FREE WEIGHTS TRAINING AND IMPACT ON SELECTED PHYSICAL PERFORMANCE VARIABLES OF SECONDARY SCHOOL STUDENTS IN ONDO, ONDO STATE, NIGERIA

Oluwasogo Ruth OGUNLEYE
Wesley University Ondo

Abstract
The advent in technology makes people to spend less time doing physical work while incidence of sedentariness and musculoskeletal disorders increases rapidly. Since schoolstudents enjoyscreen-based activitieswhich is sedentariness, free weights training has the potentials of accommodating such personalities while training the body. Physical performance variables include: arm strength (AS), arm power (AP) and lower back flexibility (LBF) and are required in carrying out daily activities. The pretest-posttest control group quasi experimental design was used. Eighty participants (forty males and forty females) selected from two secondary schools in Ondo townwere randomly assigned to free weights training (FWT)and control groups. The treatment lasted for twelve (12) weeks. Data were analysed using descriptive statistics of frequency countand percentages as well Analysis of Covariance to test the hypotheses at.05 level of significance. There were significant main effects of treatment on the physical fitnessvariablesof AS ($F_{(1,77)}=136.526;P<.05;\eta^2=.639$), AP($_{F(1,77)=}178.091;P<.05;\eta^2=.698$) and LBF ($_{F(1,77)=}$ $294.186;P<.05;\eta^2=.793$).The FWT was potent at improving physical fitness variables; AS, AP and F of secondary school students. Therefore, the youth should engage in FWT for health benefits and improved physical fitness regardless of their stature.

Keywords: Free weights training, muscular strength, muscular power, lowerback flexibility

Introduction

The youth need to live a healthy lifestyle so as to increase the chance of a good life as they grow into adulthood. This is the era of advancement in technology, especially the computer, internet, mobile phones and other information and communication technologies (Ogunleye, 2009; Ogunleye, 2010a) andyoung ones tend to indulge in the excessive use of such technologies thereby engaging with sedentary lifestyle that could eventually lead to diseases such as obesity, hypertension, heart disease, chronic diseases and diabetes at a young age. Maintaining a healthy lifestyle, promotion of peoples' health andimproving the health and longevity of human species have been advocated in different studies by Ogunlela and Ogunleye (2014)and Ogunleye (2012). However, most young people do not realize the benefits derivable from healthy living and the importance of engaging inphysical exercises. Therefore, they are attracted tounhealthy activities such as smoking and drinking which could negatively affects health. This situation negates Ogunleye's (2010b) assertion that the products of science and improved technology needed to be managed effectively to human advantage with scientific knowledge available to the users and consumers of such products and technology.

Adequate physical fitness should be an aspiration of all, because of its immense contributions to a healthy life. Physical fitness is very important to all and sundry for good health and maximum efficiency as the American College of Sports and Medicine (2000) affirms that fitness means

different things to different people, organizations and medical personnel. Ogunleye and Ojo (2019) asserted that physical fitness activities do not only contribute to a healthy life but also the mental capacity and development among secondary school students. It must be seen as an individual matter and such has little meaning unless considered in relation to the specific needs and interests of each individual. More so, it is a desirable quality that can be developed in numerous ways for a variety of reasons. In today's world that is dominated by technological innovations, a high level of fitness may no longer be needed to work. Therefore, there is high rate of inactiveness among young ones.

Physical fitness is positively related to health status across the life span and to functional ability in all populations.Fitness abilities in adolescents are very paramount as it reflects in the process of carrying out daily activities carried out both by conscious and unconscious use of resources in the environment (Ogunleye, 2019).Strength and flexibility in the right combinations contribute immensely to individual activities of daily living comfortably and safely. According to Dahaband McCambridge (2009), children can improve strength by 30% to 50% after just 8 to 12 weeks of a well-designed strength training program.

The amount of muscle strength which can be achieved depends on gender, age and inherited physical attributes (Canadian Society for Exercise Physiology, 2003). It has been extensively documented that strong muscles of the legs, buttocks, back, abdomen, chestand shoulder provide a person with the strength to stand up straight and maintain good posture. More so, strong muscles enable functional movements associated with everyday living. Exercises that strengthen muscles are associated with strengthening bones. Also, strong muscles, tendons, ligaments and bones may decrease the risk of injury as the body is better able to respond to extra loads or falls which the body experiences. Research has shown that the ability to generate maximal power typically results in enhanced athletic performance (Cormie, McGuigan and Newton, 2011). In youth fitness testing, different field tests probably assess different subdomains of muscle power, although the specific associations between individual fitness tests and the power subdomains are poorly defined. Peak muscle power depends on the rate of the action and is reciprocally associated with the external resistance against the action. Peak power has often generated an interval that varies from 40-90% of peak external resistance, or some 70% of individual's one repetition-maximum (1RM) (Reid and Fielding, 2012) and at submaximal velocity.

In males, it has been shown that strength and power increase quickly during the adolescent years, and peaks in the adult years (Balmer, Potter, Bird and Davison, 2005). Greater muscular improvements in pubescent boys, compared with pre-pubescent and elderly males in response to resistance training, are primarily due to an increase in anabolic hormones, specifically testosterone and growth hormone (Crewtheret al.,2006). It is common for strength gains of approximately 30% to be obtained in adolescents over short, 8-20 weeks, training periods (Faigenbaum et al., 2009) with the greatest rate of improvement occurring early in training periods (Falk andTenenbaum, 1996). This accelerated rate of improvement has been shown to slow down by the age of 16-17, particularly in population groups that have trained throughout their early pubescent years (Jagiello et al., 2004).

Flexibility varies between people, significantly in terms of variations in muscle length of multi-joint muscles. A lack of flexibility is related to issues in corporal punishment and sustaining motor activities in everyday life. For example, muscular low back pain may be caused by poor low back/hamstring muscle flexibility. Also, loss of flexibility can be a predisposing factor for physical issues such

as pain syndromes or balance disorders. The sit-and-reach test (SR) was developed to measure hamstring and lower back flexibility. Most SR tests include several varieties of a two-leg floor, raised platform or chair sit-and-reach with or without a box (Koen et al.,2003). Without flexibility, there is a decrease in the efficiency with which an individualcould perform everyday activities. Improper body mechanics has been attributed to poor flexibility.

The use of free weights provides movement versatility and allows a greater specificity of training than weight machines. According to Power and Howley (2004), it also involves large muscle mass and multi-segment exercise, which forces the athlete to control both balance and stabilizing factors. It is often argued that free weight exercises are superior for precisely these reasons. Training using free weights can be an effective form of strength training because exercises can be chosen, and weights precisely adjusted, to safely exhaust each individual muscle group after the specific numbers of sets and repetitions that have been found to be the most effective for the individual. Possible disadvantages of using free weight include the potential for injury (dropping weights), extra people required for spotting and the amount of time required to learn proper lifting technique. Hence, this study examined free weights training and impact on selected physical performance variables of secondary school students in Ondo, Ondo State, Nigeria.

Hypotheses

1. There is no significant effect of treatment on the arm strength (AS) of secondary school students.
2. There is no significant effect of treatment on the arm power (AP) of secondary school students.
3. There is no significant effect of treatment on thelower back flexibility (LBF) of secondary school students.

Methodology

The randomized pretest -posttest control group experimental research design was used for this study. Two secondary schools in Ondo were used for the study. Forty female and forty male students volunteered to participate in this study as their parents' completing and submitting a consent form.The participants were randomly assigned to two groups'; experimental group and control group. The experimental group was exposed to twelve weeks of FWT while the control group wasexposed to indoorgamessuch as playing *Ludo* games and cards playing.

The instruments used for this study were:Free weights of barbells, dumbbells, medicine balls, Hand-grip Dynamometer, and Flexibility Box.

Method of Data Analysis

Descriptive statistics of frequency count and percentages were used to analyse the demographic data while the inferential statistics of ANCOVA was used for the hypotheses at .05 level of significance. These are in line with the statistical prescriptions of Akinsola and Ogunleye (2004) and inference-making guidelines of Ogunleye (2008).

Results

Demographic Data

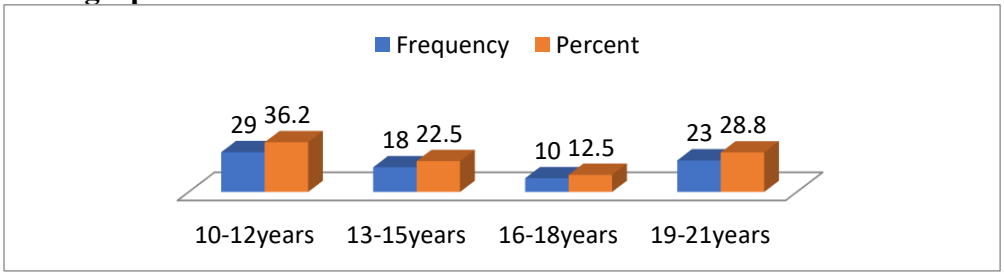

Figure 1: Bar Chart Showing Distribution of the Participants Age

Figure 1 shows that the participants were well represented across secondary school age bracket ranging from 10 years to 21 years.

Hypotheses Testing

Ho 1: There is no significant effect of treatment on the arm strength (AS) ofsecondary school students in Ondo.

Table 1: Summary of ANCOVA of Effect of Treatment on Arm Strength of Secondary School Students

Source	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	8627.036	2	4313.518	585.165	.000	.938
Intercept	230.181	1	230.181	31.226	.000	.289
Pretest	8152.698	1	8152.698	1.106E3	.000	.935
Treatment	1006.394	1	1006.394	136.526	.000*	.639
Error	567.602	77	7.371			
Total	110554.960	80				
Corrected Total	9194.638	79				

*significant

The result in table 1 shows a significant main effect of treatment on AS of the secondary school students in Ondo ($F_{(1,77)}= 136.526; P<.05; \eta^2=.639$). Hence, the null hypothesis is rejected. The partial eta square of .639 indicated that the effect of the treatmentwas large on AS.

Table 2: Estimated marginal mean of Arm Strength

			Lower Bound	Upper Bound
FWT	39.164	.431	38.307	40.022
Control	32.026	.431	31.168	32.883

Table 2 indicated FWT having higher ($\bar{x}$=39.16) compared to the arm strength of ($\bar{x}$=32.03) obtained by the control group. This implies that even though both the FWT and control grouphad strong AS, the FWT did better than the control group.

Ho 2: There is no significant effect of treatment on the arm power (AP) ofsecondary school students in Ondo

Table 3: Summary of ANCOVA of Effect of Treatment on Arm Powerof Secondary School Students

Source	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	22.628	2	11.314	1.723E3	.000	.978
Intercept	.054	1	.054	8.263	.005	.097
Pretest	20.725	1	20.725	3.156E3	.000	.976
Treatment	1.170	1	1.170	178.091	.000*	.698
Error	.506	77	.007			
Total	1720.353	80				
Corrected Total	23.134	79				

*significant

The result in table 2 shows a significant main effect of treatment on AP of the secondary school students in Ondo ($F_{(1,77)}= 178.091; P<.05; \eta^2=.698$). Hence, the null hypothesis is rejected. The partial eta square of .698 indicated that the effect of the treatmentwas large on AP.

Table 4: Estimated Marginal Mean of Arm Power

Treatment	Mean	Std. Error	Lower Bound	Upper Bound
FWT	4.727	.013	4.702	4.753
Control	4.485	.013	4.459	4.510

Table 4 indicated FWT having higher ($\bar{x}$=4.73) compared to the arm power of ($\bar{x}$=4.49) obtained by the control group. This implies that even though both the FWT and control grouphad an excellent AP, the FWT did better than the control group.

Ho 3: There is no significant main effect of treatment on the lower back flexibility (LBF) ofsecondary school students in Ondo

Table 5: Summary of ANCOVA of Main Effect of Treatment on Lower Back Flexibilityof Secondary School Students

Source	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	2332.772	2	1166.386	1.482E3	.000	.975
Intercept	116.736	1	116.736	148.367	.000	.658
Pretest	2332.194	1	2332.194	2.964E3	.000	.975
Treatment	231.467	1	231.467	294.186	.000*	.793
Error	60.584	77	.787			
Total	33574.660	80				
Corrected Total	2393.355	79				

*significant

The result in table 3 shows that there was a significant main effect of treatment on F of the secondary school students in Ondo ($F_{(1,77)}= 294.186; P<.05; \eta^2=.793$). Hence, the null hypothesis is rejected. The partial eta square of .793 indicated that the effect of the treatmentwas large on F.

Table 6: Estimated Marginal Mean of Lower Back Flexibility

			Lower Bound	Upper Bound
FWT	21.54	.144	21.25	21.83
Control	17.94	.144	17.65	18.22

From Table 6, there was an indication that FWT had higher LBF of ($\bar{x}$=21.54) compared to the LBF of ($\bar{x}$=17.94) obtained by the control group. This implies that even though both the FWT and control group had excellent LBF, the FWT did better than the control group.

Discussion

It was observed from this study that treatment had a significant effect on the AS of students with FWT group's mean higher than their counterparts in the control group. This implies that the arm exercises the FWT participants engaged with which strictly adopted the Frequency, Intensity, Type and Time (FITT) principlehad significant improvement in developing the arm strength. In this direction, Alberga, et al. (2013) reported a significant increase in arm strength following twelve weeks training though did not specify the type of resistance training. Ina study by Ojo and Oladipo (2018), it was reported that there wasimprovement in the arm strength of soccer players with body weight resistance exercises. Therefore, they would be able to carry out their daily activities appropriately with less fatigue and injury.

The findings of this study also revealed that treatment had significant effects on the arm power (AP) of the participants. The participants engage in exercises that develop the arm power over the period of twelve weeks (i.e time and type of exercises based on the FITT theory of strength training). Therefore, participants in the FWT had the highest mean than their counterparts in the control groups. This means that the effect of the upper body exercises was effective on the Variable Resistance Training group. Ojo and Oladipo (2018) reported that body weight resistance training prompts greater performance improvements in arm power ability. Though, Bartolomeil, Hoffman, Stout and Merni, (2016)reported no significant improvement of arm power after a six week of resistance training and measures of seated medicine ball throws. This study shows a significant improvement on the seated medicine ball throws of arm power after twelve weeks of training.

There was a significant main effect of treatment on the lower back flexibility of the participants who took part in this study and participants in the FWT had the highest mean than participants in the control group. This means that FWT was effective in developing lower back flexibility. It shows that FWT improves the muscles of the back, hip and thigh.Ribeiro et al. (2017) reported that resistance training improves the flexibility of different joint movements in young adult men and women.Also, free weights' training improves lower back flexibility better than other conventional resistance training (Ojo, 2019). Furthermore, this study reveals that there was a significant improvement on the flexibility of younger ones after twelve weeks of free weights training.

Conclusion

It has been established that FWT is important as a strategy for implementing the physical and health education programmes in secondary schools. The study has established the impact of free weights training on selected physical performance variables of secondary school students.

Recommendations

Based on the findings of this study, it is hereby recommended that:

- Free weightstraining should be adopted by trainers as a viable alternative training to other conventional training

techniques to improveyoung one's muscular strength and muscular power.
- Free weights training if properly supervised can be used to improve the lower back flexibility.
- If this strategy is employed, the effectiveness of physical activities towards muscular strength, muscular power and lower back flexibility will be guaranteed.

References

Akinsola, M. K. & Ogunleye, B. O. (2004). Statistical methods and research design in education. Unpublished Mimeograph, Department of Teacher Education, University of Ibadan. Ibadan, Nigeria.

Alberga,A. S., Farnesi,B. C., Lafleche,A., Legault, L. H.,& Komorowski, J.(2013). The effects of resistance exercise training on body composition and strength in obese prepubertal children.*Physician and Sports Medicine,41*(3),103-9.

Balmer, J., Potter, C.R., Davison, R.C. and Bird, S. (2005). Age-related changes in maximal power and heart rate recorded during a ramped test in 114 cyclists aged 15-73 years. *Journal of Aging and Physical Activity*, *13*(1), 75-86.

Barratt, M. (2010). "Foundations for Movement." p. 27. Barratt, Marcia, et al. *Foundations For Movement.* Dubuque, I A: Wm. C. Brown Co., 1964. Print. Edited.

Bartolomeil, S., Hoffman, J. R., Stout, J. R. & Merni, F. (2016). Effect of lower body resistance training on upper body strength adaptation in trained men. *Journal of Strength and Conditioning Research,15(3),44-62.*

Blakey, W.P. (1994). Stretching Without Pain. Canada: Twin Eagles Educational and Healing, Institute Print.

Canadian Society of Exercise Physiology (2003). The Canadian Physical Activity, Fitness and Life style Approach. 3rd edition, Otawa: CSEP.

Cormie, P., McGuigan, M.R. & Newton, R.U. (2011). Review article: Developing maximal neuromuscular power part 1: Biological basis of maximal power production. *Journal of Medicine* 41(1), 17-38. Retrieved from www.ncbi.nlm.nih.gov/ /17526834.

Crewther, B., Keogh, J. Cronin, J. and Cook, C. (2006).Possible stimuli for strength and power: acute hormonal responses. *Journal of Sports Medicine, 36*(3), 215-38.https://www.ncbi.nlm.nih.gov/pubmed/16526834.

Dahab, K. S. & McCambridge, T. M. (2009). Strength Training in Children and Adolescents *Sports Health, 1*(3), 223–226.

Faigenbaum, A.D., Kraemer, W.J., Blimkie, C.J.R., Jeffreys, I., Micheli, L.J., Nitka, M. & Rowland, T.W. (2009).Youth resistance training: Updated position statement paper from the National Strength and Conditioning Association.*Journal of Strength Conditioning Research,*23(5),60-79. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/19620931.

Falk, B. & Tenenbaum, G. (1996).The effectiveness of resistance training in children. A meta analysis. *Journal of Sports Medicine* 22, 176-186.

Franklin, B. A., Whaley, M. H., Howley, E. T. & Balad, G. J. (2000). American College of Sports Medicine ACSM's Guidelines for Exercise Testing and Prescription Seventh Edition. Lippincott Williams & Wilkins. ISBN 0683303554, 9780683303551.

Frontera, W.R., Slovik, D.M. & Dawson, D.M. (2006). Exercise in Rehabilitation

Medicine. Human Kinetics. ISBN 978-0-7360-5541-3.

Holt, L., Pelham, T. & Burke, D. (1999). Modifications to the standard Sit-and-Reach flexibility protocol. *Journal of Athletic Training* 34(l), 43-47.

Jagiełło, W., Kalina, R.M. & Tkaczuk, W. (2004). Development of strength abilities in children and youth. *Biology of Sport,*21:4.

Junior, H. S. & Cyrino, E. S. (2017).Effect of resistance training on flexibility in young adult men and women. *Isokinetic and Exercise Science, 25* (2),149-155.

Koen, A., Lemmink, H., Kemper, G., Mathieu, H.G., DeGreef, P. R. and Martin, S. (2003).

Ogunlela, V. B. & Ogunleye, B. O. (2014). Promoting quality assurance practices for ODL programmes in West African higher education institutions: The role of RETRIDAL. *International Open and Distance Learning Journal.4th ACDE 2014 Special Edition*, 95-108.

Ogunleye, B. O. (2019). Effects of concrete-representational-abstract instructional strategy on chemistry performance of students with mathematics learning difficulties in Ogun State, Nigeria. *Kampala International University Journal of Education,14(2),135-151.*

Ogunleye, B. O. (2008). Statistical data analysis and making inferences. In A. I. Olayinka, A. L. Popoola and A. Ojebode (Eds) *Methodology of Basic and Applied Research*. Ibadan: The Postgraduate School, University of Ibadan 128-139.

Ogunleye, B. O. (2009). Integration of contemporary ICT tools in the teaching of Chemistry: awareness and attitudes of Chemistry teachers in South West, Nigeria. *Journal of e-Learning*, *8* (2), 1-18.

Ogunleye, B. O. (2010a). Computer literacy and attitude to computer as predictors of Chemistry teachers' utilization of computer technology in selected Nigerian schools. *African Journal of Educational Research, 14* (1 & 2), 20-29.

Ogunleye, B. O. (2010b). Implementation of chemistry practical work in senior secondary schools in Ogun State, Nigeria. *African Journal of Educational Management, 13* (2), 227-242.

Ogunleye, B. O. (2012). Relationship among teachers' science process skills, scientific attitudes andstudents' performance in Chemistry. *International Journal of Educational Leadership, 4* (4), 41-48.

Ogunleye, B.O.& Ojo, O. R. (2019). Impact of physical fitness activities on students' Basic Science achievement in selected Nigerian secondary schools. *Annual Journal of Technical University of Varna, Bulgaria, 3(*2), 21-31. https://doi.org/10.29114/ajtuv.vol3.iss2.145.

Ojo, O. R. & Oladipo, I. O. (2018). Effect of body weight resistance training on power and strength ability among soccer players of Wesley University Ondo. *International Journal of Physical and Health Education, Sports and Dance, 6,120-132.*

Ojo, O. R. (2018).Comparative effects of variable resistance and free weights training on selected motor performance skills of adolescents in Ondo, Nigeria. Seminar Paper.

Power, S.K. & Howley, E.T. (2004). Exercise Physiology: Theory and Application to Fitness and Performance. 5th ed. New York: McGraw-Hill.

Reid, K.F. & Fielding, R.A. (2012). Skeletal muscle power: A critical determinant of physical functioning in older adults.

Exercise and Sport Sciences Reviews, 40 (1), 4–12.

Ribeiro, A. S., Filho, M. G., Avelar, A., Santos, L. Junior, A. A. Aguiar, A. F., Fleck, S. J. The validity of the sit-and-reach test and the modified sit-and-reach test in middle-aged to older men and women.*Research Quarterly for Exercise and Sport* 74(3), 331-337 Retrieved fromhttps://www.researchgate.net/publication/308038674.