https://abueducationjournals.com/gjhrr

DOI: https://doi.org/10.67203/gjhrr.2024.8ai4wxqq

COMPARATIVE EFFECT OF MODERATE INTENSITY-INTERVAL AND CONTINUOUS TRAINING ON BODY MASS INDEX (BMI) AND VISCERAL FAT OF OVERWEIGHT ADULTS IN BAYELSA STATE

Leghemo T. Stephen and Karl Eimuhi

Department of Science Education, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria
Department of Human Kinetics and Health Education, Faculty of Education, Ambrose Ali University, Epkoma, Edo State
Corresponding author: tinimoteistephen@ndu.edu.ng 07063075256

Abstract

Physical inactivity has been identified as one of the major global health issues. It has been linked to increased health risks like Coronary heart disease, type 2 diabetes, breast and colon cancers overweight and obesity. This study was conducted to compare the effect of moderate intensity interval and continuous training on Body Mass Index (BMI) and Visceral Fat of overweight adults in Bayelsa State. The study was guided by two objectives, two research questions and two hypotheses. The study adopted the randomized pretest-posttest control group design, where the control and experimental groups were administered a pretest and treatment given only to the experimental groups thereafter, a posttest was administered to the three groups. One hundred and twenty volunteers were randomly assigned to experimental groups one and two and the control group using the fishbowl method. The instruments for data collection were a Stadiometer (SECA 217) and an Omron Karda Scan Body Composition Monitor (HBF-511). The instruments used for the study are standardized. The reliability coefficients were; Body Mass Index (r = .69) and Visceral Fat (r = .64 male and r = .80 female). All statistical analysis was done using IBM Statistical Package for Social Science (SPSS) for Windows (Version. 21). Data were analyzed using Descriptive Statistics of Mean and Standard Deviation to answer the research questions and ANCOVA to test hypotheses at 0.05 alpha level. The findings of the study showed an eta value (.833) indicating a large effect on BMI and the findings of the study also revealed, an eta value (.872) indicating a large effect on the visceral fat level of the study participants. The null hypotheses which stated that there is no significant difference in the effect of moderate intensity interval and continuous training on BMI and Visceral Fat of overweight adults in Bayelsa State were thus rejected with a P-value less than the selected level of significance (0.05). The study concluded that moderate-intensity intervals and continuous training regimens improved the BMI and Visceral Fat of overweight adults in Bayelsa State. The study recommended that adults should be sensitized to various benefits of engaging in moderate-intensity interval and continuous training regimens as they relate to the general health and well-being of individuals at large.

Keywords: Moderate Intensity-Interval, Continuous Training, Body Mass Index (BMI), Visceral Fat, Overweight Adults

Introduction

Physical inactivity has been identified as one of the most important global issues of the world in the twenty-first century leading to increased risk among many adverse health conditions including the world's major Non-Communicable Diseases (NCDs) of coronary heart diseases, type 2 diabetes, and breast and colon cancers. World Health Organization (WHO) (2009) documented that physical inactivity ranks as the fourth most significant mortality factor in the world with 3.2 million deaths a year worldwide. Leem et al. (2012) and Kyu et al. (2016) also documented that physical inactivity causes 6% of the burden of disease from coronary heart disease, 3% of ischemic heart disease, 7% of type 2 diabetes, 10% of breast cancer, 10% of colon cancer and as well cause fractured hips in older persons.

Physical inactivity has been associated with overweight and obesity. Obesity and overweight are abnormal or excess fat accumulation that impairs the health of an individual (WHO, 2016). A person is said to be overweight when he/she has a BMI of 25-29.9 kg/m^2 and obese when he/she has a BMI of 30kg/ m^2 and above (WHO, 2016). These conditions are increasing at an alarming rate throughout the world and their incidences have seen a steady increase over the past few decades, allowing overweight/obesity-related effects and diseases to receive more attention than ever (Agwubike & Leghemo, 2013). They are important determinants of health and fitness. They lead to adverse metabolic changes in adults including an increase in blood pressure, unfavourable cholesterol levels, increased resistance to insulin and low/high-density lipoprotein syndrome (Mishra, 2000). It is reported that overweight and obesity are the fifth leading risk of global death with at least 2.8 million adults' deaths each year from complications attributable to them (WHO, 2018). WHO (2018) reported that 1.9 billion of the world's population are overweight while 650 million are obese as of 2016. This data is alarming, considering the health burdens associated with these medical conditions. Its increasing trend in the world is even more pronounced in developing countries of the world of which Nigeria being the most populous country in Africa, is of increasing changes in lifestyle which is associated with an increasing burden of non-communicable diseases.

Health and fitness have played a vital role in the life of adults from time immemorial and being physically fit increases life expectancy and reduces the risk of premature mortality. Physical Fitness is the ability to perform daily activities with vigour to demonstrate traits and capacities that are associated with a low risk of premature development of hypokinetic diseases (Paoli et al., 2015). The fitness parameters are a key component of the health of an individual. Fitness parameters are core variables used to assess the fitness status of an individual which are health-related. According to Esmaeiade and Ebadollahadeh (2012), fitness parameters are integrated measures of whole-body functioning, which consists of different attributes of which body composition and cardiorespiratory fitness are important.

The human body composition has been of great interest as inadequate lean body mass and excess fat mass are major risk factors related to major health outcomes. A healthy balance between fat and muscle is vital for health and wellness. An array of evidence shows that maintaining of healthy body composition increases longevity and reduces the risk of heart diseases, leading to an increase in energy level whilst improving self-esteem. Body Mass Index is used as a screening tool for overweight or obesity. Body Mass Index is a person's weight in kilograms divided by the square of his/her height in meters. It is one of the most common ways of estimating whether a person is overweight, obese, underweight or having a desirable weight (WHO, 2000). This means BMI, is an appropriate measure for screening obesity and its health risks. It has been documented by Zhu et al. (2005) that increased body mass index (BMI) predisposes to certain cancers and that a high Body Mass index predicts future morbidity and death. However, it has been observed that people who do more physical activities have a lower Body Mass Index than less active people (Orsini et al., 2007).

Everybody carries two types of body fat namely, essential and storage fat. Excess of these body fats however is detrimental to a person's health and well-being. Visceral Fat is of particular concern as it is a key player in a variety of health problems in humans. Too much visceral fat is thought to be closely linked to increased levels of fat in the bloodstream, which could lead to common diseases such as hyperlipidemia and diabetes (Leghemoet al.2017). Bosch et al. (2015) asserted that increased visceral adipose tissue accumulation above a certain threshold is associated with decreased insulin sensitivity and increased cardiovascular disease risk in both males and females independently of total body fat. Excess abdominal fat is a predictor of high coronary risk compared to generalized obesity standing out as an independent factor of cardiometabolic risk (Pinho et al., 2017).

Moderate-intensity interval training would potentially provide health benefits in a time-efficient manner which involves repeated bursts of moderate exercise interspersed with low-ntensity recovery in an obese population. Coombes and Skinner (2014) opine that moderate-intensity interval training may have the potential to promote weight loss as it has benefits similar to moderate continuous training (which involves training that is performed at a continuous intensity throughout and doesn't involve any rest periods) while requiring less time. Boule et al. (2005) asserted that regular moderate and continuous training increases muscle capillarization as well as metabolic enzymes involved in the oxidation of fatty acids and glucose. These adaptations alongside the direct energy expenditure of physical activity contribute to the control of body fat mass and risk factors of type 11 diabetes mellitus and cardiovascular diseases (Joyner & Green, 2009; Khan et al., 2012). Adulthood is a period of the life cycle that differs widely due to socioeconomic, labour and cultural conditions and people are not always aware of the changes that come with adulthood. Understanding the keys to maintaining health and quality of life and facing the decline or deterioration that occurs in old age with better physical and mental health is a vital tool to increase life expectancy. Okunbor et al. (2009) observed that adults in Nigeria live a life of relative ease and comfort coupled with insatiable acquisition of material things and power.

It has been observed that many people in Western societies prefer smaller body sizes for health reasons, as such even when body weight is normal, the desire to be slim sometimes persists particularly in females where thinness is celebrated (Okoro et al., 2014). In contrast, several cultures across Nigeria view being big as desirable and are traditionally more approving of obesity as it is associated with physical attractiveness, strength, fertility and prestige. Many Nigerians believe that having a big body size is a sign of wealth and healthy living; thus, the fatter the better. The obesity-approving cultures can be seen among the Nembes, Koluamas and Brass people, to mention but a few in Bayelsa State. Bayelsa State has traditionally favoured plumpness as a symbol of sexual beauty, socio-economic status and social standard. When the preference for large body shape exists, a direct relationship between overweight and obesity is likely to be observed in higher groups having the financial capacity to buy extra food and achieve their desire to look healthy and strong. Such group of people who appreciate obesity and overweight may be at risk of developing obesity-related health disorders. Moderate intensity intervals and continuous training may provide a panacea to these inherent challenges. Thus, there is a need for a comparative effect of moderate intensity interval and continuous training on the fitness parameters of overweight adults in Bayelsa State.

Aim and Objectives of the Study

The study compared the effect of moderate intensity interval and continuous training on Body Mass Index (BMI) and Visceral Fat of overweight adults in Bayelsa State. Specifically, the study achieved the following:

1. Determine the effect of moderate intensity interval and continuous training on the Body Mass Index (BMI) of overweight adults in Bayelsa State
2. Ascertain the effect of moderate intensity interval and continuous training on the visceral fat level of overweight adults in Bayelsa State.

Research Questions

The following research questions guided the study**:**

1. What is the effect of moderate intensity interval and continuous training on the Body Mass Index (BMI) of overweight adults in Bayelsa State?
2. What is the effect of moderate intensity interval and continuous training on the visceral fat level of overweight adults in Bayelsa State?

Hypotheses

The following hypotheses were formulated to guide the study:

$Ho_{1:}$ There is no significant difference in the effect of moderate intensity interval and continuous training on the Body Mass Index (BMI) of overweight adults in Bayelsa State.

$Ho_{2:}$ There is no significant difference in the effect of moderate intensity interval and continuous training on the visceral fat level of overweight adults in Bayelsa State.

Methodology

The study adopted the randomized pretest-posttest control group design. A pretest was administered to the control and experimental groups where anthropometric parameters such as height, weight, BMI, and Visceral Fat were measured for the control and experimental groups. The experimental groups had moderate intensity interval and continuous training for 12 weeks then both the experimental and control groups were administered a post-test, in which the responses were compared to determine the effect of the training. The sample for the study was 120 (females 61 and males 59) volunteered overweight adults who were residents of Bayelsa State. The volunteers were randomly assigned to experimental groups one and two and control groups using the fishbowl method. This method involves selecting of number of slips randomly. The researcher places all the slips of paper in a bowl and draws random samples from it making sure both the control and experimental groups have equal scores and further dividing the experimental group into two halves. The instruments for data collection were a Stadiometer (SECA 217, Hamburg, Germany) which was used to measure the heights of the study participants and an Omron Karda Scan Body Composition Monitor (HBF-511, OMRON HEALTHCARE Co.Ltd. Japan) which was used to measure Weight, BMI and Visceral Fat. The instruments for data collection in this study are standardized. The validity coefficient of body composition monitor (body mass index and visceral fat) have been documented respectively. Body Mass Index using the height and weight ratio of the Body Composition Monitor has a validity coefficient of 0.69 (James et al., 2011) and the validity coefficient for Visceral Fat using the Body Composition Monitor is 0.64 for males and 0.80 for females. The instruments used for the study were standardized. The reliability coefficient of the body composition monitor (body mass index and visceral fat) has been documented. Body Mass Index using height and weight ratio of Body Composition Monitor has a reliability coefficient of 0.69 (James et al., 2011) and the reliability coefficient for Visceral Fat using Body Composition Monitor is 0.64 for males and 0.80 for females. All statistical analyses were done using the IBM Statistical Package for Social Science for Windows (Version 21). Data were analyzed using descriptive statistics, mean (x), standard deviation (SD) and ANCOVA was used to test research hypotheses at 0.05 alpha level. Cohen's criterion for interpretation of the eta value was used to interpret the effect of moderate intensity-interval and continuous training on participants of the study with 0.20- 0.49, as small effect, 0.50- 0.79 as medium effect and ≥ 0.80 as large effect.

Results

Research Question 1: What is the effect of moderate intensity interval and continuous training on the Body Mass Index (BMI) of overweight adults in Bayelsa State?

Table 1: Description of Pretest and Posttest Values for BMI (m^2/kg).

Groups	Pre-BMI	Post-BMI	M.D	S.D	Decision
Experimental (Continuous)	31.89	28.02	3.87	3.87	
Experimental (Interval)	32.13	27.09	5.04	2.72	**Large effect**
Control	31.14	30.63	0.51	3.50	

The result of the study in Table 1. indicates that participants in the experimental group I (continuous training) had a mean score of 31.89 m^2/kg at baseline (pretest) and a mean score of 28.02±3.87 m^2/kg as posttest mean score, with a mean difference of 3.87 m^2/kg. The result in the Table also indicated that at baseline (pretest), the interval training group had a mean score of 32.13 m^2/kg and a posttest mean score of 27.09±2.72 m^2/kg, with a mean difference of 5.04 m^2/kg. The study indicates a

decrease in body mass index with moderate intensity interval training having a higher mean difference score (5.04 m^2/kg) than that of the continuous training (3.87 m^2/kg) after twelve weeks of training. The control group had a mean score of 31.14 m^2/kg at baseline and 30.62±3.50 m^2/kg as the posttest mean score. The eta square statistics were further calculated to determine the effect of moderate intensity interval and continuous training on the body mass index of overweight adults. The eta squared statistics (.833) indicate a large effect with sustainable difference in the effects of training Post-intervention. Hence, moderate intensity intervals and continuous training are said to have a very large effect on the body mass index among overweight adults in Bayelsa State.

Research Question 2: What is the effect of moderate intensity interval and continuous training on the visceral fat level of overweight adults in Bayelsa State?

Table 2: Description of Pretest and Posttest Values for Visceral Fat levels.

Groups	Pre- Visceral fat	Post- Visceral fat	M.D	S.D	Decision
Experimental (Continuous)	13.33	11.50	1.83	2.01	
Experimental (Interval)	14.12	11.15	2.97	2.05	**Large effect**
Control	11.92	11.92	-0.00	3.21	

The results of the study in Table 2. showed that at baseline (pretest), participants in the experimental group I (continuous training) had a mean score of 13.33 and 11.50±2.01 as mean for post-test score with a mean difference of 1.83. The results in the Table also indicated that the interval training group participants at baseline (pretest), had a mean score of 14.12 and a posttest mean score of 11.15±2.05 with a mean difference of 2.97. Also, the control group had a mean score of 11.92 at baseline and 11.92±3.21 as the post-test mean score. After twelve weeks of training. This indicates that both training methods of moderate interval and continuous had a similar mean difference score on the study participants when compared. The eta square statistics (.872) indicated a large effect with an essential difference in the effects of training post-intervention. Thus, moderate-intensity interval and continuous training are considered to have a very large effect on visceral fat levels among overweight adults in Bayelsa State.

Hypothesis 1: There is no significant difference in the effect of moderate intensity interval and continuous training on the Body Mass Index (BMI) of overweight adults in Bayelsa State.

Table 3: Analysis of Covariance Summary for Effect of Moderate Intensity Interval and Continuous Training on BMI.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	13509.89	5	261.97	128.94	.000	**.862**
Intercept	7.23	1	7.23	3.56	.062	**.033**
Training	4.37	2	2.18	1.07	.345	**.020**
Training * BMI	1045.46	3	348.49	171.52	.000	**.833**
Error	209.26	103	2.032			
Total	93397.08	109				
Corrected Total	1519.16	108				

The result in Table 3. showed an F value of 171.52 and a P-value of .000. The P-value is less than the selected levels of significance (0.05). The Table therefore showed a statistically significant difference (0.05). The null hypothesis which states that there is no significant difference in the effect of moderate intensity interval and continuous training on the Body Mass Index (BMI) of overweight adults in Bayelsa State was thus rejected.

Hypothesis 2: There is no significant difference in the effect of moderate intensity interval and continuous training on the visceral fat of overweight adults in Bayelsa State.

Table 4: Analysis of Covariance Summary for Effect of Moderate Intensity Interval and Continuous Training on Visceral Fat.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	669.49	5	133.89	143.18	.000	**.874**
Intercept	42.18	1	42.18	45.10	.000	**.305**
Training	29.95	2	14.97	16.01	.000	**.237**
Training * visceral fat	658.28	3	219.42	234.64	.000	**.872**
Error	96.31	103	.93			
Total	15470.00	109				
Corrected Total	765.81	108				

The result in Table 4. showed an F value of 234.64 and a P-value of .000. The P-value is less than the selected levels of significance (0.05). The Table, therefore, showed a statistically significant difference (0.05). Thus, the null hypothesis which states that there is no significant difference in the effect of moderate intensity interval and continuous training on the visceral fat of overweight adults in Bayelsa State was rejected.

Discussion

The result of the study in Table 4.1 revealed a large effect (.833) of moderate-intensity interval and continuous training on the Body Mass Index of overweight adults which was statistically significant at 0.05 alpha level. This implies that both moderate-intensity interval and continuous training have a considerable effect on the body mass index of overweight adults. The large effect size could be attributed to the twelve weeks of training given to the study participants. Also, the large effect could be attributed to the training methods and training plan regimen employed during the intervention across the training groups which could be different from the regular physical activities which are not geared towards achieving any bodily fitness goals. Another plausible reason which might have resulted in the large effect size could be the result of the pep talk done before the training, educating adults who volunteered to participate in the study on the health risks of having high Body Mass Index and the health benefits of having moderate/desirable and healthy Body Mass Index. The findings of this study are similar to the findings of Ativie et al., (2018) on the impact of interval and continuous training on selected anthropometric, cardiovascular and metabolic indicators of overweight and obese females in Enugu which showed that participants in the experimental groups of the study had a significant difference ($p<0.05$) in the value of the anthropometric parameter (Body Mass Index) of both training groups following a ten-week training programme.

The findings of this study are in line with the findings of Khammassi et al., (2018), Skrypnik et al., (2015), Sá, et al., (2012) and Sheikholeslami-Vantani and Ebrahimi (2018).

The findings of the study in Table 2 on the effect of moderate intensity interval and continuous training on the visceral fat level of overweight adults, indicated a large effect (.872). The table also indicated a decreased post-mean score (11.50±2.01) with a mean difference of 1.83 amongst the moderate continuous training group and a decreased mean score (11.14±2.05) with a mean difference of 2.97 amongst the moderate intensity interval training group. The hypothesis test revealed that there is a significant difference in the visceral fat level of overweight adults after the twelve weeks of training. This could be attributed to the fact that study participants trained for twelve weeks. This implies that both training methods are equally beneficial for eliciting a reduction in visceral fat levels when a similar time commitment or energy expenditure is used in adults who are overweight or obese. The large effect could also be attributed to the training intensity employed during the twelve weeks of intervention. Another plausible reason could be motivation to partake in the training program that is, negative body image can influence the decision to participate in an exercise program. The findings of this study are similar to the findings of Heydari, et al. (2012) where 1.5kg ($P< -0.001$) 17% of reduction of visceral fat after twelve weeks of intervention was observed.

Conclusion

Participating in a planned exercise regimen can lead to an improvement in the fitness parameters of overweight adults. The study demonstrated a significantly lower body mass index and visceral fat level amongst overweight adults in Bayelsa State who participated in a 12-week moderate intensity interval and continuous training intervention program. It was noted that both exercise training protocols resulted in a significant improvement in the fitness parameters. However, the outcomes of the study

suggest that moderate-intensity interval training may be a more effective intervention than continuous training amongst overweight adults due to its time efficiency and rest intervals.

Recommendations

Based on the findings of the study, the following recommendations were postulated:

1. Stakeholders at the community level should consider as part of community projects engaging residents in some sessions of moderate intensity interval and continuous training regimen once a month as a key element in eliciting fitness parameters amongst the overweight adult population.
2. Exercise experts should sensitize adults on the various benefits of engaging in moderate-intensity intervals and continuous training regimens as they relate to the general health and well-being of individuals as large through planned Audio-visual sessions.
3. Coaches and Personal trainers should attend courses and seminars, where they can learn more about how to incorporate moderate intensity intervals and continuous training programmes into their training program to elicit physiological adaptation.
4. Health and Physical Educators through the Ministry of Health should organize seminars in rural areas to educate the adult population on the health benefits of engaging in simple moderate-intensity intervals and continuous training regimes in their day-to-day life rather than living in drugs as it contributes to an increase in life span expectancy.

References

Agwubike, E. O., & Leghemo, T. S. (2013). Undergraduate female students' body weight problems assessed through body mass index and percentage fat. *Nigerian Journal of Health & Kinesiology*, 9, 1-6.

Bosch, T. A., Steingberger, J., Sinakio, A. R., Moran, A., Jacob, R. D., Kelly, A. S., & Dengels, D. R. (2015). Identification of Sex-specific threshold for accumulation of Visceral adipose tissue in Adults. *Obesity*, 23; 375-382.

Boule, N. G., Weinsnagel, S. J., Lukka, T. A., Tremblay, A., Bergman, R. N., Rainkinen, T., Leon, A. S., Skinner, J. S., Wilmore, J. H., Rao, D. C., & Bouchard, C. (2005). Effect of Exercise Training on Glucose Homeostasis: The HERITAGE Family Study. *Diabetes Care*, 28 (1), 108-114.

Coombes, J. S., & Skinner, T. (2014). ESSA's Students Manual for Health, Exercise as Sport Assessment. Brisbane, QLD: *Elsevier*, 444.

Esmaeialzah, S., & Ebadollahzadeh, K. (2012). Physical fitness and sedentary behaviour characteristics of 7-11years old boys in different physical activity levels. *World Applied Science Journal*, 15 (5), 624-630.

Heydari, M., Freund, J., & Boutcher, S. H. (2012). The effect of high-intensity intermittent exercise on body composition of overweight young males. *J Obes*. 2012, 480467. https://doi.org/10.1155/2012/480467.

Joyner, M. J., & Green, D. J. (2009). Exercise protects the Cardiovascular System: effects beyond traditional risk factors. *J Physiol*, 93 (4), 1502-505.

Khammassi, M., Ouerghi, N., Hadj-Taieb, S., Fek, M., Thivel, D., & Bovassida, A. (2018). Impact of a 12-week High-Intensity Interval without Caloric Restriction on Body Composition and Lipid Profile in Sedentary Healthy Overweight/Obese Youth. *Journal of Exercise Rehabilitation*, 14 (1), 118-125.

Khan, K. M., Thompson, A. M., Blair, S. N., Sallis, J. F., Powell, K. E., Bull, F. C., & Bauman, A. E. (2012). Sports and Exercise as contributors to the health of nations. *Lancets*, 380 (9836), 7;59-64.

Kyu, H. H., Bachman, V. F., Alexander, L. T., Mumford, J. E., Afshin, A., Estep, K., Veerman, J. L., Delwiche, K., Llannarone, M., Moyer, M. L., Cercy, K., Vos, T., Murray, C. J. L., & Forouzanfar, M. H. (2016). Physical Activity and Risk of Breast Cancer, Colon Cancer, Diabetes, Ischemic Heart Disease and Ischemic Stroke events: systematic review and dose-response meta-analysis for the Global Burden of Disease Study 2013. *BMJ*, 354. https://doi.org/10.1136/bmj.i3857.

Leem, I. M., Shiroma, E. J., Lobelo, F., Puska, P., Blair, S. N., & Katz-Mary, P. T. (2012). Effect of Physical inactivity in a major non-communicable disease worldwide: an analysis of burden of disease and life expectancy. *Lancet*, 380-219.

Leghemo, T. S., Agwubike, E. O., & Efe-Aigbovo, A. E. (2017). Body Weight Profile Categorization of Uniben Early Morning Fitness Promotion Club Members. *Institute Journal of Studies in Education*, 7 (1); 37-42.

Mishra, A. (2000). Central Obesity: Origin and relevance. In: Metabolic Syndrome, Seventh Annual Symposium, New Delhi: *Ranbaxy Science Foundation*.

Okoro, E. O., Oyejola, B. A., Etebu, E. N., Sholagberu, H., Kolo, P. M., Chijioke, A., & Adebisi, S. A. (2014). Body size Preference among Yoruba in three Nigerian Communities. *Eat Weight Disord*, 19; 77-88.

Okunbor, A. O., Agwubike, E. O., & Efe-Aigbovo, A. E. (2009). Assessing University of Benin staff participation levels in a structured fitness/ recreation. *Nigerian Association of Physical Health Education Recreation Sports and Dance (NAPHER.SD)*, 38-39.

Orinsi, N., Bellocco, R., Bottai, M., Pagano, M., Michaelsson, K., & Wolk, A. (2007). Combined effects of Obesity and Physical Activity in Predicting Mortality among Men. *Journal of Internal Medicine*, 264; 442-451.

Pinho, C. P. S., Diniz, A. S., de Arruda, I. K. G., Leao, A. P. D., de Albuquerque, E. C., & Rodrques, I. G. (2017). Factors Associated with the Concentration of Visceral and Subcutaneous Fat. *Health Care Current Reviews*, 5 (4),1-8. https://doi.org/10.4172/2375-4375.1000214.

Sa, C. K. C., Tenorio, M. C. C., Freitas, M. M., Ruas, G. R., & Cancio, J. F. P. (2012). Effects of interval training versus continuous exercise on anthropometric and cardiorespiratory fitness markers in obese women. *J Nutr Disorders Ther*, S 2; 2161-0509. http://dx.doi.org/10.4172/2161-0509.S2-002.

Sheikholeslami-Vatani, D., & Ebrahim, A. (2018). The Effect of Moderate-Intensity Continuous Training Vs. High-Intensity Interval Training on Visceral and Subcutaneous Fats in Obese Women. *J Rafsanjan Univ Med Sci*, 16 (12), 999-1012.

Skrypnik, D., Bogdanski, P., Madry, E., Karolkiewicz, J., Ratajczack, M., Krysciak, J., Pupek-Musialik, D., & Walkowiak, J. (2015). Effects of Endurance and Endurance Strength Training on Body Composition and Physical Capacity in Women with Abdominal Obesity. *Obes Facts*, 8175-187. https://doi.org/10.1159/000431002.

WHO (2000). Obesity: Preventing and managing the global epidemic. Report of a WHO consolation. *WHO Technical reports series*, WHO press, 2, (4-6) 894; 38-99.

WHO (2009). Global health risk: mortality and burden of disease attributable to selected major risks. Geneva. www.who.int./evidence/bod.

WHO (2016). Obesity and Overweight: *Fact Sheet*, 311.

WHO (2018). Obesity and Overweight. *Fact Sheet*. https://www.who.int.mediacentre/factsheet/fs311.

Zhu, K., Caulfield, J., Hunter, S., Roland, C. L., Payne-Wilks, K., & Texter, L. (2005). Body mass index and breast cancer risk in African American Women. *Annals of Epidemiology*, 15 (2), 123-128. https://doi.org/10.1016/j.annepidem.2004.05.011.