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EFFECTS OF AEROBIC EXERCISE TRAINING PROGRAMME ON PERCENT BODY FAT LEVEL AS CARDIOVASCULAR DISEASE RISK FACTOR IN CHILDREN

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ABSTRACT

This study investigated the effects of aerobic exercise training programme on percent body fat level as cardiovascular disease risk factor in children. The study employed the true experimental research design of pretest posttest with one experimental and control group. The population consisted of 745 pupils of Ekiti State University Staff School, Ado –Ekiti, Nigeria out of which 32 participants were selected randomly. They were assigned into experimental (22) and control (10) groups with equal number of male and female in each case. The training programme consisted of aerobic exercises lasting for 25 – 40 minutes, administered three times a week for 12 weeks. Blood sample were taken from the participants before and after the 12 weeks training for data generation. Statistical analysis showed significant reduction of percent body fat after training in the experimental group ($p<0.05$). Aerobic exercise training programme enhanced the reduction of percent body fat and can be effective in reduction of the risk for cardiovascular diseases. Aerobic exercise training programme should be encouraged among children.

INTRODUCTION

Excessive deposits of fat in the body result into either overweight or obesity. Overweight refers to a person's overall body weight and whether it is too high. Overweight is having extra body weight from muscle, bone, fat and or water while obesity is having a high amount of extra body fat. Overweight is body weight that exceeds the normal or standard weight allowed for a particular individual on the basis of sex, height and frame size (Uzoalor, 1999) or a body mass index equal to or more than 25 (World Health Organization, 2002).

Obesity is the condition in which the entire body weight is made up of more than 20% fat or adipose tissue for men and more than 25% for women (Adegun, 2005). For a normal average man, the value is put at 15% while for an average woman, it is about 20%. It is also a body condition characterized by excessive deposition and storage of adipose tissue which must have occurred at some point or time in the overweight person's life. The quality of food required by an individual above which is necessary for body maintenance and growth depends on the amount of physical activity that he/she experiences and for body weight to remain constant, food intake must equal energy needs. If too much food is consumed, weight is gained or has positive energy balance which is the foundation of obesity.

The fundamental cause of obesity and overweight is an energy imbalance between calories gained and calories expended (Otinwa, 2008). Physical inactivity and sedentary lifestyles predispose to overweight and obesity. These lifestyles track from childhood to adulthood with consequent cardiovascular and metabolic problems. Less physical activity and unhealthy eating habits appear to be major contributors to potential determinants of overweight and obesity (Collins,Pakiz & Rock, 2008). Many studies like Westerterp and Goran (1997); Planinsec and Matejek (2004); Mahfouz(2008) and Collins, Pakiz and Rock (2008) reported that overweight subjects are involved in fewer physical activities than their non-overweight peers. Obesity often begins early in childhood and when it occurs, the chances for adult obesity are three times greater compared to children of normal body weight. Tracking studies by Nicalasen,Retzoad and Schnohr (2006); Chakar and Salameh (2006) indicated that 70%- 80% of obese children have likelihood of being obese adults.

Obesity is associated with significant comorbidities and health problems such as diabetes mellitus, hypertension, coronary heart disease, elevated blood lipids and lipoproteins, orthopedic problems and negative self-esteem

(Deckelbaum & Williams, 2001; Musa, 2008). Obesity is a major risk factor for heart disease (Texas Heart Institute, 2012). Preventing or treating obesity in childhood may reduce the risk of adult obesity and may also reduce the risk of heart disease, diabetes and other obesity related diseases. Childhood obesity also increases the risk for diabetes, heart diseases and cancer (Adegun, 2005). People who are considered 20% or more over fat have a mortality rate from cardiovascular diseases that is 2½ times greater than that of people with average or below average body weight.

The prevalence of obesity in the developing countries ranges from 7% to 10% (Senbanjo & Oshikoya, 2010). The consequences of obesity are likely to be worse in developing countries where health facilities to manage the condition and its implications are scarce. The rapidly increasing prevalence of overweight and obesity among pre-school children in developing countries such as Egypt, Malawi and Nigeria is exceeding that of the United States (deOnis & Blossner, 2000; Ben Bassey, Oduwole & Ogundipe, 2007). Childhood obesity is a creeping problem in Ekiti State, Nigeria (Adegun, 2005) and also increases the risk for diabetes, cardiovascular diseases and cancer.

An optimal body fat level which is ideal can be attained through regular exercise, proper dietary intake and a healthy lifestyle. Aerobic exercise is effective for decreasing percent body fat (%BF) (Young & Steinhard, 1995) and loss of adipose tissue occurs when an individual's aerobic exercise level increases (Catenacci & Wyatt, 2007). Other studies confirmed that aerobic exercise training induced reduction in fat mass and increased fat free mass (Treuth et al 1994; Ross, Freeman & Jansseen, 2000; Byrne & Wilmore, 2001; Irwin, 2003). According to this literature knowledge, this study investigated the effects of aerobic exercise training programme on percent body fat level as cardiovascular disease risk factor in children.

METHODOLOGY

Research design:
The study design was a true experimental research design of pretest posttest with one experimental and one control group. The experimental group went through an aerobic exercise training programme while the control group did not. In the study, the two groups were observed at the beginning before the treatment on the experimental group and at the end after the experiment, the two groups were again observed.

Participants:
The sample consisted of 32 primary school pupils (male and female) of Ekiti State University Staff School, Ado-Ekiti, Nigeria. The samples were randomly assigned to experimental (22) and control (10) groups with equal number of male and female.

Informed consent:
All the participants, their teachers and parents were well informed about the nature and purpose of the measurements before commencement. The participants through their teachers and parents signed the informed consent form for their permission.

Intervention programme:
The experimental group was taken through 30-40 minutes of aerobic exercise training programme 3 times a week between 7.30a.m-8.30a.mfor 12 weeks. The training programmes were a continuous low to moderate impact aerobic exercises, that is, at 35-70% maximal aerobic capacity. Every training session was made up of three segments of general body warm up, aerobic exercise segment and cool down. All training took place in a room within the University Staff School.

Measurements:
All measurements were conducted in a room in the school between 8-9a.m. The participant's age, sex, stature and body mass were taken and triceps and calf skin fold were measured before and after treatment at resting level for both groups. The participants appeared in minimum clothing for the measurements and aerobic exercise training programme. The age of participants were obtained from the school file to the nearest birthday. A calibrated stadiometer was used to measure the height of the participants. They were asked to stand erect with both feet on the floor without shoes. Arms and shoulder were in a relaxed manner, looking straight ahead (Frankfort plane) while the height was recorded to the nearest centimeter. The stadiometer had a reliability coefficient of 0.96.

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The body weight was measured using a (HANA Model) portable bathroom weighing scale. Each participant was weighed while in light sport dress and without foot wears and cap. Measurement was recorded to the nearest 0.1kg. The weighing scale had a reliability coefficient of 0.96.

The skinfold thickness was measured to determine the percent body fat. The skinfold caliper was used to measure two skinfold sites of triceps and calf skinfold as recommended by ISAK (2001). The anatomical sites were located and marked. All measurements for the skinfold thickness were taken on the right side of the body. The sum of skinfold had a reliability coefficient of 0.99.

Thetriceps skinfold site was marked in the mid line of the marked mid-acromiale-radiale level. The participant assumed a relaxed standing position with the left arm hanging by the side. The right arm was relaxed with the shoulder joint slightly externally rotated and elbow extended by the side of the body. The fold was taken parallel to the long axis of the arm between the thumb and index finger of the left hand. The nearest edge of the contact faces of the caliper were applied one centimeter (1cm) away from the edge of the thumb and finger. The caliper was held at 90 degrees to the surface of the site. Measurement was recorded two seconds after the full pressure of the caliper was applied.

The calf skinfold site was marked while the participant assumed relax standing position with the arms hanging by the sides and the right foot placed on the box. The right knee was bent at about 90 degrees. The participant right foot was placed on a box with the calf relaxed. The fold was taken parallel to the long axis of the leg between the thumb and index finger of the left hand. The nearest edge of the contact faces of the caliper were applied one centimeter (1cm) away from the edge of the thumb and finger. The caliper was held 90 degrees to the surface of the site. Measurement was recorded two seconds after the full pressure of the caliper was applied.

The equation for computing percent body fat by Lohman (1992) was used to estimate relative body fat from the sums of triceps and calf skinfold.
% fat =0.610€sf + 5.0 (female)
%fat = 0.735€sf + 1.0 (male)
€sf=sum of skinfold.

Statistical analysis:
The data collected were analyzed using the descriptive statistics of range, mean and standard deviation while inferential statistics of analysis of covariance (ANCOVA) was used to test the hypothesis formulated at 0.05 level of significance. Multiple classification analysis (MCA) was used for specific differences in ANCOVA results.

RESULTS

Table1: Mean, Standard Deviation and Range values of the Age and Stature of the Control and Experimental Groups.

Variables	Group	N	Mean	SD	Range
Age (yr)	Control	10	10.70	0.95	9 – 12
	Experimental	22	10.18	1.18	9 – 13
Stature (cm)	Control	10	1.45	0.06	1.35 - 1.53
	Experimental	22	1.39	0.13	1.26 - 1.69

Source: Author's (2016)

Table 1 presents the means, standard deviation and age range and stature of the control and experimental groups. The control group mean value for age was 10.70 ± 0.95 years with a range of 9 - 12 years while the experimental group had a mean value of 10.18 ± 1.18 years with a range of 9 - 13years. The control group mean value for stature was 1.45 ± 0.06cm with a range of 1.35 - 1.53cm while the experimental group had a mean value of 1.39 ± 0.13cm with a range of 1.26 - 1.69cm.The age and stature mean differences in the two groups were 0.52years and 0.06cm respectively. These results indicate that the two groups were homogenous in relation to age and stature.

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Table2: Mean values of the Physical Characteristics of the Control and Experimental Groups. (n=10, 22).

Variable	Group	Pretest value			Posttest values			Diff. in Mean
		Mean	SD	Range	Mean	SD	Range	
Body Mass	Control	35.10	10.69	25 - 64	35.80	11.13	25 - 66	0.70
	Experimental	31.55	9.46	22 - 65	31.18	9.22	22 - 65	0.37
Body Mass Index	Control	16.69	4.61	13.06 - 28.83	17.02	4.80	13.51- 29.73	0.33
	Experimental	16.10	3.19	12.44 - 24.10	15.93	3.03	12.44 -23.03	0.17
Percent Body Fat	Control	14.79	6.79	9.54 - 32.61	16.90	8.54	11.37- 39.96	2.11

Source: Author's (2016)

Table 2 shows the pretest and posttest values of the physical characteristics of the control and experimental groups. For the control group, the mean pre-test value of body mass was 35.10 ± 10.69kg with a range of 25 - 64kg and a posttest value of 35.80 ± 11.13 with a range of 25 - 66kg. While the experimental group had a pretest means value of 31.55 ± 9.46 with a range of 22 - 65kg and 31.18 ± 9.22 with a range of 22 - 65kg for the posttest. The mean difference of body mass was 0.70kg and 0.37kg for the control and experimental groups respectively. It is important to highlight that the control group showed more increase in body mass than the experimental group.

The mean pretest value of body mass index for the control group was 16.69 ± 4.61 with a range of 13.06 - 28.83 and a posttest value of 17.02 ± 4.80 with a range of 13.51 - 29.73. While the experimental group had a pretest means value of 16.10 ± 3.19 with range of 12.44 - 24.10 and 15.93 ± 3.03 with a range of 12.44-23.03 for the posttest. The mean difference in the pretest and posttest values of body mass index was 0.33 and 0.17 for the control and experimental groups respectively. It is worthy to note that the control group showed more increase (0.33) in the BMI than the experimental group that showed a decrease of 0.17.

Table 2 also shows the pretest and posttest values of the percent body fat of the control and experimental groups. For the control, the mean pretest value was 14.79 ± 6.79 with a range of 9.54 - 32.61 and a posttest value of 16.90 ± 8.54 with a range of 11.37 - 39.96. The experimental group had a pre-test mean value of 11.33 ± 3.36 with a range of 6.88 - 19.61 and 11.00 ± 3.29 with a range of 6.88-18.69 for the posttest. The mean difference in the pretest and posttest values of percent body fat was 2.11% and 0.33% for the control and experimental groups respectively. The difference in the pretest and posttest mean values in percent body fat in the control group showed a high increase of 2.11% while the experimental group showed a decrease of 0.33%.

Table 3: **Summary of ANCOVA Showing Effect of Aerobic Exercise on Percent Body Fat of Primary School Children by the Treatment**

Source	SS	df	MS	F_{cal}	P
Corrected model	1097.951	2	548.975	647.256*	.000
Covariate (pretest)	9858.901	1	858.901	1012.666*	.000
Group	22.491	1	22.491	26.518*	.000

Error	24.597	29	0.848	0.936	
Corrected Total	1122.547	31			
Total	6402.998	32			

Source: Author's (2016) ***level of Significance* p<0.05***

Table 3 shows that p = 0.000 < 0.05 at 0.05 level of significance. The null hypothesis was rejected. It implied that aerobic exercise training programme had significant effect on percent body fat of primary school children. The MCA showing the effect of aerobic exercise training programme on percent body fat of the participants is presented in Table 4.

Table 4: Multiple Classification Analysis Showing the Effect of Aerobic Exercise Training Programme on Percent Body Fat of the Participants.

Grand Mean=12.85					
Variable + Category	**N**	**Unadjusted Devn'**	**Eta^2**	**Adjusted For Independent + Covariate**	**Beta**
Experimental	22	-1.85	1.21	-0.54	0.98
Control	10	0.05		1.17	
Multiple R				0.979	
Multiple R^2				0.958	

Source: Author's (2016)

The result of MCA in Table 4 reveals that primary school pupils exposed to aerobic exercise training programme had adjusted mean score of 12.31(12.85 +(-0.54) while those in the control group recorded an adjusted mean score of 14.02 (12.85+1.17). It was observed that the aerobic exercise training programme accounted for 95.8% reduction in percent body fat of primary school children. This implied that the treatment constituted a better way for enhancing reduced percent body fat in children.

DISCUSSION

The findings from this study revealed that the age and stature mean differences in the control and experimental groups were 0.52 years and 0.06cm respectively. There results indicated that the two groups were homogenous in relation to age and stature. The mean difference of body mass was 0.70kg and 0.37kg for the control and experimental groups respectively. It is important to highlight that the control group showed more increase in body mass than the experimental group. The mean difference in the pretest and posttest values of percent body fat was 2.11% and 0.33% for the control and experimental groups respectively. The difference in the mean values in percent body fat in the control group showed a high increase while the experimental group showed a decrease.

The findings from this study also revealed that the mean scores of primary school children exposed to aerobic exercise training programme and those not exposed on percent body fat showed that p = 0.000 < 0.05 at 0.05 level of significance. The MCA result also indicated that the participants exposed to aerobic exercise training programme had adjusted mean score of 12.31 while the control group had 14.02. This implied in this study that percent body fat was significantly reduced after a 12-week aerobic exercise training programme when compared with control participants. This corroborates the reports of Young and Steinhard (1995) who reported in their findings that aerobic training is effective for decreasing percent body fat (%BF). In Wilmore's (1974) study,

participants who trained 2days a week for 10 weeks exhibited similar alterations in body composition. Other studies also confirmed that aerobic exercise training induced reduction in fat mass and increased fat free mass (Treuth, et al., 1994; Byrne and Wilmore, 2001). Catenacci and Wyatt (2007) revealed that loss of adipose tissue occurs when an individual's aerobic exercise level increases. Several studies that involve body composition consistently show that aerobic exercise training improves body composition (Kohrt, 1996; Ross, Freeman & Janssen, 2000) and can preferentially reduce abdominal visceral fat (Ross, Janssen & Tremblay, 2000; Irwin, 2003). A school based study by Moody as reported by Armstrong and Welsman (1997) involved 28 obese girls and 12 normal girls in a 15 week programme of daily exercise showed a markedly decrease in the skin fold thickness of the obese group.

CONCLUSION

Based on the findings of the study, aerobic exercise training programme was capable of causing improved changes on percent body fat of children. It was therefore concluded that aerobic exercise training programme is beneficial in improving percent body fat of children taking into cognizance the decreases that are beneficial to the health and fitness of children. It is recommended that teachers, coaches and trainers should use structured aerobic exercise training programme to elicit desired effects in percent body fat level of children.

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