International Journal of Preventive Medicine Research
Vol. 4, No. 3, 2018, pp. 68-75
http://www.aiscience.org/journal/ijpmr
ISSN: 2381-7038 (Print); ISSN: 2381-7046 (Online)

Effects of Aerobic Exercise Training on Cardiorespiratory Parameters of Obese Nurses

Adebisi Isiak Hammed*, Taiwo Joseph Oyewumi, Oghumu Saturday Nicholas

Department of Physiotherapy, University of Benin Teaching Hospital, Benin City, Nigeria

Abstract

The nurses with the requisite education are equipped to promote health, prevent illness and also care for the sick as a member of the health team. Abnormal body weight, dietary concerns and unhealthy weight gain behaviors are increasingly being observed among health personnel (nurses) in Nigeria. The lack of physical activity in daily life induces obesity and increases the risk of diseases such as diabetes mellitus, hypertension and heart diseases. Obesity and physical inactivity comprise an important worldwide epidemic that has been linked to the metabolic syndrome. The purpose of this study was to establish the effects of an 8-week aerobic exercise (EA) programme on cardiorespiratory parameters of obese nurses. The findings of this study would help clinicians/clinical staff to take AE into consideration in the management of obese nurses thereby enhancing clinical outcome. This study was a pre-test, post-test control group design. A total of 44 obese nurses participated in the study. The resting heart rate (RHR), systolic blood pressure (SBP), diastolic blood pressure (DBP), vital capacity (VC) and respiratory rate (RR) were measured prior to and following an 8-week AE programme. Data generated were analyzed using inferential statistics of one way analysis of variance (ANOVA) and the statistical significance was accepted for p value of <0.05. The findings of the study showed that the AEprogramme had significant effects only on RHR and RR of obese nurses. It was concluded that the AEprogramme can substantially enhance RHR and RR of obese nurses. However, the AE cannot improve SBP, DBP and VC of the participants. Thus, the AEprogramme should be considered a good training modality for improving only the RHR and RR of obese nurses.

Keywords

Exercise, Cardiorespiratory Variables, Obesity and Nurses

Received: July 8, 2018 / Accepted: July 27, 2018 / Published online: August 31, 2018

1. Introduction

Recently, it seems some of the female health personnel in health sector especially nurses are becoming social cripples, ‘too tired’ to attend to emergency situation, ‘too tired’ to assist the patients that needs assistance, ‘too tired’ to go for ward-round and may be they are ‘too tired’ to even administer drugs. Day-in-day-out, people are complaining about the sluggish attitude of the nurses in the health sector in reaction to emergency situations in particular and patient case in general. Meanwhile, the nurses with the requisite education are equipped to promote health, prevent illness and also care for the sick as a member of the health team. Abnormal body weight, dietary concerns and unhealthy weight gain behaviors are increasingly being observed among health personnel (nurses) in Nigeria [18]. Generally, a widespread concern exists about the low level of vigorous physical activity and high rates of sedentary behavior in women. The lack of physical activity in daily life induces obesity and increases the risk of diseases such as diabetes mellitus, hypertension and heart diseases. Obesity and

* Corresponding author
E-mail address: aiadebisi@yahoo.com (A. I. Hammed)

physical inactivity comprise an important worldwide epidemic that has been linked to the metabolic syndrome [23]. Body mass index (BMI) appears to be the best index of obesity, as it approximates adiposity and fat distribution in adults. There is increasing evidence showing that the associations between BMI, percentage of body fat and body fat distribution differ across populations [25]. Moreover, obesity and cardiorespiratory fitness are modifiable & independent risk factors for cardiovascular mortality. Technological developments & modern day commodities have driven most people into sedentary life style leading to chronic diseases like hypertension, heart disease, diabetes mellitus, metabolic syndrome, chronic low backache & obesity. Obesity is a serious public health problem in both developed and developing countries [5]. According to the World Health Organization [22], overweight and obesity had taken the fifth rank of leading risk factors cause of death in 2004. Despite the fact that fat is required for the proper functioning of human body, too much storage of fat above the required amount can cause the rise of metabolic abnormalities called metabolic syndrome. In addition, the [21] classifiedbody fatnessbased on BMI and is considered healthy if BMI > 18.5, overweight if BMI > 25, obese if BMI > 30 and morbidly obese if BMI > 40.

Despite the fact that human body is designed to be active, aerobic exercise (AE) can be used to optimize the level of physical fitness and maintain normal cardiorespiratory parameters including blood pressure and heart rate levels. This is because human body needs to function more efficiently to avert the risks for cardiorespiratory mortality. Besides physiologic and genetic properties as well as good nutrition, regular physical activity is considered an important component of good health and prevention of cardiovascular problems. According to [3], physical activity is a broad term, referring to all bodily movements produced by the contraction and relaxation of skeletal muscles that use energy which include all forms of physical education, sports, recreation and dance activities. It may involve indoor, outdoor and adventurous activities such as using the stairs, activities of daily living and the like. Moreover, AE is any activity that stimulates heart rate and increases breathing but not so much that one cannot sustain the activity for more than a few minutes. This type of exercise results in profound adaptation of the cardiorespiratory system that enhances the delivery of oxygen from the atmosphere to the mitochondria and enables a tight regulation of muscle metabolism [11]. Therefore, regular physical activity and good physical fitness are widely accepted as factors that reduce all-cause mortality and improve a number of health outcomes [1].

Studies have reported that cardiorespiratory function was significantly decreased in overweight and obese individuals when fat mass was taken into account. This suggests the possibility of deconditioning or changes in cardiorespiratory function in severely overweight or obese individuals. [19] reported that excess body fat impairs cardiorespiratory functions and decreases mechanical efficiency for a given workload. Similarly, obesity accentuates exercise intolerance and lowers aerobic capacity [6]. Moreover, other studies have clearly demonstrated that AE regimens improve cardiovascular function. This is true not only in healthy subjects without any underlying risk factors [7], but also in older people [4], and those with cardiovascular risk factors such as obesity [10]. Indeed, those with cardiovascular risk factor/disease will benefit more. In healthy individuals, a longer and more intense exercise protocol is needed to induce measureable changes in cardiovascular parameters, while older, obese and sicker subjects can benefit from less intense exercise regimens. Likewise, [27] reported thatAE increases cardiorespiratory efficiency (the ability of the body to deliver and utilize oxygen), reduces coronary heart disease and improve general health and assist in weight control. However, [2] pointed out that AE increases systolic blood pressure and concluded that the exercise programme normalizes the systolic blood pressure. Also, a very important study that was conducted by [9] among well-trained endurance athletes revealed that AE does have significant positive effect on elevated diastolic blood pressure.

Furthermore, AE can increase the delta between HR at the end of the exercise and at the beginning of recovery, and eight weeks of training would be enough to augment this difference within the first 30 seconds post-exercise [24], with no differences in outcome for gender or age group and however, such adaptation may be lost in few weeks without training [26]. Equally, [15] have suggested that such improvement in cardiorespiratory parameter should be further evidenced in individuals with abnormal cardiovascular function, believing that AE would have a smaller impact on HR variability of healthy individuals. Little or no known researches have been undertaken in Oyo state Nigeria, regarding the effects of AE on cardiorespiratory parameters of obese nurses. This observed gap in knowledge and research efforts informed the need for the present study. Therefore, in the present study, the effects of AE on cardiorespiratory parameters in obese nurses were investigated. The results serve to generate further hypothesis and facilitate the planning of AE training and management of these individuals.

Research hypotheses

The following hypotheses were formulated and tested at 0.05

alpha level.

1. There will be no significant difference in the resting heart rate of obese nurses prior to andfollowing AE training.
2. There will be no significant difference in the systolic blood pressure of obese nurses prior to and following AE training.
3. There will be no significant difference in the diastolic blood pressure of obese nurses prior to and following AE training.
4. There will be no significant difference in the vital capacity of obese nurses prior to and following AE training.
5. There will be no significant difference in the respiratory rate of obese nurses prior to and followingAEtraining.

2. Methods

Research design

This study was a pre-test, post-test control group experimental design of the effects of an 8-week AE training on cardiorespiratory parameters of obese nurses.

Population

The population of this study included sixty six (66) obese nursesbetween the biological ages of 28 and 56 years inthe Muslim HospitalShaki, Oyo State, Nigeria, within the period of November, 2016 to July, 2017. However, nurses who are pregnant or suffering from any cardiovascular, pulmonary, orthopedic, or neurological disorders were excluded from the study.

Sample size and sampling technique

A total of fourty four (44) obese nurses in the above mentioned hospital participated in this study. They were recruited using the simple random sampling technique. Balloting without replacement was used to select two-third (2/3) of the population for the study. The names of the obese nurses were written on pieces of paper and these pieces of paper were put in a bag from where one piece of the paper was picked at a time and the name on the piece of paper picked was recorded. This process was repeated until the desired sample size was obtained. Thereafter, the recorded names were serialized and systematically assigned randomly into two (2) groups (the experimental and the control groups). Twenty two (22) participants were assigned to the experimental group and the other twenty two (22) to the control group using the same process. The first name in the list was assigned to the experimental group and the second name to the control group, the procedure was continued till the last name in the list was assigned.

2.1. Data Collection Instruments

Aerobic treadmill walking exercise training using modified Bruce protocol was adopted for the study.

2.2. Data Collection Procedure

The study received ethical approval from the Research Ethics Committee of the Muslim Hospital Shaki to conduct this study and the participants were then recruited consecutively. Also, an informed consent form was issued to each of the participants who signed it before participating in this study. Prior to the exercise trainingprogramme, a detailed explanation of the test, training programme, the objectives and intricacies of the study were provided for the participants. Thereafter, the participants were randomly assigned to experimental and the control groups. However, cardiorespiratory parameters (heart rate, systolic blood pressure, diastolic blood pressure, vital capacity and respiratory rate) of the participants were obtained from the two groups prior to an 8-week AE programme. After the 8-week of the AE (intervention), a post intervention measure was taken from each of the participants.

AE training protocol

The experimental group received aerobic treadmill walking exercise training for 8 weeks, at a frequency of 3 sessions per week (Monday, Wednesday, and Friday). The aerobic treadmill-based training program (Zan 800, made in Germany) was started with a 5-minute warm-up phase performed on the treadmill at a low load. The active phase of the training session was gradually increased from 20 to 30 minutes in the form of walking/running on the electronic treadmill with zero inclination 3 times per weekfor 8 weeks, its intensity being increased gradually from 60% to 70% of the maximum HR (HRmax) achieved in a reference, which was performed in accordance with a modified Bruce protocol. This rate was defined as the training HR (THR). The session ended with a 5-minute recovery and relaxation phase [20]. All the participants performed 3 weekly sessions. HRmax = 220−age. Meanwhile, subjects in the control group were instructed to continue their normal routine and not participate in any formal exercise program for the duration of the 8-week portion of the study.

Measurements and tools

All the measurements were performed 3 days before the exercise training and 2 days after the exercise program terminated for both (experimental/control) groups. The standing heights were measured using a PRESTIGE stadiometer (Model HM0016D, India). Each participant was assessed while in good standing posture on the foot resting on the device with minimal clothing, without shoes but with the head facing forward in front font position. The participants also had their shoulders relaxed, arms hanging loosely on both sides, palms facing forward, feet together and knees straight. The height for each participant was taken when the movable headboard was lowered to touch the vertex of the head. The measurements were taken to the nearest 0.1cm.

The calibrated weighing scale (Seca 770, Marsden, UK) was used to measure body weight and was checked for zero balance before each use. Participants were instructed to empty their pockets and remove shoes and any apparel that could interfere with weight measurements. They then stood on the scale looking straight ahead, relaxed and remained motionless without leaning on any object or the wall. Weight measurements were taken when the scale stabilized and recorded to the nearest 0.1kg while protecting the confidentiality of the participants' values. BMI was then calculated using the formula: weight (kg)/height (m^2). Using WHO (2010) classifications, body fatness of individual is classified based on BMI and is considered healthy if BMI > 18.5, overweight if BMI > 25, obese if BMI > 30.

The resting heart rate was measured in the morning. The measurement was taken from the radial artery with forefinger and the middle finger of the right hand placed horizontally across the participant's wrist while sitting on the chair. After that, the number of pulse beats multiplied by two to give the 1 min heart rate. Also, a mercury sphygmomanometer (Diplomat, Presameter) and stethoscope (Riester, duplex, Germany) were used to measure blood pressure of the participants. The cuff was normally placed smoothly and snugly around an upper arm, at roughly the same vertical height as the heart while the subject was seated with the arm supported. The systolic blood pressure and diastolic blood pressure were recorded.

The vital capacity was measured using the proper compact spirometer. Each participant was expected to maximally exhale through the mouth into the spirometer. The score was read and recorded to the nearest cubic centimeter. Meanwhile, respiratory rate was measured in cycle per minute (c/m). The rate was taken when the participant was at rest by counting the number of times the chest rise and fall in one minute using a stop watch. The rise and fall (inhalation and exhalation) of the participant's chest was observed and the number of respirations counted out loudly for one full minute was recorded as respiratory rate.

2.3. Method of Data Analysis

An inferential statistics of one-way analysis of variance (ANOVA) was used to test the hypotheses. Then, when there wassignificant result, Turkey's honesty significant difference post-hoc test was used to identify the source of the difference between the groups. Statistical significance was accepted for p value of <0.05. All the analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 22.0.

3. Results

The results are presented in Tables 1-4.

In Table 1, the mean and standard deviation of RHR were pre-exp [(72.36±9.25), pre-control (71.82±10.43), post-exp (63.68±4.52) and post-control (71.59±10.40)], for SBP, the mean and standard deviation were pre-exp [(126.59±9.05), pre-control (126.82±6.99), post-exp (122.27±7.36) and post-control (128.18±7.33)], for DBP, the mean and standard deviation were pre-exp [(79.77±6.98), pre-control (79.09±7.01), post-exp (75.23±4.75) and post-control (77.95±6.11)], for VC, the mean and standard deviation were pre-exp [(2068.18±757.43), pre-control (2109.09±721.71), post-exp (2227.27±653.33) and post-control (2118.18±702.13)] and for RR, the mean and standard deviation were pre-exp [(16.18±2.15), pre-control (16.05±1.96), post-exp (13.91±0.97) and post-control (16.27±1.80)].

Table 1. Descriptive statistics for general samples (N = 44).

		Mean	Std. Deviation	Minimum	Maximum
RHR	Pre-exp	72.36	9.25	57.00	87.00
	Pre-control	71.82	10.43	54.00	87.00
	Post-exp	63.68	4.52	56.00	72.00
	Post-control	71.59	10.40	54.00	88.00
	Total	69.86	9.54	54.00	88.00
SBP	Pre-exp	126.59	9.05	110.00	140.00
	Pre-control	126.82	6.99	120.00	140.00
	Post-exp	122.27	7.36	110.00	135.00
	Post-control	128.18	7.33	120.00	140.00
	Total	125.97	7.91	110.00	140.00
DBP	Pre-exp	79.77	6.98	70.00	90.00
	Pre-control	79.09	7.01	70.00	90.00
	Post-exp	75.23	4.75	70.00	80.00
	Post-control	77.95	6.11	70.00	90.00
	Total	78.01	6.41	70.00	90.00

		Mean	Std. Deviation	Minimum	Maximum
	Pre-exp	2068.18	757.43	1000.00	3100.00
	Pre-control	2109.09	721.71	1000.00	3100.00
VC	Post-exp	2227.27	653.33	1300.00	3100.00
	Post-control	2118.18	702.13	1000.00	3000.00
	Total	2130.68	699.81	1000.00	3100.00
	Pre-exp	16.18	2.15	13.00	20.00
	Pre-control	16.05	1.96	13.00	19.00
RR	Post-exp	13.91	.97	12.00	16.00
	Post-control	16.27	1.80	13.00	19.00
	Total	15.60	2.01	12.00	20.00

RHR- resting heart rate, SBP- systolic blood pressure, DBP- diastolic blood pressure, VC- vital capacity and RR- respiratory rate.

Table 2. Analysis of Variance (ANOVA) Showing Differences in the Cardiorespiratory Parameters of the Participants.

		Sum of Squares	Df	Mean Square	F	Sig.
	Between Groups	1127.909	3	375.970	4.656	.005
RHR	Within Groups	6782.455	84	80.744		
	Total	7910.364	87			
	Between Groups	432.670	3	144.223	2.418	.072
SBP	Within Groups	5010.227	84	59.646		
	Total	5442.898	87			
	Between Groups	264.489	3	88.163	2.236	.090
DBP	Within Groups	3312.500	84	39.435		
	Total	3576.989	87			
	Between Groups	304886.364	3	101628.788	.202	.895
VC	Within Groups	42302272.727	84	503598.485		
	Total	42607159.091	87			
	Between Groups	84.670	3	28.223	8.899	.000
RR	Within Groups	266.409	84	3.172		
	Total	351.080	87			

RHR- resting heart rate, SBP- systolic blood pressure, DBP- diastolic blood pressure, VC- vital capacity, RR- respiratory rate, Df-degree of freedom, F-test is a ratio of sample variance, Sig.-the two-tailed p-value associated with the null that the groups have the same variance.

Hypotheses testing

Hypothesis 1

There will be no significant difference in the resting heart rate of obese nurses prior to and following AE training.

The one-way analysis of variance (ANOVA) conducted to determine the significance of the difference in the resting heart rate prior to and following AE training is presented in Table 2. The F-value of 4.656 with 3 and 87 degree of freedom was observed to be statistically significant at 0.05 ($p<0.05$). Thus, the hypothesis which stated that there was no significant difference in the resting heart rate of obese nurses prior to and following AE training was rejected. This implies that the AE training had substantial effect on the resting heart rate of the participants. However, this difference necessitated the conduct of post-hoc test to identify where the difference liesas reflected in Table 3.

Hypothesis 2

There will be no significant difference in the systolic blood pressure of obese nurses prior to and following AE training.

Table 2 also shows the one-way analysis of variance (ANOVA) conducted to determine the significance of the difference in the systolic blood pressure prior to and following AE training. The F-value of 2.418 with 3 and 87 degree of freedom was observed to be statistically insignificant at 0.05 ($p>0.05$). Thus, the hypothesis which stated that there was no significant difference in thesystolic blood pressure of obese nurses prior to and following AE training was retained. This implies that the AE training had no substantial effect on the systolic blood pressure of the participants.

Hypothesis 3

There will be no significant difference in the diastolic blood pressure of obese nurses prior to and following AE training.

Likewise, the one-way analysis of variance (ANOVA) conducted to determine the significance of the difference in the diastolic blood pressure prior to and followingAEtraining is equally shown in Table 2. The F-value of 2.236 with 3 and 87 degree of freedom was found to be statistically insignificant at 0.05 ($p>0.05$). Thus, the hypothesis which stated that there was no significant difference in thediastolic blood pressure of obese nurses prior to and followingAEtraining was retained. This implies that the AE training did not have substantial effect on the diastolic blood pressure of the participants.

Hypothesis 4

There will be no significant difference in the vital capacity of obese nurses prior to and following AE training.

Similarly, Table 2 also reveals the one-way analysis of variance (ANOVA) conducted to determine the significance of the difference in the vital capacity prior to and following AE training. The F-value of 0.202 with 3 and 87 degree of freedom was observed to be statistically not significant at 0.05 ($p>0.05$). Thus, the hypothesis which stated that there was no significant difference in thevital capacity of obese nurses prior to and following aerobic exercise training was retained. This implies that the AE training had no substantial effect on the vital capacity of the participants.

Hypothesis 5

There will be no significant difference in the respiratory rate of obese nurses prior to and following AE training.

Meanwhile, the one-way analysis of variance (ANOVA) conducted to determine the significance of the difference in the respiratory rate prior to and followingAE training is equally presented in Table 2. The F-value of 8.899 with 3 and 87 degree of freedom was observed to be statistically significant at 0.05 ($p<0.05$). Thus, the hypothesis which stated that there was no significant difference in therespiratory rate of obese nurses prior to and following AE training was rejected. This implies that the AE training had substantial effect on the resting heart rate of the participants. However, this difference necessitated probing into post-hoc test to identify the source of the significance of RRas presented in Table 4.

Table 3. Turkey's Honesty Significant Difference Post Hoc Test Showing Difference in the Resting Heart Rate of the Participants.

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.
Pre-exp	Pre-control	.54545	2.709	.997
	Post-exp	8.68182*	2.709	.010
	Post-control	.77273	2.709	.992
Pre-control	Pre-exp	-.54545	2.709	.997
	Post-exp	8.13636*	2.709	.018
	Post-control	.22727	2.709	1.000
Post-exp	Pre-exp	-8.68182*	2.709	.010
	Pre-control	-8.13636*	2.709	.018
	Post-control	-7.90909*	2.709	.023
Post-control	Pre-exp	-.77273	2.709	.992
	Pre-control	-.22727	2.709	1.000
	Post-exp	7.90909*	2.709	.023

From Table 3, Turkey's honesty significant difference test was conducted to determine the difference in variation in the resting heart rate of the participants. Statistically significant differences were found in all the pair wise of mean difference except pre-exp versus pre-control (.54545), pre-exp versus post control (.77273), pre-control versus pre-exp (-.54545), pre-control versus post-control (.22727), post-control versus pre-exp (-.77273) and post-control versus pre-control (-.22727). This indicates that the entire pair wise mean had variable influence and thus, the training influenced the variation in the resting heart rate of the participants.

Table 4. Turkey's Honesty Significant Difference Post Hoc Test Showing Difference in the Respiratory Rate of the Participants.

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.
Pre-exp	Pre-control	.13636	.536	.994
	Post-exp	2.27273*	.536	.000
	Post-control	-.09091	.536	.998
Pre-control	Pre-exp	-.13636	.536	.994
	Post-exp	2.13636*	.536	.001
	Post-control	-.22727	.536	.974
Post-exp	Pre-exp	-2.27273*	.536	.000
	Pre-control	-2.13636*	.536	.001
	Post-control	-2.36364*	.536	.000
Post-control	Pre-exp	.09091	.536	.998
	Pre-control	.22727	.536	.974
	Post-exp	2.36364*	.536	.000

The Turkey's honesty significant difference test wasconductedto determine the difference in variation in the respiratory rate of the participants as reflected in Table 4. Statistically significant differences were found in all the pair wise of mean difference except pre-exp versus pre-control (.13636), pre-exp versus post control (-.09091), pre-control versus pre-exp (-.13636), pre-control versus post-control (-.22727), post-control versus pre-exp (.09091) and post-control versus pre-control (.22727). This indicates that the entire pair wise mean had variable influence and thus, the training influenced the variation in the respiratory rate of the participants.

4. Discussion

The main outcome of this study indicated that of all the cardiorespiratory parameters investigated; only resting heart rate and respiratory rate had significant response to the AE training. This study showed that the AE training substantially lowers the resting heart rate of obese nurses. Related studies also showed thatAE can increase the delta between heart rate at the end of the exercise and at the beginning of recovery, and eight weeks of training would be enough to augment this difference within the first 30 seconds post-exercise [24], with no differences in outcome for gender or age group and however, such adaptation may be lost in few weeks without training [26]. It is generally believed that regularAE induces significant adaptations both at rest and during maximum exercise in a variety of dimensional and functional capacities related to the cardiorespiratory regulation system and therefore, optimizing the supply of oxygen to the contracting muscles. These alterations include decreases in resting and maximal exercise heart rate [8]. Therefore, the reduction of resting heart rate in the AE group after the training might be due to nitric oxide, an important and potent endothelium-derived relaxing factor that facilitates blood vessel dilatation and decreases vascular resistance [12]. In addition, a low resting heart rate reflects a good health condition, whereas higher values are apparently related to a higher mortality risk. A mistake often made in sports area is to use resting heart rate as an indicator of the degree of aerobic conditioning, since the association between low resting heart rate and maximal aerobic power is quite modest, and may be due to higher resting vagal activity, reducing diastolic depolarization rate and prolonging duration of the cardiac cycle, primarily on account of a proportionally longer diastole [17]. Therefore, the physiological mechanisms modulating heart rate during or after an exercise program are not totally clear, and further studies are needed.

However, the results of this study also indicated that there were no significant changes in systolic blood pressure, diastolic blood pressure and vital capacity of the participants followingthe AE training. These findings are in contrast with the studies of [2] that AE increases systolic blood pressure and concluded that the exercise programme normalizes the systolic blood pressure. Also, a very important study that was conducted by [9] among well-trained endurance athletes revealed that AE does have significant positive effect on elevated diastolic blood pressure. This disagreement might not be unconnected to variation in study methodology including subject characteristics and differences in measuring instruments of cardiorespiratory parameters, among others. Meanwhile, the study equally revealed that theAE training had significant influence on respiratory rate of the participants. In addition, increased levels of physical activity and fitness, both in men and women, have been confirmed to reduce the relative risk of death by about 20–35% [14]. Some studies even suggest greater benefits (up to 50% risk reduction) for exercise in terms of all cause mortality and death from cardiovascular and metabolic diseases [16]. AE training has been affirmed to have a significant impact on the morphology of various blood vessels. These structural changes are followed by functional changes and lead to improved blood circulation. Exercise induces "angiogenesis", which is an expansion of the capillary network by the formation of new blood vessels at the level of capillaries and resistance arterioles, and arteriogenesis, which is an enlargement of existing vessels [13].

5. Conclusions

This study concluded thatthe AE trainingprogramme can substantially improve resting heart rate and respiratory rate of obese nurses. However, the training cannot improvesystolic blood pressure, diastolic blood pressure and vital capacity of the participants. Therefore, the AE trainingprogramme is a good training modality for improving only the resting heart rate and respiratory rate of obese nurses.

References

[1] Ascensao, A., Ferreira, R. &Magalhaes, J. (2007). Exercise-induced cardioprotection--biochemical, morphological and functional evidence in whole tissue and isolated mitochondria. *Int J Cardiol*, 117 (1), 16-30.

[2] Atare, F. U. & Mong, U. E. (2006). Concepts approach to exercise physiology. Warri: Basic thrust computers.

[3] Banerjee, A. K., Mandal, A., Chanda, D. & Chakraborti, S. (2003). Oxidant, antioxidant and physical exercise. *Mol. Cell Biochem*, 253 (12), 307-12.

[4] Benjamin, E. J., Larson, M. G. & Keyes, M. J. (2004). Clinical correlates and heritability of flow-mediated dilation in the community: the Framingham Heart Study. Circulation, 109 (5), 613–619.

[5] Campbell, I. (2003). The obesity epidemic: Can we turn the tide? Heart, 89 (Suppl 2): ii 22–24.

[6] Chatterjee, S., Chatterjee, P. & Bandopadhyay, A. (2005). Validity of Queen's College Step Test for estimation of maximal oxygen uptake in female students. *Indian J Med Res*, 121, 32-35.

[7] Clarkson, P., Montgomery, H. E. & Mullen, M. J. (1999). Exercise training enhances endothelial function in young men. Journal of the American College of Cardiology, 33 (5), 1379–1385.

[8] Fagard, R. H. (2001). Exercise characteristics and the blood pressure response to dynamic physicaltraining. *Med Sci Sports Exerc*, 33, 484–492.

[9] Foss, M. L. & Keteyain, S. J. (1998). Fox's physiological basis for exercise and sport, (6th edition). McGray, New York-Hill Companies.

[10] Hambrecht, R., Fiehn, E. & Weigl, C. (1998). Regular physical exercise corrects endothelial dysfunction and improves exercise capacity in patients with chronic heart failure. Circulation, 98 (24), 2709–2715.

[11] Jones, A. M. & Carter, H. (2000). The effects of endurance training on parameters of aerobic fitness. *Sports medicine*, 29 (6), 373-386.

[12] Joyner, M. J. & Tschakovsky, M. E. (2003). Nitric oxide and physiologic vasodilation in human limbs: where do we go from here? *J Appl Physiol*, 28, 475–490.

[13] Leung, F. P., Yung, L. M., Laher, I., Yao, X., Chen, Z. Y. & Huang, Y. (2008). Exercise, vascular wall and cardiovascular diseases: anupdate (part 1). *Sports Medicine*, 38 (12), 1009–1024.

[14] Macera, C. A. & Powell, K. E. (2001). Population attributable risk: implications of physical activity dose. Medicine and Science in Sports and Exercise, 33 (6), 635–639.

[15] Melanson, E. L. & Freedson, P. S. (2001). The effect of endurance training on resting heart rate variability in sedentary adult males. *Eur J ApplPhysiol*, 85, 442-449.

[16] Myers, J., Kaykha, A. & George, S. (2004). Fitness versus physical activity patterns in predicting mortality in men. American Journal of Medicine, 117 (12), 912–918.

[17] Nottin, S., Vinet, A., Stecken, F., N'Guyen, L. D., Ounissi, F., Lecoq, A. M. & Obert, P. (2002). Central and peripheral cardiovascular adaptations to exercise in endurance-trained children. *Acta Physiol Scand*, 175, 85-92.

[18] Ogunjimi, L. O., Ikorok, M. M. & Olayinka, Y. O. (2010). Prevalence of obesity among Nigeria nurses: The AkwaIbom state experience. *International NGO Journal*, 5 (2), 045049.

[19] Ozcelik, O., Aslan, M., Ayar, A. &Kelestimur, H. (2004). Effects of body mass index on maximal work production capacity and aerobic fitness during incremental exercise. *Physiol Res*, 53, 165-170.

[20] Perna, F., Bryner, R. & Donley, D. (1999). Effect of diet and exercise on quality of life and fitness parameters among obese individuals. *J Exerc Physiol*, 1, 125–131.

[21] World Health Organization (2010). Global estimate of the burden of disease from second-hand smoke. Geneva: World Health Organisation.

[22] World Health Organization (2013). Cardiovascular diseases (CVDs) Fact sheet N°317. Geneva: World Health Organisation.

[23] Chan, R. S. M. & Woo, J. (2010). Prevention of Overweight and Obesity: How Effective is the Current Public Health Approach. *International Journal of Environmental Research and Public Health*, 7, 765-783.

[24] Danger, C. V., Danger, E. V., Borel, J. C. & Pepin, J. L. (2011). Respiratory muscle endurance training in obese patients. *International Journal of Obesity*, 35, 692-699.

[25] Vibarel, N. &Hayot, M. (2002). Effect of aerobic exercise training on inspiratory muscle performance and dyspnoea in patients with chronic heart failure. *The European Journal of Heart Failure*, 4, 745–751.

[26] Almeida, R. T., Almeida, M. M. G. & Araujo, T. M. (2009). Abdominal obesity and cardiovascular risk: performance of anthropometric indexes in women. *Arq Bras Cardiol*, 92, 375-380.

[27] Zouhal, H., Jacob, C., Delamarche, P. & Gratas-Delamarche, A. (2008). Catecholamines and the effects of exercise, training and gender. *Sports Med*, 38, 401-423.