EFFECTS OF ROPE SKIPPING ON VISCERAL FAT OF FEMALE ADOLESCENTS IN MAKURDI, NIGERIA

SHACHIA T.T. [1] and BABUJE H.M. [2]

[1]Human Kinetics and Health Education Department, Ahmadu Bello University Zaria
[2]Physical and Health Education Department, Federal University, Wukari.
shachiaterfa@gmail.com

Abstract

The purpose of this study was to assess the effect of rope-skipping on visceral fat of female adolescents in Makurdi, Nigeria. To achieve this purpose, the pretest-posttest control group was adopted in this study; the population for the study was 334 female adolescent students of St. Dominic's High School, Makurdi. Multi-stage sampling technique was used for this study. The six (6) existing classes of the school served as strata. Purposive sampling technique was used to select only female adolescent students, whose BMI ranges between 85th and 95th percentile of Body mass index (overweight) and 13-19 years old respectively. Simple random sampling techniques of deep and pick with replacement was used in selecting five (5) students from each class. Therefore, total of (30) participants were selected and used for this study. They were randomly assigned into either control group (n = 15) or experimental group (n = 15), in the course of the training, two (2) were dropped out as a result of inconsistency of training attendance and one (1) dropped as a result of parental influence. Thus, twenty-seven (27) participants were used for this study. The experimental group performed rope skipping training three (3) times in a week for eight (8) weeks, while the control group did not take any form of training. Prior to and after the training, waist-hip ratio (WHR) was measured in centimeters (cm), using a flexible anthropometric tape. The data collected were analysed using descriptive statistics of mean and standard deviation to describe the physical characteristics of participants and the hypotheses were tested using student's independent t-test at significant level of 0.05, the statistical package for the social sciences (IBM SPSS®) for windows version 21 was used to analyse the data. The results of the study revealed that eight (8) weeks of rope-skipping significantly reduced WHR ($P < 0.05$) of female adolescents in Makurdi. Based on the findings of this study, it was concluded that rope-skipping exercise significantly reduced WHR which is an index measure of visceral fat of female adolescents in Makurdi, Nigeria. It was therefore recommended that; female adolescents should regularly engage in rope skipping as an exercise to positively improve their physiological parameters.

Keywords: waist-hip ratio, visceral fat, overweight, adolescent, rope-skipping

Introduction

Early active lifestyle forms the basis for healthy development in adolescents for transition into adulthood. Epidemiological studies have shown that sedentary lifestyle leads to onset and progression of life-threatening disease conditions such as hypertension, cardiovascular diseases early overweight and obesity (Al-Attas, Al-Daghri, Alokail, Alkharfy, Sabico, & Chrousos, 2020; Madden & Smith, 2022). Sedentary life is a serious growing health problem, hence, it is essential to be physically active to improve physical fitness among female adolescents, who are on their peak of physiological development (Suleiman, Abdullahi, Tsauri, Abdullahi, Olasunkanmi, & Dikki, (2019).

Adolescents who engage in forms of plays like jumping and hopping tend to experience less prevalence of diseases related to obesity, excess visceral fat and child onset diabetes (Onaji, Petrosk, & Pelegrini, 2017).

Thus, the researcher became interested in the rope skipping play way of female adolescents, especially secondary school girls, during break periods and physical education programmes, which are sustained for a period of time similar to normal form of exercises.

However, the current play ways of adolescence are influenced by parental guidance which has forced them to focus more on intellectual activities of learning, and less on physical activities of running around and jumping, the focus renders most students sedentary, hindering them from deriving the benefits of physical activities to health; such as accumulation of excess visceral fat.

Visceral fat is a type of abdominal fat that is found deep within the abdomen and surrounds the internal organs. In contrast to surface-level (subcutaneous) fat. Visceral fat, according to Harvard University, secretes a variety

of hormones and substances. Cytokines are one sort of molecule that visceral fat produces. Cytokines serves as an important role in the human body, however, elevated cytokine levels due to excess visceral fat can be detrimental to the health of female adolescents. When cytokines enter the liver, they alter blood lipid production, which has been related to greater cholesterol and insulin resistance, potentially leading to type 2 diabetes, a severe health risk. Excessive visceral adipose tissue appears to trigger a cascade of metabolic disturbances that seem to coexist with ectopic fat storage in muscle, liver, heart and the ß-cell. Therefore, the reduction of visceral adipose tissue potentially plays a pivotal role in the treatment of the metabolic syndrome. In line with few findings by previous researchers (Ha, Wong, Chan, & Morris, 2018; Hatfield *et al.*, 2016; Kirthika, Lakshmanan, Padmanabhan, Sudhakar, & Selvam, 2019), supporting the effect physical activities on the modification of fat patterns in participants, the researcher desires to use rope skipping exercise, to assess its effect on visceral fat of female adolescents in Makurdi, Nigeria.

Methods and Material

The purpose of this study is to assess the effects of rope skipping on visceral fat of female adolescents in Makurdi, Nigeria. To achieve this purpose, the pretest-posttest control group was adopted in this study; the population for this study was 334 female adolescent students of St. Dominic's High School, Makurdi. Multi-stage sampling technique was used for this study. The six (6) existing classes of the school served as strata. Purposive sampling technique was used to select only female adolescent students, whose BMI ranges between 85th ≤ 95th percentile of Body mass index (overweight) and 13-19 years old respectively. Simple random sampling techniques of deep and pick with replacement was used in selecting five (5) students from each class. Therefore, total of (30) participants were selected and used for this study. They were randomly assigned into either control group (15) or experimental group (15), in the course of the training, two (2) were dropped out as a result of inconsistency of training attendance and one (1) dropped as a result of parental influence. Thus, twenty-seven (27) participants were used for this study. The experimental group performed rope skipping training three (3) times in a week for eight (8) weeks while the control group did not take any form of training. Prior to the training and after the training, waist hip ratio (WHR) was measured in centimeters (cm), using a flexible anthropometric tape. The data collected was analysed using descriptive statistics of mean and standard deviation to describe the physical characteristics of participants and the hypotheses were tested using student's independent t-test at significant level of 0.05, the statistical package for the social sciences (IBM SPSS®) for windows version 21 was used to analyse the data.

Criteria for Inclusion

All the participants were screened and those who met the following criteria were selected for this study:

i. The Physical Activity Readiness Questionnaire (PAR-Q) was used to select participants.
ii. Participants were female adolescents of St. Dominic's High School, Makurdi.
iii. The BMI of the participants ranged between 85th ≤ 95th percentiles (overweight).

Research Assistants: the two research assistants were nurses and trained to take anthropometric measurement of participants, these includes the BMI and WHR of participants. The researcher collated and keeps record of all the data for statistical analyses.

Procedures for Data Collection

The researcher obtained a letter of introduction from the Head of Department, Human Kinetics and Health Education, Ahmadu Bello University, Zaria, and presented to St. Dominic's High School, Makurdi.

Informed Consent Form

The selected participants for the study were adequately briefed on the procedures, commitments required of them, the benefits and the precautions to be taken during the research. After the explanation, since they are not adults and cannot be held liable for their opinion and decisions, the informed consent form was administered to each participant to take home for their parents to consent for them. Those parents, who gave approval for the inclusion of their ward (s) in the study, sign the consent column, and students from such parents were used as participants.

Training Programme

The participants performed the rope skipping in singles, the pace and exercise intensity was controlled and guided by the use of the talk test.

Prior to the commencement of training programme, the participants performed a five-minute warm up of dynamic stretches and flexibility exercises in an indoor space in the school. This was done to prepare the body system for the physical exertion so as to prevent musculoskeletal injuries during the exercise programme (ACSM, 2019). Following the warm-up, the participants performed rope skipping training under the supervision of the fitness trainer, the researcher and the research assistants. The participants were allowed to have some seconds of rest slow walking on the spot in between the training session as most of them could not be able to go for more than the prescribed duration at a stretch and also to prevent buildup of lactic acid, which cause fatigue and muscle soreness (Lee et al., 2020). However, the trainings were altered depending on the rate of intensity or effort the participants were exerting during the rope skipping exercise. The talk test is rated as follows:

If participants can easily talk in full complete sentences and even sing simple songs simultaneously performing the exercise, then such performance is of low intensity exercise.

If the participants can speak in-complete sentences fairly easy, but cannot sing simple songs while simultaneously performing the exercise, then such performance is of moderate intensity.

If the participants can only mutter a few words or simple sentences while simultaneously performing the exercise, such performance is of high or vigorous intensity. For this study, the rope skipping exercise was of moderate to high intensity.

During the 1st-2nd week of training, participants began the programme with 5 minutes warm up after which they skip the rope for 20 minutes at 50-55% intensity (HR max) and cooled down for 5 minutes. During the 3rd-4th week, the participants began the programme with 5 minutes warm up after which they perform the rope skipping for 25 minutes at 60-65% intensity (HR max) and cooled down for 5 minutes. During the 5th-6th week, the participants began the programme with 5 minutes warm up after which they perform the rope skipping for 30 minutes at 70-75% intensity (HR max) and cooled down for 5 minutes. The last session (7th-8th week), the participants began the programme with 5 minutes warm up after which they performed the rope skipping for 35 minutes at 80-85% intensity (HR max) and cooled down for 5 minutes. This was determined by the Tanaka formula of 208 (0.7 x age) = Max Heart Rate, multiply by the intended exercise intensity. Consequently, all post-training programme measurements were taken at 8^{th} week.

This progression in the intensity of training added more load and demand on the body there by causing a modification on the physiological parameters from the base line to the end of the rope-skipping training programme.

Measurement of Waist to Hip Ratio

The Waist Hip Ratio (WHR) which can be used as a proxy for visceral fat was measured before and after the rope-skipping exercise, WHR is specifically a measure of fat component of the body composition; it is associated with various health problems rooted from excess visceral fat. To determine the circumference values, measurement of the waist circumference was taken at the iliocristale landmark and hip circumference was taken at the trochanterion landmark, since the hips are the widest part of the buttocks. Using the anthropometric tape, the tape was placed over the skin to contact the skin but not to compress the skin in any way. Waist-hip ratio is the dimensionless ratio of the circumference of the waist to that of the hips. This is calculated as waist measurement divided by hip measurement (Bulbul, 2020). Therefore, Waist-hip ratio was calculated as (waist circumference in centimeters / hip circumference in centimeters).

Table1. Showing Training Schedule

Week	Warm Up	Training Intensity	Training Duration	RPE	Cool Down
1st-2nd	5 minutes	50% - 55%	20 minutes	6 - 8	5 minutes
3rd-4th	5 minutes	60% - 65%	25 minutes	9-10	5 minutes
5th-6th	5 minutes	70% - 75%	30 minutes	11 -12	5 minutes
7th-8th	5 minutes	80% - 85%	35 minutes	12-13	5 minutes

Adapted from (Jahromi & Gholami, 2017)

Results and Discussion

Physical Characteristics of participants

Table 2. below shows the physical characteristics of all the participants before the commencement of training in the control group and experimental group.

	Control Group n = 14		Experimental Group n = 13	
Variables	**Mean**	**SD**	**Mean**	**SD**
Age	15.57	1.60	15.92	1.38
BMI	89.64	2.34	89.92	2.53

Table 2. shows that, before the commencement of the training, the mean age, of the control group was 15.57 ± 1.60 years with the mean BMI of 89.64 ± 2.34 percentile while the mean age of the experimental group was 15.92 ± 1.38 years with the mean BMI of 89.92±2.53 percentile.

Test of hypothesis

The hypothesis which states that, there is no significant effect of rope-skipping exercise on visceral fat of female adolescents in Makurdi, Nigeria.

Table 3. Independent t-test analysis on the effect of rope skipping exercise on visceral fat of female adolescents.

Variable	Group	n	Mean	SD	DF	t	p
	Control	14	0.83	0.05			
WHR					25	2.41	0.024
	Experiment	13	0.77	0.06			

Table 3. showed the t- test analysis of control group and experimental group effect of rope skipping exercise on WHR of female adolescents in Makurdi, Nigeria. An observation of this result revealed that 8 weeks of rope skipping exercise caused statistical significant reduction on the WHR of female adolescents in Makurdi. (p= 0.024). Therefore, the null hypothesis which states that there is no significant effect of rope skipping exercise on visceral in female adolescents in Makurdi is rejected.

Discussion

The result of this study also revealed that 8 weeks of rope skipping exercise caused statistical significant reduction on the visceral fat of female adolescents in Makurdi. (p= 0.024). This study agrees with the findings of Jahromi and Gholami (2017) on assessment of the effect of rope jumping Exercise on body composition of 12 to 18 years old female students, in their study, 20 respondents whose BMI was between $85^{th} \geq 95^{th}$ percentile were randomly selected and assigned in to an experimenter group or control group, the experimenter group performed rope jumping exercise for 8-week while the control group was not exposed to any intervention, data was collected on Waist-Hip Ratio (WHR) and Body Mass Index (BMI) at

base line and after 8 week rope jumping exercise. The result showed a significant decreased in WHR (p=0.024) and BMI (p=0.001).

In a study reported by James, Ko, and Kumanyika, (2021) on overweight young females who performed rope skipping exercise at an intensity of 55% - 70% of maximal oxygen intake, 4 times per week, observed a significant decrease on the measure of WHR and improved aerobic capacity (P< 0.05).

Anjana *et al*., (2019) investigated the effects of 8-week rope skipping exercise program on abdominal adiposity in sedentary female adolescent aged 15-19 years. During the study, experimental research design was adopted, 43 overweight adolescent girls were recruited and randomly assigned to an exercise group (EX, $n = 22$) or control group (CON, $n = 21$). Participants were screened using Physical Activity Readiness Questionnaire. Waist-Hip Ratio (WHR), Resting Systolic Blood Pressure and Resting Diastolic Blood Pressure (RSBP, RDBP) were measured from the two groups via anthropometric tape and Digital Blood Pressure Apparatus (DBPA) before and after 8 weeks rope skipping exercise program. Independent sample t-test was used to analyse the data via SPSS and the result reviewed a significant difference in WHR between the exercising group and the control group (p=0.001). There were no significant differences for RSBP and RDBP.

Arden and Spector (2020) conducted a study to investigate if participation in rope skipping for 8 weeks will modify the level of body fat among overweight females students. Experimental research design of pre-test posttest group was used, 28 participants were sampled and randomly placed into control group or experimental group, Waist Hip-Ratio (WHR), body fat percentage and metabolic rate were measured at pre and post exercise. The data collected were analysed and the result showed a significant difference between the pre and posttest value for WHR, fat percentage and metabolic rate of experimental group (p<0.05) after 8 weeks of rope skipping exercise.

Conclusion

Based on the results of this study, it was concluded that, eight weeks of rope skipping had a significant reduction on the visceral fat of female adolescents in Makurdi, Nigeria.

Recommendation

On the basis of the findings of this study, the researcher recommends that, female adolescents should regularly engage in rope skipping thrice per week at moderate to high intensity levels as an exercise to modify their visceral fat adipose.

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