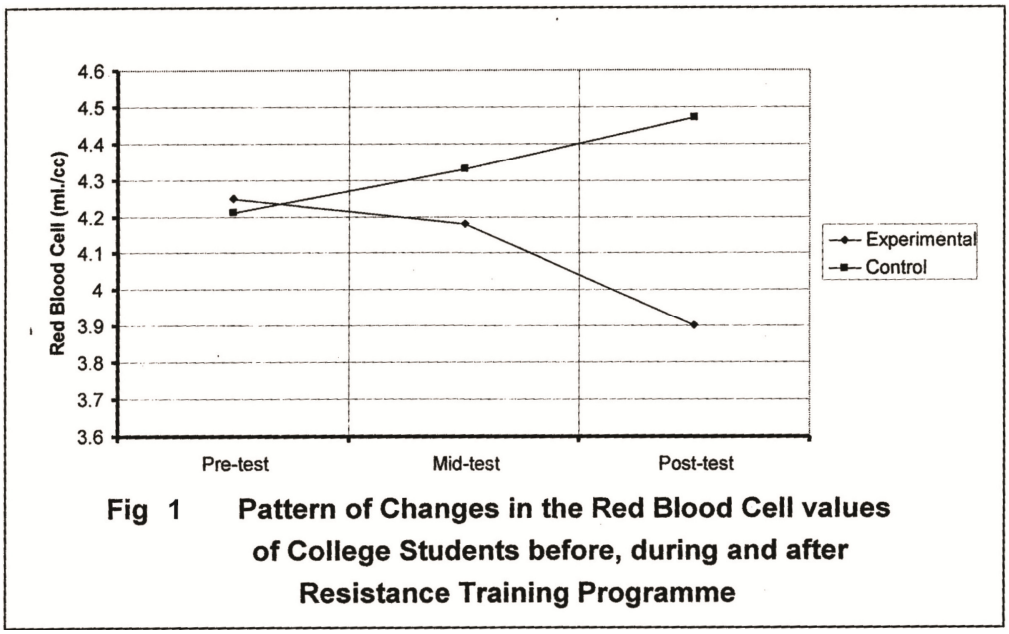

Fig 1 Pattern of Changes in the Red Blood Cell values of College Students before, during and after Resistance Training Programme

Table 1 Recommended Resistance Exercise Prescription

Frequency	2-3 times per week
Intensity	
Time	30 - 60 minutes.
Sets	1 - 3 sets
Type	Weight Training

Recommendations in Sale (1989) Strength training programme.

Table 2: Pre-test, Mid-test and Post-test values of the Hematological Parameters of the Control and Experimental group

Variables	**Group**	**Pre-test Values**	**Mid-test Values**	**Post-test Values**
		Mean SD Range	**Mean SD Range**	**Mean SD Range**
Red Blood Cell (ml./cc)	Control Experimental	4.21 ± 0.65 3.15-5.45 4.25+ 0.46 3.50-5.10	4.33 ± 0.71 3.00-5.50 4.18 ± 0.58 3.05-5.92	4.47 ± 0.68 3.25-5.75 3.90 ± 0.51 3.00-5.50

Table 3 below present he Analysis of Covariance (ANCOVA) for the red blood cells

	Source	**RBC (mmol/L)**
	Covariate	
	Main	15.772
SS	Effect	5.546
	Explained	5.474
	Residual	1077.030
	Total	28.176
MS	**Covariate**	
	Main	15.772
	Effect	5.546
	Explained	9.604
	Residual	57.749
	Total	

F [0.05]=4.03

Table 4: Multiple Classification Analysis (MCA) of ANCOVA on the Red Blood Cells.

Parameters	**Grand Mean**	**Groups**	**N**	**Unadjusted Dev'n**	**Eta**	**Adjusted for Independent + Covariate Dev'n**	**Beta**	**Multiple R^2**
Red Blood Cell (mmol/L)	4.1850	1	30	-0.2917		-.3039		
		2	30	0.2867	.913	0.3039	.761	.579

1 = Experimental group

2 = control group

This academic article was published by The International Institute for Science, Technology and Education (IISTE). The IISTE is a pioneer in the Open Access Publishing service based in the U.S. and Europe. The aim of the institute is Accelerating Global Knowledge Sharing.

More information about the publisher can be found in the IISTE's homepage: http://www.iiste.org

CALL FOR PAPERS

The IISTE is currently hosting more than 30 peer-reviewed academic journals and collaborating with academic institutions around the world. There's no deadline for submission. **Prospective authors of IISTE journals can find the submission instruction on the following page:** http://www.iiste.org/Journals/

The IISTE editorial team promises to the review and publish all the qualified submissions in a **fast** manner. All the journals articles are available online to the readers all over the world without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. Printed version of the journals is also available upon request of readers and authors.

IISTE Knowledge Sharing Partners

EBSCO, Index Copernicus, Ulrich's Periodicals Directory, JournalTOCS, PKP Open Archives Harvester, Bielefeld Academic Search Engine, Elektronische Zeitschriftenbibliothek EZB, Open J-Gate, OCLC WorldCat, Universe Digtial Library , NewJour, Google Scholar