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Effects of Three Modes of Exercise Training Programme on Body Mass Index of Adults

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Abstract

The study examined the effects of three modes of exercise training programme: aerobics exercise, resistance exercise and combination of aerobics and resistance exercise on Body Mass Index among senior non-teaching staff in University of Lagos, Akoka, Nigeria, after a 12-week training programme. Age ranged from 45-55 years. The study adopted pretest posttest research design. The participants were subjected to the three modes of the exercise training programme lasting 30 minutes, performed three times a week. Data were collected on the body weight using a bathroom weighing scaleand height of the participants with calibrated wall. The data collected were analyzed with descriptive statistics of mean, standard deviation and inferential statistics of analysis of covariance (ANCOVA). There was significant difference in the pretest and posttest values of Body Mass Index of the participants after exposure to aerobics exercise, resistance exercise and combination of aerobics/resistance exercise training programmes [$F_{(3,47)}$ =24.732, p=0.000]. It was observed that there was reduction in the Body Mass Index of experimental groups: Aerobics exercise from pretest value of 31.08 to 28.92, resistance exercise from pretest value of 32.42 to 28.35 and combination of aerobics/resistance from pretest value of 32.54 to 30.38. the study identified the training programmes as a means of reducing Body Mass Index from increasing to the level of high risk for diseases. It is suggested that adults should take part in the training programme three times a week, so as to enhance their fitness status.

Keywords: *Aerobics exercise, Body Mass Index, Non-teaching Staff, and Resistance Exercises*

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Background to the Study

Physical activities like walking, swimming, cycling, throwing, climbing and wrestling were seen as essentials on daily basis for survival in early centuries in Nigeria. People walk long distances in assessing their place of livelihood, some people toil round bush shooting arrows or throwing stones for livelihood or protection, and some people delight in evening physical activities as a way of recreation after the days' work. All these promote an active lifestyle among the citizenry. Presently, automation and cybernation have not only reduced the work week for many but have also greatly reduced muscular work. With the wide use automobiles with power steering, "push button" windows and seats in cars for transporting workers to their places of work, the use of computers, no more the use of typewriters which enhances the fingers dexterity of workers, setting down at their places of work for many hours in offices, people do not trek to offices as it was done before the introduction of cars, this made man not satisfying his biologic needs for physical activity. Illness and death from degenerated diseases are increasing. Automation also reduces the pride and satisfaction man takes in his work as a result of sedentary recreational activities.

A healthy weight or normal weight means a body mass index that falls within a weight range that is not associated with an increased risk for weight-related diseases and health issues. The National Institutes of Health define a healthy weight as a BMI equal to or more than 19 and less than 25. Being overweight is defined as having a BMI of 25 or higher. Obesity is defined as having a BMI of 30 of higher (NIH, 1998). U.S Department of Health and Human Services (2005) submitted that overweight is not limited only to Adults, eleven percent of children ages 6 to 19, are overweight or obese. Some experts proclaim that obesity is a chronic health condition of epidemic, due to the dramatic increase in body weight.

Obesity has been declared a disease by the National Institute of Health (NIH, 1988), it has also been elevated to the status of a major risk factor for heart disease (AHA, 2004, David, Michael & Frank, 2003). People are getting heavier due to too much energy going in (as food) and too little energy going out (as exercise) and due to sedentary way of life. To maintain healthy weight, David Michael and Frank (2003), submitted that caloric intake must be balanced by caloric expenditure. To lose weight a person has to achieve a caloric deficit in which the number of calories burned exceeds the number of calories consumed, it includes three obvious strategies: (1) restricting caloric intake by dieting, (2) physical activity, and (3) a combination of dieting and physical activity.

Mayo (2001) stated that caloric intake should not drop below 1200 per day in women or 1400 per day in men. Gender differences in caloric intake are due to differences in physical activity pattern, metabolism (from more or less muscle tissue), and size. It is observed that physical activity alone cannot maintain BMI and body fat percent, but it can reduce the risk of overweight and high body fat percent in the population (Dietz, 2004 and Welk, 2000). Inactivity or low level of physical activity combined with changes in eating habits are believed to be the reasons for the increased prevalence of overweight/obesity among children and adolescent (Welk and Blair, 2000). The genetic differences in weight gain among them also make them vulnerable to overweight. As physical activity is an important component in weight control and also associated with other. Major health benefits, (U.S Dept. of Health and Human Services, 2005).

Scientific evidence indicates that the risk for disease starts to increase when BMI exceeds 25 (Frank, 2001). Although a BMI between 18.5 and 25 is considered normal, the lowest risk for chronic disease is in the 22 to 25 range (U.S Department Health and Human Services, 2005). Individuals are classified as overweight if their indexes lie between 25 and 30. BMIs above 30 are defined as obesity and those below 18.5 as underweight. Scientific evidence has shown that even though the risk of preventive illness and death is greater for those who are overweight, the risk also increases for individuals who are underweight (AHA, 2004).

Population of the Study

The population for the study were apparently healthy senior non-teaching staff within the age range of 45-55 years old. A total of 1,386 senior non-teaching staff in the University of Lagos formed the population of the study (Unilag, 2018).

Purpose of the Study

The purpose of this study is to ascertain the effects of aerobics exercise, resistance exercise and the combination of aerobics and resistance exercise on Body Mass Index among senior non-teaching staff in University of Lagos.

Research Hypothesis

There will be no significant difference in the pretest and posttest values of Body Mass Index of senior non-teaching staff in University of Lagos after exposure to 12 weeks aerobics, resistance exercise and the combination of aerobics and resistance exercise training programme.

Methodology

This study adopted pretest posttest control group research design. The experimental research design is shown below:

Experimental group: $O_1 \times O_2$
$O_3 O_4$

Where O_1, and O_3 are the pretest for experimental and control groups, respectively while the posttest for experimental and control groups are O_2 and O_4, respectively. X represents the treatment for the experimental group.

Participants who took part in the study are 52men and women of University of Lagos, Akoka Nigeria non-teaching staff. They were selected using the multi-stage and purposive sampling techniques in the age range of 45-55 years. The participants were then randomly assigned to four groups: three experimental (men and women), aerobics exercise, aerobics exercise/resistance exercise, and resistance groups) and control group (men and women). None of them ever participated in organized sporting activities through the previous year.

After meeting the inclusion criteria of being: members of the University of Lagos senior non-teaching staff with at least 10years of service as a senior non-teaching staff, must be within the age range of 45-55 years, must not be on leave during the period of intervention, apparently

healthy, must not be pregnant or just delivered of a child within one year before the commencement of the study and must not be a stroke survivor or other related diseases within one year from the commencement of this study. The nature of the test and purpose of the study were explained to the participants. Informed consent form in which a short description of the investigation was written was given to them. The forms were duly filled and signed by the participants. There were 37 participants in the experimental group, that is, 17 men and 20 women. The control group also consisted of 15 participants, 7 men and 8 women. The four groups took part in pre- and post-training measurements while the experimental groups alone were exposed to12 weeks three modes of training programme.

The participants in the experimental group were subjected to the training programmme, three times a week for 12 weeks. The intervention programme are in three phases: namely pre-invention phase, intervention phase and post-intervention phase.

Pre-intervention Phase

The phase lasted for 4 weeks starting with advertisement placement to recruit participants to volunteer for the study, followed by the selection and training of research assistants. The selected participants were initially screened with the PAR-Q to detect if they met the inclusion criteria. The participants who met the inclusion criteria were placed into groups and were also tested at baseline on all the CVD risk variables under investigation prior to the commencement of the study. Testing sessions took place between the hours 7am and 8:30am on the three testing days. Testing was conducted by research assistants who are nurses and laboratory technicians from the University of Lagos Medical center. The intervention process is tabulated as follows:

Table 1: Activity schedule of the pre-intervention phase.

Week	Activity	Duration	Objectives
1	Selection and training of research assistants	2hours each day for 3 days	1. To acquaint the research assistants with the purpose and objectives of the research. 2. To train them on the protocols involved in the execution of the activity. 3. Training on ethics of the research
1-4	Advert placement to recruit participants	4weeks	1. To ensure information goes round the campus for eligible participants. Media used were, Unilag radio station, posters, flyers, handbills and interpersonal persuasions
4	1. Baseline screening to meet inclusion criteria 2. Pre-assessment for eligible participants	4days	1. To ensure participants in the study meet inclusion criteria 2. To test eligible participants on the variables under investigation

Source: Field Survey

Invention phase
The intervention phase is represented in table 2

Table 2: Activity summary of intervention phase

Group	Warm Up	Main Activity	Cool Down
	5 Minutes	**30 Minutes**	**5 Minutes**
AR	**Individual Warm Up Session**	**Dancing Aerobics Programme**	**Individual Cool Down Session**
RE		**Resistance Exercise Programme `**	
ARE		**Aerobics And Resistance Exercise**	

Source: Field Survey

Table 2 shows that the exercise groups met with, the training team three times a week for 12 weeks. The AR, R.B and AR-RE group both had their workout with a 5-minute joint warm up session of aerobics exercise of walking and light jogging. The AR group engaged in a variety of dance aerobics exercise programme for duration of 30 minutes. The RE group engaged in a series of resistance exercise programme using the developed training template for duration of 30 minutes, also the AR-RE engaged in exercises that combine 15 minutes aerobics and 15 minutes resistance exercises lasting in a total of 30 minutes. The participants participated in exercise activities under the direct supervision of the researcher and trained research assistants. The participants in AR, RE and AR-RE groups were finally subjected to a general cool down session for 5 minutes. The same protocol was adhered to throughout the period of the study. The CTR group was regularly engaged with health talk, and after the study they were invited for a 4-week dance aerobics exercise programme. Incentives like free T-shirts, water and fruits were distributed regularly in order to encourage adherence. Immediately after the 12 weeks of exercise, the participants were also tested on the same CVD risk variables in the pre-intervention phase.

Measurement of Body weight and height
The participant's bodyweight was measured with bathroom weighing scale. The participant stands erect on the weighing scale bare-footed with light clothing, hands by the side. The weight measurement was read from the scale to the nearest 0.lkg.The height of each participant was measured using the calibrated wall.

The participant stood barefooted with the feet together and the heels, buttocks and upper part of the back touching the wall. The Frankfort plane is achieved when the orbitale {lower edge of the socket) is in the sane horizontal plane as the Tragion (the notch superior to the tragus of the ear). When aligned, the vertex is the highest point on the skull

The measurer places the hands far enough along the line of the jaw of the participant to ensure the upward pressure Is transferred through the mastoid processes. The participant was

instructed to take and hold a deep breath and while keeping head in the Frankfort plane, the measurer applies gentle upward lift through, the mastoid process. The recorder places the ruler firmly down on the vertex, crushing the hair as much as possible. The recorder further assists by watching that the feet do not come off the floor and that the position of the head is maintained *in* the Frankfort plane. Measurement is taken at the end of a deep inward breath. Reading is to nearest 0.1 cm.

The Body Mass Index of the participant was calculated by dividing the weight of the participants by the Height in metres square. BMI = Weight/Height m^2

Data Analysis

Data collected were analysed with descriptive statistics of mean and standard deviation. While inferential statistics of analysis of covariance (ANCOVA) was used to test formulated hypotheses at 0.05 level of significance.

Results

Table 3: Descriptive Analysis showing Body Mass Index of Participants Before and After Aerobics, Aerobic/Resistance, Resistance and Control groups

Parameters	Group	N	Pretest			Posttest		
			Means	SD	Range	Mean	SD	Range
Body mass index	1	12	31.08	3.99	26.00-39.00	28.92	3.40	24.00-58.00
	2	12	32.42	4.32	27.00-42.00	28.85	3.66	24.00-37.00
	3	13	32.54	2.73	28.00-38.00	30.38	2.50	26.00-35.00
	4	15	34.80	3.93	29.00-43.00	34.67	3.92	29.00-43.00

Hypothesis 1

There will be no significant difference in the pretest and posttest values of body mass index among Senior Non-teaching staff in University of Lagos after exposure to aerobic exercise, resistance exercise and combination of aerobic/resistance exercise training programmes.

Table 4: ANCOVA showing the effect of exercise training pogramme on body mass index of UNILAG Senior Non-Teaching Staff

Source	SS	df	MS0	F	P	Partial Eta
Corrected Model	826.410	4	206.603	138.011	.000	.922
Covariate (Pretest)	493.968	1	493.963	329.971	.000	.875
Group	111.073	3	37.024	24.732	.000	.612
Error	70.359	47	1.497			
Total	50374.000	52				
Corrected Total	896.769	51				

***p<0.05**

Table 5: Estimated Marginal Means on BMI of study Participants by Treatment

Group	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Aerobic	30.397	.362	29.668	31.126
Resistance Exercise	28.848	.354	28.137	29.560
Aerobic/Resistance Exercise	30.629	.340	29.946	31.313
Control	32.992	.329	32.330	33.654

Table 6: Adjustment for multiple comparisons

(1) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Interval for Lower bound	Confidence Difference Upper Bound
Aerobic	Resistance Exercise	1.549*	.503	.021	.162.	2.935
	Aerobic/Resistance Exercise	-.233	.494	1.000	-1.595	1.129
	Control	-2.595*	.505	.000	-3.985	-1.205
	Aerobic	-1.549*	.503	.021	-2.935	-.162
Resistance Exercise	Aerobic/Resistance Exercise	-1.781*	.490	.004	-3.130	-.432
	Control	-4.143*	.487	.000	-5.484	-2.803
	Aerobic	.233*	.494	1.000	-1.129	1.595
Aerobic/Resistance	Resistance Exercise	1.781*	.490	.004	.432	3.130
	Control	-2.362*	.476	.000	-3.672	-1.052
	Aerobic	2.595*	.505	.000	1.205	3.985
Control	Resistance Exercise	4.143*	.487	.000	2.803	5.484
	Aerobic/Resistance Exercise	2.362*	.476	.000	1.052	3.672

P>0.05

Table 6 presents the one-way ANCOVA conducted to compare the effectiveness of exercise training programme on the body mass index among the Senior Non-teaching staff of University of Lagos whilst controlling for pretest scores. The result shows that there was significant difference in the pretest and posttest values of body mass index among Senior Non-teaching staff in University of Lagos after exposure to aerobic exercise, resistance

exercise and combination of aerobic/resistance exercise training programmes [F (3,47) =24.732, p=0.000]. The null hypothesis was rejected. The partial Eta Squared value - effect size was 0.61. This implies that about 61% of the observed variance in the body mass index of the participants was explained by the treatment (exercise training programme). The result of Post hoc tests on table 6 shows there was a significant difference between BMI of Aerobic and resistance exercise (p = 0.021), aerobic and control (p = 0.000), resistance exercise and aerobic resistance exercise (p=0.004), resistance exercise and control (p = 0.000) groups. Comparing the estimated marginal means as depicted on Table 5 indicates that the control group had the highest study mass index (32.992} compared to aerobic + resistance, aerobic, and resistance group (mean= 30.629, 30.397 and 28.848 respectively).

Discussion

Table 4, 5, and 6 shows the analysis of covariance (ANCOVA) on the significant difference observed in male and female participants in the experimental and control groups were due to the effect of the three modes of the exercises training programmes. This was due to the submission of (AHA, 2004; David, Michael and Frank, 2003), that people are getting heavier due to too much energy going in (as food) and too little energy going out (as exercise) sedentary nature of their work, sitting down for 8 hours at work 8:00am-4:00pm, this led to dramatic increase in their body weight increase to the level of overweight/obesity, BMI higher than 30kg/m^2, this status is a major risk factor for heart disease as opined by (David, Michael and Frank, 2003; AHA, 2004; NIH, 1998). To ameliorate this and to maintain ideal weight, David, Michael and Frank (2003) submitted that caloric intake must be balanced by caloric expenditure and to lose weight a person has to achieve a caloric deficit in which the number of calories burned exceeds the number of calories consumed, they proposed three obvious strategies of achieving this: (1) restricting caloric intake by dieting; (2) increasing caloric expenditure through physical activity, and (3) a combination of dieting and physical activity.

The findings of this study is in line with literature as opined by David, Michael and Frank (2003), that increasing caloric expenditure through physical activity will prevent obesity, this has been manifested in this study by the decrease in the BMI of the participants in the experimental groups (those in the Aerobic exercise from pretest value of 31.08 to 28.92, resistance exercise from pretest value of 32.54 to 30.38 respectively. Based on the findings of this study, the posttest values of the experimental groups showed that the participants are still at risk health wise with the BMIs of 28-92, 28.85 and 30.38 closed to BMI of 30kg/m^2 considered as BMI with risk factor. The gradual reduction in Body Mass Index of the experimental groups is in line with literature as opined by Wilmore and Costill (2004) that body composition changes take place slowly in human exercise studies and the magnitude of change is small. For continuous reduction in the BMI of the participants, the duration and intensity of the exercises engaged in by the participants in experimental group should be increased to prevent cardiovascular risk factors attributed to obesity. If this sedentary way of life continues, it would lead to a high risk for disease.

Conclusion

Eight weeks of Aerobics, Aerobic/Resistance, Resistance exercises performed 3days a week showed improvements in the Body Mass Index of the participants in the experimental group compared to participants in the control group. It was observed that the exercises prevents BMI of the participants from increasing above the pretest values. The training programmes were effective in reducing high risk for disease.

Recommendations

Participants should take part in regular physical exercises 3 times in a week. They should ensure that caloric intake does not exceed caloric expenditure. Individuals with obesity should exercise consistently to achieve significant improvements in their health.

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