



ASSESSMENT OF THE EFFECT OF STEP AEROBICS ON BODY FAT PERCENT OF OVERWEIGHT FEMALE ADOLESCENTS IN GINDIRI, PLATEAU STATE, NIGERIA

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Abstract

This study assessed the effect of step aerobics on body fat percent of overweight female adolescents in Gindiri, Plateau state, Nigeria. One group repeated measure experimental research design was used. Sixteen (16) overweight female adolescents who were between 14 and 16 years volunteered to participate in the study. The participants were subjected to 8-week step aerobics exercise performed three times a week on alternate days. The training intensity was maintained at between 45% and 50% of heart rate reserve (HRR) and 50% to 55% HRR at the first 4 week and 5th – 8th week respectively. The Borg's rate of perceived exertion (RPE) scale was used to monitor the rate of exertion throughout the training period. Bioelectrical Impedance Analysis (BIA) method was used to assess body fat percent of the participants. Body fat percent of the participants was measured at baseline, immediately after the 4th week and 8th week respectively. Descriptive statistics were used to analyze demographic data of the participants. Repeated-measures Analysis of Variance (ANOVA) was used to test hypothesis at 0.05 level of significance using Statistical Package of Social Sciences (SPSS) version 23. The result of the study revealed significant decrease in body fat percent due to 8-week step aerobics training ($p < 0.000$) at an alpha level of 0.05. It was concluded that moderate intensity step aerobics performed at 45% -55% HRR three times a week on alternate days for a period of 8 weeks had significant effect on body fat percent of overweight female adolescents in Gindiri, Plateau State, Nigeria. It was recommended that overweight female adolescents should participate regularly in step aerobics to manage body fat percent to achieve optimal health.

Key words: BIA, Body fat percent, Female adolescents, Heart rate reserve, Moderate intensity, Overweight, Step aerobics.

Introduction

Adolescence is a developmental stage in life where females experience a sharp increase in the production of progesterone, oestrogen and small amount of androgen and testosterone which cause reproductive maturation and stimulate physical growth towards adulthood (Kapur, 2015, Todd, Street, Ziviani, Byrne & Hills, 2015). Girls mature early in life usually around the age of 12 years (Bay, Mora, Sloboda, Morton, Vickers & Gluckman, 2012). They show signs of developed adult adipose tissue and lean body mass. During middle adolescence, female's show a decrease in their growth process and most of them are fully developed during late adolescence (Bay *et al.*, 2012).

Puberty is a period of physiological change in adolescents characterised by a decrease in insulin sensitivity (Kelsey & Zeitler, 2016). Insulin insensitivity is the major mechanism in the development of metabolic syndrome (MS) (Vukovic, Milenkovic, Mitrovic, Todorovic, Plavic, Vokovic & Zdravkovic, 2015). The term "metabolic syndrome" is a universal term used to indicate that an individual has three out of the following five risk factors: visceral adiposity, high blood pressure, high level of glucose, high level of triglycerides and low level of high-density lipoprotein cholesterol (HDL-C) in individuals (Magge, Goodman, & Armstrong 2017). Kaur (2014) opined that MS is the association of clinical, biochemical, physiological and metabolic factors that are present in an individual which could lead to the growth of atherosclerosis, type II diabetes mellitus (TIIDM), and many causes of cardiovascular mortality. Park, Sovio, Viner, Hardy & Kinra, (2013) posited that some children and adolescents are already being diagnosed with some common adult diseases, when left untreated these diseases will continue throughout one's lifetime and will cause a rise in the risk of cardiovascular diseases and metabolic syndrome later in life.

Gungor (2014) reported that overweight is the accumulation of excess fat in the body which causes increase in body weight. Body Mass Index (BMI) is often used to estimate overweight in individuals by dividing the weight of the body in kilograms by height in meters squared (kg/m^2). A person with a BMI of 25 kg/m^2 - 29.9 kg/m^2 is considered being overweight. Omisore, Omisore & Abioye-Kuteyi, (2015) reported that the incidence of overweight and obesity among Nigerian adolescence whose ages are 12 - 18 years and are in secondary school is 0 - 2.7% in males and 0 - 9% in females.

Body fat percent is the proportion of the weight of fat in the body in relation to total body weight (Xu, Liu, Liu, Zhu & Han, 2017). MS risk is increased when the percentage of fat in the body is high more specifically visceral fat which affects metabolism (Olafsdottir, Torfadottir, & Arngrimsson, 2016). The BMI is associated with visceral adiposity and is used in assessing the risk of cardiometabolic diseases which serves as a target of cardiometabolic disease therapy (Shah, Murthy, Abbasi, Blankstein, Kwong, Goldfine, Jeroh-Herold, Lima, Ding, & Allison, 2014). Using BMI alone does not categorically identify those at an increased risk of cardio-metabolic diseases, it must be used in combination with BIA method. There is a strong association between metabolic disease risk with regional fat mass and total body fat (Tchernof & Despres, 2013). Body fat percent, waist to hip ratio and circumference of the waist are usually used in calculating measures of body fat percent and are strongly associated to BMI and MS risk (Bener, Yousafzai Darwish, Al-Hamaq, Nasralla & Abdul-Ghani 2013, González-Muniesa, Martínez-González, Hu, Després, Matsuzawa, Loos, Moreno, Bray & Martinez, 2017). The most recent frequently used procedure in clinical practice to analyze body composition and estimate body fat percent is BIA method due to its exactness, ease to use and it correlates well with dual-energy X-ray absorptiometry (DXA), computed tomography (CT) or magnetic resonance imaging (MRI) (Xu, Cheng, Wang, Cao, Sato, Wang, Zhao & Liang, 2011).

Energy balance is the main cause of overweight and obesity, when the body is not able to use all the energy consumed, achieving an energy imbalance helps in preventing overweight in children and adolescents (Wang, Olean & Gortmaker, 2012, Pandita, Sharma, Pandita, Pawar, Tariq, & Kaul, 2016). People who combine sensible eating habit with exercise can have a better reduction in their body fat percent, most especially visceral fat than in other areas affected by the exercise (Marandi, *et al.* 2013). Increase in physical activity (PA) can cause a rise in insulin sensitivity in muscles and glucose usage for energy production. The enzyme lipoprotein lipase (LPL) regulates fat storage, and when PA level raises the release of stored energy in adipose tissue increases, the oxidation of carbohydrates and fat from the muscle is also increased (Hochber, 2011). Skeletal muscle metabolism thus plays a significant role in fat metabolism. The substrates needed for energy supply in the working muscles during continuous moderate exercise are the non-esterified fatty acids transported into muscle from the circulation, as well as from lipolysis of intramuscular triacylglycerol (Van Hall, 2015). During exercise the rate of metabolism and demand for energy increases many folds over the resting rate thereby activating the metabolic pathways for the oxidation of fat and carbohydrate at the same time (Spriet, 2014).

Adolescents are supposed to experience balance growth both in height and weight and are not to be overweight or obese because of their high energy expenditure during this active stage of their growth and development. The school environment and activities encourage active lifestyle and does not permit sedentary living. However, most adolescent girls are living a sedentary lifestyle despite the (WHO, 2011) recommendation that people should perform physical activity at a moderate to severe intensity lasting at least 60 minutes or more daily to achieve optimal health. Most female adolescent girls of Girls High School Gindiri are living a sedentary lifestyle, they are not regularly involved in sporting activities organized by the school. They spent their leisure time doing their assignment, chatting or playing games with their phones.

Step aerobics is a cardiovascular workout that involves stepping up and down on a step platform that can be modified which makes it versatile. People of all fitness levels can engage in it because the height of the step bench can be modified to suit their fitness levels (Nikić & Milenkovic, 2013, Laurel, 2014). Step aerobics could be beneficial particularly to those who

desire to improve their body composition and VO_{2max} . Therefore, this study investigated the effect of step aerobics on body fat percent of overweight female adolescents in Gindiri Plateau State, Nigeria.

Methods and Material

In this study, one group repeated measure experimental research design was used. With this design the participants were assed at three (3) different intervals at baseline, first and second levels of exercise intensity. In the first exercise level, the participants performed step aerobics exercise on a bench height of 10.16cm at an intensity of 45% - 50% HRR for 4 weeks. While in the second exercise level, the participants performed step aerobics exercise on a bench height of 12.7cm at an intensity of 50% -55% HRR for another 4 weeks making a total of 8 weeks.

The population of the study consisted of twenty four (24) overweight female adolescents' students of Girls High School Gindiri, Plateau Sate, Nigeria with a BMI of 25 kg/m² to 29.9 kg/m² and were 14 to 16 years old. Purposive sampling technique was used to sample nineteen (19) overweight female adolescents from the student's population. The 19 overweight female adolescents volunteered to participate in the study and 3 out of the 19 participants could not continue with the training, after the 4th week. Only 16 participants continued with the exercise to the end of the 8th week and the results of their measurements were used for the analysis. The OMRON BF511 body composition monitor by Omron Kunotsubo, Japan was used to measure the body fat percent at baseline, immediately after the 4th and the 8th week of training respectively. The body composition monitor is a digital device that uses BIA method for the measurement of body composition indices. It does this by sending an extremely weak electrical current through the body along with an individual's height, age and gender data to generate body composition indices.

Informed consent form was willingly signed by every participant. The principal of the school who is a custodian of the students signed as a witness on behalf of the parents. Ethical approval with approval No. ABUCUHSR/2023/013 was obtained to use human subjects for the research from the ethical committee of Ahmadu Bello University, Zaria.

Results and Discussion

The descriptive statistics of mean, standard deviation and standard error of body fat percent of the respondents is presented in Table 1.

Table 1 Descriptive Statistics of Mean, Standard Deviation and Standard Error of Body Fat Percent of the Participants

Variable	Duration	N	Mean	SD	SE
BF%	Baseline	16	36.41	3.57	0.89
	4 th Week	16	34.88	4.35	1.09
	8 th Week	16	33.73	4.51	1.13

Table 1 shows the means, standard deviation and standard error of body fat percent of overweight female adolescents at baseline, immediately after 4th and 8th week of training. The results showed that the participants had mean body fat percent of $36.41 \pm 3.57\%$, $34.88 \pm 4.35\%$ and $33.73 \pm 4.51\%$ at baseline, 4th and 8th week of training respectively. The body fat percent was observed to reduce immediately after the 4th and 8th week of step aerobics. This implies that the 8 weeks moderate intensity step aerobics reduced body fat percent of the participants.

To test if this reduction is significant the data is subjected to repeated measure analysis of variance and is presented in Table 2.

Table 2 Repeated-Measures Analysis of Variance on Body Fat Percent of Overweight Female Adolescents

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Training	Sphericity Assumed	57.620	2	28.810	32.170	.000
	Greenhouse-Geisser	57.620	1.308	44.037	32.170	.000
	Huynh-Feldt	57.620	1.383	41.664	32.170	.000
	Lower-bound	57.620	1.000	57.620	32.170	.000
Error (Training)	Sphericity Assumed	26.867	30	.896		
	Greenhouse-Geisser	26.867	19.627	1.369		
	Huynh-Feldt	26.867	20.745	1.295		
	Lower-bound	26.867	15.000	1.791		

Table 2 shows the results of the repeated-measures analysis of variance on body fat percent of overweight female adolescents in Gindiri, Plateau State, Nigeria. The analysis showed that the 8 weeks moderate intensity step aerobics training had statistically significant reduction on body fat percent of the participants ($p = 0.000$) at an alpha level of 0.05. Therefore, the null hypothesis which states that there is no significant effect of moderate intensity step aerobics on body fat percent of overweight female adolescents in Gindiri, Plateau State, Nigeria is rejected.

Discussion

The purpose of this study was to assess the effect of step aerobics on body fat percent of overweight female adolescents in Gindiri, Plateau State, Nigeria. Sixteen (16) female adolescents with mean age of 14.81 years, mean weight 69.94.kg and mean height 1.56m participated in the study. The finding of this study on the effect of step aerobics on body fat percent of overweight female adolescents in Gindiri showed significant reduction of 2.68% after eight weeks of step aerobics on female adolescents ($p = 0.000 < 0.05$). This finding supports that of Najafnia, Bararpour, Amirinejhad and Nakhae (2013) who reported that there was significant decrease in body fat percent of young girls who participated in 8-week step aerobics. The training sessions were performed three times a week lasting 50 = 60 minutes. The training started with an intensity of 50% HR_{max} and was increased to 75% HR_{max} . The significant effect could be attributed to the increase in training intensity. Similarly, the finding of this study supports that of (Mustedanagic *et al.*, 2016) who assessed the effect of step aerobic exercise programme on body composition of female college students for a period of 12 weeks. The main training programme constituted step aerobics exercise. Significant decrease was found in body fat percent of the participants. In their study the training duration was for 12 weeks. In this study, step aerobics was done for 8 weeks which showed significant reduction in body fat percent of the participants. This implies that duration of 8week regular participation of moderate intensity step aerobics would decrease body fat percent of the participants.

The study also supports the result of Narayani and Raj (2010), who reported that the mean body fat percent of overweight women before the commencement of 6 weeks step aerobics training was 23.3835 and was 20.5015 after training. Gokyurek, Sokmen and Usta (2016) reported that a person loses 13% of body fat when he is involved in step aerobics programme. They further went on to advise that it is healthier to lose or control weight through combining healthy diet and exercise to prevent the loss of fat free mass due to diet restriction only. People who combine sensible eating habit with exercise can have a better reduction in their body fat percent (Marandi *et al.*, 2013). Reduction of body fat percent due to aerobics exercise is mediated by the activity of the enzyme lipoprotein lipase (LPL) which regulates fat storage. When physical activity level raises the release of stored energy in adipose tissue increases the oxidation of carbohydrates and fat from muscles is also increased. The increase in physical activity cause a rise in insulin sensitivity in the muscles and glucose usage for energy production. Fat is being metabolized in the skeletal muscles thereby causing a depletion in the fat stores which causes decrease in body fat percent (Spriet, 2014, Van Hall, 2015).

Conclusion

Based on the findings of this study after participating in step aerobics training three times a week on alternate days for 8weeks at a moderate intensity of 45-55% HRR lasting 55-60 minutes per session, it was concluded that there was reduction in body fat percent in overweight female adolescents in Gindiri, Plateau State, Nigeria.

Recommendations

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

1. Moderate intensity step aerobics has been shown to decrease body fat percent in overweight female adolescents therefore, overweight female adolescents should participate regularly in moderate intensity step aerobics to decrease body fat percent.
2. Step aerobics training programme provides a lot of fun to the participants, it should be used as an intervention to promote active lifestyle among adolescent girls in schools to achieve optimal health.

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