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EFFECTS OF EIGHT (8) WEEKS CARDIO EXERCISE ON FORCE EXPIRATORY VOLUME OF OVERWEIGHT MALE ADOLESCENTS IN YADIN GARUN-KURAMA, KADUNA STATE, NIGERia

BY

Balarabe, J.[1]; Suleiman, U. O[1]; Kingsley, J. I[1]., Ubaidu, A[1]., Achikasim, N.C.M[2]; Gwani, J.A[1]

[1]Department of Human Kinetics and Health Education, Ahmadu Bello University, Zaria

[2]Nigeria Army Departments of Training and Operation, Army Headquarters, Garki, Abuja, Nigeria
joe16balarabe@gmail.com

ABSTRACT

This study assessed the effects of eight (8) weeks Cardio Exercise on forced expiratory volume (FEV1) of overweight male adolescents in Yadin Garun Kurama, Kaduna State, Nigeria. Twenty eight (28) male adolescents were selected from the total population of 87 students. The participants were selected based on the inclusion and exclusion criteria which included BMI between 25.0 kg/m^2 and 29.9kg/m^2, male adolescents whose ages were between 10 and 13 years old and had no underlying health risk factors that will aggravate their participation in the training programme. Anthropometric and pulmonary measurements were taken at baseline and after the 8th week of training that is post-test. Quasi-experimental research design was used for this study. The Spiro bank G device by MIR, Roma, Italy was used to measure the force expiratory volume. Borg's rating scale was used to monitor the perceived intensity of the training programme. Data were analysed using SPSS software (version 21). The descriptive statistics of means, standard deviation, and standard error of means were used to analyze the physical characteristics (age, weight, height, and BMI) and raw data of the variables. t-test was used to analyze the effect of the training programme on the variables. An alpha level of 0.05 was used for all statistical analyses. The results of the study showed significant improvement in forced expiratory volume in one second (FEV1) (19.01%) following eight weeks of jogging. It was recommended that adolescents should be encouraged to participate in regular jogging to improve and maintain a normal forced expiratory volume in one-second function.

Keywords: Cardio, Exercise, Force Expiratory Volume, Overweight, Adolescence.

Introduction

Cardio exercise is any rhythmic activity that raises the participant's heart rate into his target heart rate zone, this zone, is where the participant burns the most fat and calories. Some of the most common examples of cardio include walking, jogging cycling, and swimming. Part of what sets cardio aside from other types of exercise such as strength training is that it relies on your body's ability to use oxygen during the workout session (Healthline, 2023). A person's cardio ability or capacity can vary based on several factors (Offor, 2022). Research published by the American Heart Association reports that genetics have a 20% to 40% influence over what you can do cardio-wise (Henriksson, Henriksson, Tynelius, Ekstedt, Berglind, Labayen, Ruiz, Lavie, & Ortega, 2020).

Regular cardio exercise training and good physical fitness are related to better pulmonary function (Silva, Filho, Soares, Ritti-Dias & Farah, 2022). Among the different systems affected by being overweight, the respiratory system needs special attention, as being overweight can cause changes in respiratory function (Nazeer, Jan, Rafiq, & Aara, 2023). The main function of the respiratory system is to maintain blood gas levels within fixed limits and to provide gas exchange between blood and air. (Kılıç & Göriş, 2020). There is relationship between pulmonary function and overweight (Ullah, Usman, Gul, & Muhammad, 2022). scientifically, indicators based on weight and height measurements such as body mass index (BMI) which is defined as a person's weight in kilograms (kg) divided by the square of height in meters (m), are mostly used for clinical practice and epidemiological studies in classifying body weight status (Anumah, Mseila-Ren, Omonua, Adelaiye, Suaibu, & Odumodu, 2020). Being overweight inflicts changes in mechanical properties e.g. elasticity, compliance, and resistance of the respiratory system, mainly for excess chest fat, limiting lung expansion and also impairing strengths of dilation that maintain the potency of airways which increases contractility and responsiveness on the smooth musculature of air airways (Liu, Ma, Fan, Yu, Wang, & Littleton, 2023; Hermassi, Hayes, Sanal-Hayes & Schwesig,2022).

The World Health Organization (WHO, 2012), estimated that 43 million children are overweight and even in their preschool years and 35 million of these children are in developing countries. The prevalence of overweight among adolescents aged 5 – 19 has risen dramatically from just 4% in 1975 to over 18% in 2016 (WHO, 2016). Recently, in 2017, WHO also estimated that about 340 million children and adolescents aged 5 – 19 were overweight (WHO, 2017). Adolescents make up about 20% of the world's population, with 85% living in developing countries (Dehne, Karl, Riedner, Gabriele, 2001). Adolescence is a stage of maturation between childhood and adulthood and a critical period characterized by rapid growth and change with respect to physical, cognitive and social development (Chaitra, Ramesh, Deviprasad, Seema & Vijay, 2013). The World Health Organization defines adolescence as the period between the ages of 10 to 19 years (WHO, 2012).

Overweight in Adolescent is a serious public health problem because of its strong association with adulthood overweight and the related adverse health consequences (Andersen, Crespo, Bartlett, Cheskin & Pratt, 2005). The negative impact of overweight on pulmonary function in adolescents is directly proportional to the degree of overweight, which causes reductions in expiratory reserve volume (ERV); increase in small airway resistance; increase in the residual volume to total lung capacity ratio (RV/TLC); reduction of lung and thorax compliance; reduction of oxygen arterial pressure, increase in oxygen arterial-alveolar difference, and alveolar hypoventilation (Memish, El-Bcheraoui, Tuffaha, Robinson, Daoud, Jaber, Mikhitarian, Al- Saeedi, Al-Mazroa, Mokdad & Al-Rabeeah, 2014).

The common causes of overweight include excess caloric intake and lack of physical activity (Shamaki, Markson, Idemudia, Murphy, Bob-Manuel, Antia, & Corteville, 2023). The relationship between overweight and body mass index is directly proportional (Jordan, Indraswari, Basyar, & Puruhito, 2023), that is, the higher the body weight, the higher the BMI and vice versa. Exercise has been constantly adopted as a preventive method to reduce BMI, and to improve cardiorespiratory fitness (Martinsone-Bērzkalne, Umbraško, Duļevska, Pļaviņa, Cīrule, & Oginska, 2020). However, recent studies have associated overweight with limitations of pulmonary function in adolescents, which result in more resistance for physical exercise and experience of related disorders (Mahajan, Hundal, Arora, & Gupta, 2020).

FEV1 is the maximal volume of air exhaled during the first second. This is usually 70 - 80% of the forced vital capacity. Wee, Min, Park, Park, Park, and Choi, (2021), conducted a study on athletes who were non-smokers between the ages 13-19, they found athletes that who engaged in team sports like football, volleyball, basketball and hand ball had higher FEV1 values as compared to swimmers, long-distance runners and skiers. Bostanci, Kabadayi, Mayda, Yilmaz, and Yilmaz, (2021), found that FEV1 values of children 13-16 who engaged in sports was 2.78± 0.60 liters while FEV1 values of the children who were also 13-16 years of age but not engaged in sports were found to be 2.57± 0.64 liters. FEV1 is the volume of air expired in the first second of maximal expiration after a maximal inspiration and is a useful measure of how quickly lungs can be emptied (Debeaumont, Tardif, Folope, Castres, Lemaitre, Tourny, Dechelotte, Thill, Darmon, & Coquart, 2016).

Shashikala and Jaiswal, (2022) compared the four different groups that engaged in basketball, volleyball, and other individual sports among themselves and with sedentary groups; they concluded that FVC and FEV1 values of all groups were higher than sedentary groups. In another research to compare lung functions among Yogis, Athletes, and Sedentary individuals, the researchers found that both athletes and Yogis have better PEFR and FEV1 than sedentary individuals. Yogis and athletes had similar lung functions

except for better PEFR among Yogis (Rahmania, Prabowo, & Tessa, 2016). When exercise testing is performed to identify the presence of exercise-induced asthma, spirometry is measured periodically over the 30 minutes after a 6-8 minutes bout of high-intensity exercise.

A decrease in FEV1 in the post exercise recovery period of 15% or more compared with before exercise is the most widely used criterion for identifying exercise-induced bronchoconstriction. (Bostanci, *et al*; 2021).

Cardio exercise has been one of the means of testing the physical capabilities and physiological responses of an individual that form the basis of good health and well-being (Harsoda & Purohit, 2020). It develops the ability to tolerate and withstand stress and carry on in circumstances where an unfit person cannot continue (Dominic & Kishore, 2021).

The World Health Organization recognizes that childhood overweight and obesity have reached epidemic proportions in most industrialized countries (Wilson, Thai, Williams, Nutter, Myre, & Russell-Mayhew, 2023). The definitions of overweight and obesity are based on the percentile values of body mass index (BMI), adjusted for age and gender, corresponding to a BMI of≥25.0 and ≥30.0 kg/m^2, respectively, as recommended by the (Phan, Nguyen, Bui, Doan, Nguyen, & Van Minh, 2020).

Among the different systems affected by being overweight, the respiratory system deserves special attention, as being overweight can cause changes in respiratory function, exercise tolerance, pulmonary gas exchange, respiratory pattern, strength and endurance of the respiratory muscles (Nazeer, *et al,* 2023).

Purpose of the study

The purpose of this study was to assess the effect of eight (8) weeks Cardio Exercise on Forced expiratory volume in one second (FEV1) of overweight male adolescents in Yadin Garun Kurama, Kaduna State.

Materials and Method

Quasi Experimental design was used to test the effect of eight weeks cardio exercise on overweight male participants at pretest and posttest (baseline and at eight week). Eighty seven (87) male students of upper basic LGEA Primary school, Yadin Garun Kurama in Lere local government, Kaduna State, Nigeria; whose age were between10-13 were selected. The participants were selected using informed consent form and Physical Assessment Readiness Questionnaire (PAR-Q) which were used to screen participants for the study. The BMI was computed as weight (kg) divided by height in meter squared (m^2) (Selland, Kelly, Gums, Meendering, & Vukovich,2021). The adolescents who's BMI

were between 25.0 kg/m^2 and 29.9kg/m^2 were selected for this study and only 28 pupils met the inclusion criteria.

The participants warm up for 5-10 minutes at the school playground before the commencement of the training. This was done to prepare the body system for the physical exertion so as to prevent injuries before the exercise programme. After the warm-up, the participants began the jogging training under the supervision of the researcher and the research assistants. The trainings were altered depending on the rate of perceived physical exertion (RPE) of the participants using the modified Borg Scale. The scale rates from 6-20; where 6 stands for "no exertion at all" while 20 stands for "maximal exertion" to permit optimal adaptation to aerobic training. The first two weeks of training, representing the initial training phase were maintained between 8 and 9 which are 'very light'. The second phase of two weeks of training was maintained between 10 and 11 representing 'light'. The final two weeks were monitored between 12 and 13 representing rate of perceive exertion (RPE) of 'somewhat hard'. The participants were taught the RPE rating of between 6 and 20. During 0-4th week of training, participants jog at 40-50% Max HR intensity (HR max). During the 5-6th week, the participants jogged at 50-60% intensity HR. The last session 7-8th week, the participants jogged at 60-70% intensity (HR max). All post-training programme measurements were taken from the participants at the end of the 8th week. Descriptive Statistics was used to analyze the central tendency and variability values of the collected data (means, standard deviation and standard error).the variables. An alpha level of 0.05 was used to retain or reject the hypotheses that were raised for this study.

Results

Twenty eight (28) adolescents participated in the study for duration of 8 weeks. Training was conducted on three alternate days per week (Mondays Wednesdays and Fridays). Information on the physical characteristics (age, weight and height and body mass index: BMI) of the subjects used in this study is presented in table 1.

Table 1: Physical Characteristics of the Participants

Variables	Mean	SD	SE
Age (yrs)	12.11	1.57	0.25
Weight (kg)	65.79	4.58	0.77
Height (m)	1.10	0.05	0.01
BMI (kg/m^2)	26.23	1.33	0.23

Note: BMI= Body Mass Index; kilogram per metre square (kg/m^2)

The mean age of the participants was 12.11±1.57 years with an average height, weight and BMI of 1.10±0.05m, 65.79± 4.58kg and 26.20±1.30kg/m^2) respectively. An observation of the BMI classification revealed that the participants were overweight (26.20kg/m^2).

Table 2: Paired t-test analysis of the pre and post test scores of FEV1 of the subjects

Variable	Testing Period	Mean	SD	Df	T	p
	Pre test	1.90	0.33			
FEV_1				31	-4.284	0.001
	Post test	2.28	0.34			

t (31) = -4.284 $p \leq 0.05$ * = significant

Table 2 shows the paired t-test analysis of the pre-posttest scores of the FEV_1 of the participants. An observation of the result showed that 12 weeks of jogging had significant effect on the FEV_1 of the subjects t(31) = -4.284, $p \leq 0.05$). FEV_1 had significant improvement of 19.01%. Therefore, jogging training had a significant effect on forced expiratory volume in first second (FEV_1) of overweight male adolescents in Yadin Garun Kurama Kaduna State, Nigeria.

Discussion

The findings of this study revealed a significant improvement in mean values of forced expiratory volume in one second (FEV_1) of the participants who engaged in jogging FEV_1 increased from 1.90±0.34 to 2.28±0.36 which represents an increase of 19.069% after 8 weeks of jogging.

These results is in line with the study of Bostanci, *et al*; (2021), who found that FEV_1 values of children 10-13 who engaged in sports was 2.69± 0.60 liters while FEV_1 values of the children who were also 10-13 years of age but not engaged in sports was found to be 2.57± 0.64 liters. The increase in the FEV_1 of overweight adolescents due to training as observed in this study is also in agreement with the findings of Egbono, Mong, and Gonsi, (2023), who concluded that aerobic exercise training in adolescents leads to improved lung function parameters (FEV_1 and FVC).

Frenzel, Bis, Gudmundsson, O'Donnell, Simino, Yaqub, Bartz, Brusselle, Bülow, and DeCarli (2022), also showed that the release of catecholamine during exercise causes a significant rise in FEV_1 after exercise in adolescents. Muthukrishnan, Lakshmi, Sathyanath, & Muralidharan, (2023), studied the cardiopulmonary changes with exercise in adolescents and observed an increase in FEV_1.

The findings of this study revealed a slight increase but non-significant improvement in mean values of FEV_1/FVC. FEV_1/FVC increased from 73.55 ± 16.21 to 76.65 ± 12.73 which represents an increment of 4.21% after 8 weeks of jogging. This result is in agreement with the findings of Phan and his colleagues who found a reduction in mid-expiratory flows and the FEV_1 to FVC ratio (Phan *et al*., 2020). This result also agrees with the findings of the study carried out by Kaise, Sakihara, Tamaki, Miyata, Hirahara, Kirichek, Tawara, Akiyama, Katsumata, & Haruya, (2021).

Conclusion

Based on the findings of this study, it is concluded that cardio exercise for 8 weeks significantly improved FEV_1 of overweight male adolescents in Yadin Garun Kurama, Kaduna State.

Recommendation

It is therefore recommended that cardio exercise should be used as an alternative exercise to improved FEV_1 of overweight male adolescents in Yadin Garun Kurama, Kaduna State. Parents/teachers should encourage their children engage in any form of physical activity, particularly cardio exercise, this would prevent the prevalence of overweight in adolescents.

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