EFFECT OF AEROBIC AND RESISTANCE EXERICSE FOR CARDIOMETABOLIC PROFIL FOR OBESITY PERSON: CRITICAL REVIEW

Farid Rahman[1], Yulia Vionita[2], Yulis Susanti[3], Ilham Setya Budi[4]

[1,2] Physiotherapy Departmen, Faculty of Health Science University of Muhammadiyah Surakarta

[3] Physiotherapy Departmen, Faculty of Health Science University of Binawan Jakarta

[4] Medical Rehabilitation Unit, M. Sani District Hospital, Kepulauan Riau.

Abstract

The prevalence of obesity has increased significantly globally and is considered a severe public health problem in the coming decades. Obesity can increase the risk of morbidity and mortality of cardiometabolic disease (metabolic syndrome). Combining aerobic exercise and resistance training can improve the cardiometabolic profile associated with metabolic syndrome markers. This study aims to determine whether a combination of aerobic exercise and resistance training affects the cardiometabolic profile of obese individuals. The design of this research study used a critical review with a Randomized Controlled Trial (RCT). A critical review study was conducted by appraising the selected articles using the PEDro scale. The PEDro scale score was obtained with a score of 7/10; there were two articles, 6/10 were two articles, 5/10 had 1 article, and 4/10 were two articles. The combination of aerobic exercise and resistance training affects the cardiometabolic profile (triglyceride levels, high-density lipoprotein cholesterol, low-density lipoprotein, glucose intolerance) in obese individuals compared to just being given aerobic exercise or resistance training alone. Providing a combination of aerobic exercise and resistance training can improve cardiometabolic profile (triglyceride levels, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol, glucose intolerance) in obese individuals with the recommendation of exercise is aerobic exercise (treadmill) with an intensity of 40-85% of the maximum. Heart Rate (HRmax) 3 times per week for at least 30 minutes. While resistance training (lifting exercises for upper limb limbs and lower limb with an intensity of 60-80% of 1 Repetition Maximum (1RM) 3 times per week, two sets, 8-10 reps, rest 1-2 minutes, and the exercise is done for at least 30 minutes.

Keyword: aerobic exercise, resistance exercise, combination exercise, cardiometabolic, obesity

1. Introduction

The prevalence of obesity has increased significantly globally and is expected to become a severe public health problem in the coming decades [1] . According to the World Health Organization (WHO), obesity affects >1.9 billion people worldwide, and 650 million people are classified as obese [2]. According to Basic Health Research data (RISKESDAS) shows that the obesity rate in Indonesia continues to increase, from 10.5% (2013) to 14.8% (2017), then 21.8% (2018) [3].

The World Health Organization (WHO) defines obesity as a condition of excessive adipose tissue that can worsen individual health [4]. The definition of obesity is based on Body Mass Index (BMI). Suppose a BMI > 30 kg/m2, and someone with a BMI of 25-30 kg/m2 means overweight [5]. BMI is an index used to classify individuals who are overweight or obese [6].

Obesity is a chronic metabolic disease characterized by an increase in the number and size of fat cells. Overweight and obesity are the fifth leading risk of death in the world. Previously considered a problem in developed countries, overweight and obesity are becoming more common in developing countries [7]. Overweight and obesity continue to have severe health impacts, including mortality and high costs, caused mainly by cardiovascular disease (CVD) in men and women [8].

Obesity increases the risk of morbidity and mortality of cardiometabolic disease (metabolic syndrome) [9]. Some of the symptoms of metabolic syndrome include high triglyceride levels, low High-Density Lipoprotein (HDL-c) cholesterol levels, high Low-Density Lipoprotein (LDL-c) cholesterol levels, and abnormal glucose levels, which are closely related to a systemic disease called insulin resistance [10]. Insulin resistance is closely related to obesity. Complications of obesity-related diseases reduce the

quality of life and life expectancy and increase the cost of medical care. Several studies have shown that obesity does not necessarily lead to an increased risk of metabolic abnormalities and cardiometabolic complications [11].

Guidelines from the American Heart Association and the American College of Cardiology mark obesity as a major modifiable risk factor for cardiovascular disease (CVD). Higher obesity and insulin resistance, type 2 diabetes, hypertension, dyslipidemia, coronary heart disease (CHD), gallbladder disease, obstructive sleep apnea, non-alcoholic fatty liver disease and various tumour-associated malignancies, including endometrial, breast and colon. Obesity is considered an independent risk factor for CVD and is associated with increased mortality in the general healthy population [7].

Aerobic exercise can effectively reduce body weight and body mass index of obese individuals; it can also improve glycemic control and peak oxygen consumption (VO2max) [12,13]. In addition to aerobic exercise, resistance training is also effective in promoting clinically significant weight loss and reducing cardiovascular risk, which has also been associated with increased muscle mass, decreased body fat, and a better cardiometabolic profile (e.g. glucose control and lipid levels) [14]. Although the two exercises have their respective effects, [15] research showed that a combination of aerobic exercise and resistance training could effectively improve the cardiometabolic profile associated with markers of metabolic syndrome. Therefore, the authors are interested in conducting a critical review study based on a review of studies with a Randomized Controlled Trial (RCT) design, namely whether there is an effect of a combination of aerobic exercise and resistance training on the cardiometabolic profile of obese individuals.

2. Methods

This research study uses a critical review with Randomized Controlled Trial (RCT), the most robust design used to analyze and evaluate interventions to prove that the interventions used are appropriate for the articles in journals. Critical review studies are assisted by the basis of search sites such as the Physiotherapy Evidence Database (Pedro), ScienceDirect, National Center of Biotechnology Information (NCBI)-PubMed, and Google Scholar using the keyword "combined aerobic and resistance exercise," which is then combined with other keywords. in the form of "obesity and cardiometabolic" to find articles related to the research being studied and then evaluated through several stages that have been designed for the study. After that, check the Quartile (Q) with a minimum requirement of Quartile 3 (Q3) of the articles found using the Scimago Journal and Country Rank (SJR).

The next stage is to appraise selected articles using the Physiotherapy Evidence Database (PEDro) scale. The PEDro scale is used to assess the quality of this type of critical review study with an RCT design. The PEDro scale consists of 11 items: (1) eligibility criteria, (2) random allocation, (3) concealed allocation, (4) baseline comparability, (5) blind subjects, (6) blind therapists, (7) blind assessors, (8) at least one primary outcome 85% adequate follow-up, (9) analysis for treatment (intention-to-treat analysis), (10) between-group comparison, and (11) point estimates and variability. If any, evaluation of items is given a value of 1, and none is given a value of 0. However, item (1) eligibility criteria do not contribute to the total score, so a score of 10 is obtained from the summation result.

3. Results

After searching through the specified search engines such as the Physiotherapy Evidence Database (Pedro), ScienceDirect, National Center of Biotechnology Information (NCBI)-PubMed and Gray Literature and databases found, 179 articles were found. Then, from 179 articles, 35 articles were found that matched the combination of aerobic exercise and resistance training on the cardiometabolic profile of obese individuals. Furthermore, from 35 articles, 18 articles that met the inclusion criteria included scientific articles published in 2011-2020, these articles used RCT studies, and according to the provisions of the obese adult population aged 20-60 years, the intervention provided a combination of aerobic exercise and resistance training that compared with aerobic exercise or resistance training alone with an improvement in the cardiometabolic profile.

Furthermore, from the 18 articles, seven articles match the minimum value of Quartile 3 (Q3), obtained five articles have a value of Quartile 1 (Q1), 1 article has a value of Quartile 2 (Q2), and 1 article has a value of Quartile 3 (Q3). After that, seven selected articles were assessed using the PEDro scale.

Table 1. PEDro Scale

Author	PEDro Scale
(Dianatinasab et al., 2020)	7/10
(Schroeder et al., 2019)	7/10
(Dieli-Conwright et al., 2018)	6/10
(Nuri et al., 2012)	6/10
(Ha & So 2012)	4/10
(Ho et al., 2012)	4/10
(Jorge et al., 2011)	5/10

Of the seven articles conducted by the appraisal, they met relatively similar criteria. All seven articles had eligibility criteria and were allocated randomly to patients, and no selected articles did not meet these criteria. Six of the seven selected articles stated that they did not perform concealed allocations to patients during the study. However, only 1 article has a concealed allocation, namely from research [18], the rest do not have that point.

The baseline in the article is all set (baseline comparability), and all have these criteria as a comparison or benchmark for results before and after the intervention. There is no article explaining these criteria regarding the blind subject and therapist (blind subject and blind therapist). However, 3 out of 7 articles contained blind assessors even though the subject and therapist were not blinded, namely from research [16, 17, 19].

Based on seven selected articles, five articles from research [16], [17], [18], [19], and [13], had a primary outcome of 85% as follow-up (adequate follow-up). Analysis for treatment (intention-to-treat analysis) obtained 2 of 7 articles describing these items, namely research from [16] and [17]. Furthermore, of the seven selected articles, all have between-group comparison items, point estimates, and variability items. Finally got the PEDro scale score, two articles from [16] and [17] with a score 7/10, 2 articles from [18] and [19] with a score of 6/10, 1 article from [13] with a score of 5/10, and 2 articles from [20] and [21] with a score of 4/10.

Table 2. Article Review

Author	Subject			Intervention (Week)	Intervention (Type)	Treatment
	Year	n	Age/profile			
(Dianatinasab et al., 2020)	2020	485	46-60 years old/ obese woman with at least three criteria for metabolic syndrome (glucose intolerance, hypertension, dyslipidemia)	8 weeks	Combination of aerobic exercise and resistance training	Frequency: Twice/Week Intensity: Aerobic Exercise: 60-75% Heart Rate Maximum (HRmax) Resistance Training: 60-80% 1 Repetition Maximum (1 RM) Time: 60 minutes Aerobic Exercise: 30 minutes Resistance Exercise: 2 set, 8-10 repetition, & Interval 5-10 minutes between set. Type: Aerobic Exercise with treadmill Resistance Training:

Author	Subject			Intervention (Week)	Intervention (Type)	Treatment
	Year	n	Age/profile			
						strengthening
(Schroeder et al., 2019)	2019	206	45-74 years/obese women with hypertension	8 weeks	Combination of aerobic exercise and resistance training	Frequency: twice/weeks Intensity: Aerobic Exercise: 60-75% Heart Rate Maximum (HRmax) Resistance Training: 60-80% 1 Repetition Maximum (1 RM) Time: 60 minutes Aerobic Exercise: 30 minutes Resistance Training: 3 set, 10-14 repetition, and rest1-2 menit between set. Type: Aerobic Exercise with treadmill Resistance Training:

Author	Subject			Intervention (Week)	Intervention (Type)	Treatment
	Year	n	Age/profile			
(Dieli-Conwright et al., 2018)	2018	418	53 ± 10.4 years/obese women with comorbid breast cancer	16 weeks	Combination of aerobic exercise and resistance training	strengthening Frequency: 2-3 times/week Intensity: Aerobic Exercise: 65-85% of Heart Rate Maximum (HRmax) Resistance Exericse: 65-85% of 1 Repetition Maximum (1 RM) Time: 150 minutes per week Aerobic Exericse : 1st and 3rd 80 minutes and 2nd day for 50 minutes Resistance Training: 10 repetition Type:

Author	Subject			Intervention (Week)	Intervention (Type)	Treatment
	Year	n	Age/profile			
(Nuri et al., 2012)	2012	342	50-60 years old/ woman with obesity without comorbid	15 weeks	Combination Aerobic and Resistance Exercise	Aerobic (treadmill) Resistance: strengthening Frequency: 2x/Weeks Intensity: Aerobic: 45-65% of Target Heart Rate (THR) Time: 150 minutes/week Aerobic Exercise: first 5 Weeks for 25 menitus, Second 5 Weeks kedua for 35 minutes, and last 5 minggu weeks for 45 minutes. Resistance Exercise: 3 set, 10 repetition for 1st 5 weeks, dan 14 repetition for last 5 weeks

Author	Subject			Intervention (Week)	Intervention (Type)	Treatment
	Year	n	Age/profile			
						Type: Aerobic Exercise (brisk walking). Resistance Exericse : Cybex dan free weightlifting
(Ha & So 2012)	2012	20	20-26 years old/woman 12 with DM obesity and abnormal glucose	12 weeks	Combination Aerobic Exercise and resistance	Frequency: 3x/Week Intensity: Aerobic Exercise: 45-65% dari Target Heart Rate (THR) Time: 60 minutes Aerobic Exercise: 30 minutes Resistance training: 3 set and 10-15 repetition Type: Latihan aerobik dengan jenis

Author	Subject			Intervention (Week)	Intervention (Type)	Treatment
	Year	n	Age/profile			
						treadmill/ Aerobic Exc (Treadmill).
(Ho et al., 2012)	2012	420	40-66 years old/woman 12 with DM obesity.	12 Weeks	Combination Aerobic Exercise and resistance	Frequency: 3x/ Week Aerobic Exercise: 60% HRR Resistance Exercise : 75% of 1 Repetition Maximum (1 RM) Aerobic Exc.: 30 Minutes Exercise Resistance: 2 set, 8-10 repetition, dan rest 1 minutes. Type: Treadmill Exercise. Resistance: Strengthening
(Jorge et al., 2011)	2011	83	53 years old/woman 12 with DM obesity.	12 Weeks	Combination Aerobic Exercise and resistance	Frequency: 3x/ Week Aerobic Exercise: 70-79% MHR Resistance Exercise : 70% of 1

Author	Subject			Intervention (Week)	Intervention (Type)	Treatment
	Year	n	Age/profile			
						Repetition Maximum (1 RM) Time: 60 minutes Aerobic Exc.: 30 Minutes Exercise Resistance: 2 set, 10 repettition, dan rest 3 minutes. Type: Cucle Ergometer. Resistance: Strengthrening

4. Discussion

Based on the seven articles that have been reviewed, most of them have a moderate level of bias. The subject population in this article comes from Singapore, the United States, Iran, Australia, and Brazil, all of which are developed countries. Most of the seven selected articles had inclusion criteria, namely obese adults with an age range of 20-60 years, metabolic syndrome (glucose intolerance, hypertension, dyslipidemia, and obesity), and a sedentary lifestyle. While the exclusion criteria, namely the conditions that prevent the subject from doing an exercise program (musculoskeletal problems, cardiovascular) and have certain diseases.

Regarding the evaluation of the seven selected articles, it was stated that the cause of the worsening cardiometabolic profile in obese individuals was caused by several risk factors, including a sedentary lifestyle, high triglyceride levels, low High-Density Lipoprotein (HDL) cholesterol, and high Low-Density Lipoprotein (LDL) cholesterol.) resulting in a situation where the health quality of obese individuals deteriorates. Of the seven selected articles, some mention that a combination of aerobic exercise and resistance training has a better impact on improving the cardiometabolic profile.

Another study also stated, regarding the administration of a combination of aerobic exercise and resistance training, that this combination intervention only sometimes provided significant results on cardiometabolic profiles such as glycemic control, body composition, lipid profile, and insulin resistance. However, the administration of this combination can positively impact subjects to maintain their quality of life and prevent exacerbation of the risk of metabolic syndrome or decreased cardiometabolic profile. In addition to providing a combination of aerobic exercise and resistance training, paying attention to exercise intensity is also very important. From all studies of 7 selected articles, it turns out that the intervention of a combination of aerobic exercise and resistance training with moderate intensity where aerobic exercise (60-70% Heart Rate Maximum) and resistance exercise (60-80% 1 Repetition Maximum) which is gradually increased

can provide usefulness in increasing all aspects of risk experienced by obese adults on the cardiometabolic profile.

Each article has population criteria are not always the same because not all obese individuals have the same cardiometabolic risk factors. For example, one article from [20] took a female population only because the related article studied studies on obese women with a high risk of developing metabolic syndrome. Meanwhile, [18] in his study wanted the population criteria to have at least three diagnostic criteria for metabolic syndrome (glucose intolerance, hypertension, dyslipidemia, and obesity) and were in the pre-menopausal period to be included as part of the research criteria. In addition, a study by [17] looked at the population criteria of blood pressure, the value of Body Mass Index (BMI), and proven to have a sedentary lifestyle.

The main focus of this study is intervention in controlling a decrease in the cardiometabolic profile and the combination of aerobic exercise and resistance training as the primary modality. Of the seven selected articles, the treatment that will be used as the basis of the study is the administration of a combination of aerobic exercise and resistance training and the same outcome, namely improvement of cardiometabolic profile (triglyceride levels, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol, glucose) in obese adults. However, from the intervention of aerobic exercise and resistance training, only some articles describe a method that is the same as one another; for example, in one article written by [21] that giving aerobic exercise can be done with the treadmill method.

In addition, another article from [13] provides aerobic exercise using cycle ergometers as form exercise. Likewise, with resistance training, each article has a different method. Like the article [16], which uses resistance training methods focused on the upper and lower limbs or other methods from the article [19] that focus on resistance training using Cybex (strength training tool) and free weightlifting as a form of exercise.

The combination of aerobic exercise and resistance training improves the cardiometabolic profile in obese individuals. Overall, data review articles with the highest scores from the PEDro scale state that the combination of aerobic exercise and resistance training provides significant changes to body composition (body weight, body fat percentage), lipid profile (triglyceride levels, high-density lipoprotein cholesterol, low cholesterol). Density lipoprotein), and glucose intolerance. However, several things affect these changes, including the subject's compliance (exercise adherence) during the exercise program to the predetermined provisions, the exercise dose used must follow the provisions, and the type of exercise given must comply with the stipulated provisions.

From the statement above, the article used as a review study explains that the exercise recommendations combine aerobic exercise and resistance training. Aerobic exercise (treadmill type) is carried out with a dose of 3 times per week with an intensity of 40-85% of the Maximum Heart Rate (HRmax). It lasts about 30 minutes, or it can be done by walking and the exercise dose is two times per week with an intensity of 45 % Target Heart Rate (THR) for 25 minutes, then increased to 55% THR for 35 minutes, and increased again to 65% THR). Then proceed with resistance exercises (types of strengthening exercises for upper and lower limbs: bench press, chest press, lat pull down, abdominal crunch, leg extension, triceps pushdown, and seated bicep curl) which are performed three times per week with an intensity of 60-80% of 1 Repetition Maximum (1 RM), two sets, 8-10 repetitions, and rest 1-2 minutes between sets for approximately 30 minutes.

A combination of aerobic exercise and resistance training based on exercise recommendations in terms of type and dose will affect the cardiometabolic profile (triglyceride levels, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol, glucose intolerance) in obese individuals themselves. Mechanistically, aerobic exercise's physiological process begins with using oxygen to store carbohydrates and proteins as a medium for fat metabolism. Then fat oxidation increases, which theoretically will burn fat faster

and control the body's glycemic level. In addition, the physiology of resistance training stimulates muscle contraction, stimulating the translocation of transporter 4 (GLUT-4) to the plasma membrane. The transfer of GLUT-4 from the inner cell membrane to the plasma membrane in the body is significant for the transfer of glucose to muscle tissue which affects insulin [22] .

Long-term resistance training will significantly increase the stimulation of GLUT-4 protein in muscle cells and accelerate its transport to cell membranes, thereby increasing glucose transport in the body. After exercise, the ATP produced will be transported into the body as the primary energy that plays a role in metabolic processes to become a glycemic load. Adenosine Triphosphate (ATP) produced from aerobic processes is reused when reactivated through glycolysis [22] .

Based on the results of the physical activity program, namely a combination of aerobic exercise and resistance training, it turns out that giving this combination of exercise is an excellent exercise method to improve the cardiometabolic profile (triglyceride levels, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol, glucose intolerance) in individuals. Obesity, compared to only given aerobic exercise or resistance training alone. However, aerobic exercise with this type of treadmill has a less good aspect of feasibility because only some are used to and have these tools. In addition, several provisions, as described above, must be met in the interest of the safety of obese individuals. However, several things must be considered when a combination of aerobic exercise and resistance training is given, including when performing physical activities under medical supervision and age. With increasing age, all body functions experience a decline in function. Therefore, simple physical activity can negatively impact if not done carefully.

In the process, this study has several obstacles. Namely, this study only uses subjects in women who are obese; the type of aerobic exercise only uses a treadmill even though there are still other types of aerobic exercise such as jogging, walking, and cycling. The age range is too far for several treadmill

exercise studies, so there are differences in physiological responses. The researchers hope that in future studies, the sample will be taken more widely, both in men and women who are obese and the type of aerobic exercise used is not only by using a treadmill.

5. Conclusion

The combination of aerobic exercise and resistance training affects the cardiometabolic profile (triglyceride levels, high-density lipoprotein cholesterol, low-density lipoprotein, glucose intolerance) in obese individuals.) 3 times per week for at least 30 minutes and continued with resistance training (upper and lower limb strengthening exercises: bench press, shoulder press, chest press, lat pull down, abdominal crunch, leg extension, triceps pushdown, and seated bicep curl) with an intensity of 60-80% of 1 Repetition Maximum (1RM) 3 times per week, two sets, 8-10 repetitions, rest 1-2 minutes, and the exercise is done for at least 30 minutes.

Acknowledgment

Future researchers are expected to be able to develop more both from the scope of theory and scientific development when conducting critical reviews of articles, journals, and other sources of information relevant to the study being studied. For physiotherapists, the results of this study can be used as theoretical recommendations regarding the effect of aerobic exercise and resistance training on improving the cardiometabolic profile of obese individuals, which can later be applied in the field.

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