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(REVIEW ARTICLE)

The effect of low intensity exercise on BMI in adults with obesity

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Abstract

Obesity can attack all ages, one of which is in adults. Adults with obesity can reduce their Body Mass Index (BMI) by doing low intensity exercise because it does not require a lot of energy to do so and is beneficial for healthy development. Low intensity exercise is exercise with an energy expenditure of between 1.5 – 3 MET. The conduction of this review is aimed to find out and learn about the effect on low intensity exercise on Body Mass Index (BMI) in obese adults. The literature review of these six research journals uses an observational analytic study with a cross-sectional study design. There were seven research on the effect of low intensity exercise on BMI in obese adults. The study was conducted on obese women with a BMI of 27-37 kg/m2. Subsequent research on obese men and women by doing four exercise programs and comparing weight loss in both. Subsequent research on college students aged 19-20 years. Furthermore, studies with dietary restrictions on energy intake and regular exercise in hypoxic conditions resulted in higher weight loss than normoxic conditions. The higher energy expenditure caused by increased exercise and longer exposure to hypoxia results in higher energy expenditure. hypoxic exercise can reduce body weight or improve lipid metabolism. Based on the seven literatures that have been reviewed, it can be concluded that in general low-intensity training has a significant effect on weight loss, increases insulin, increases oxygen levels.

Keywords: Low Intensity; Exercise; Body Mass Index (BMI); Adults; Obesity

1. Introduction

Obesity is a type of disease which attacks from all range age of groups. Obesity can be occurred, starting from childhood to adulthood. This disease is often accompanied by co-risk factors or comorbidities such as hypertension, cardiovascular disease, diabetes, and other dangerous diseases. Low intensity exercise is a type of exercise where energy expenditure includes 1.5 – 3 MET. MET (Metabolic Equivalent Task) itself is the level of energy released. Lower intensity exercise is suitable for people with old age and obesity along with their diseases because it doesn't take too much energy to do it. A study showing that low intensity exercise is beneficial for health development in the elderly [1]. Of course, this can be taken into account considering that people with obesity also have limitations in their daily lifestyle.

2. Material and methods

This Literature Review uses an observational analytic study with a cross-sectional study design. The population in the seven research articles is obese adolescents who perform low-intensity exercise. Literature review using all international journals published in 2014-2022. The search process was carried out using the Scopus database.

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3. Results and discussion

We discovered only six researches that were aimed to know low intensity training effect on BMI conducted in overweight adults

The first one was performed in sedentary obese women taking place in Tehran, Iran [n = 75; age: 18–40 y; body mass index (BMI; in kg/m2): 27–37] in which were then distributed to one of two intervention categories: low-frequency physical activity one (LF) or high-frequency physical activity one (HF) [1].

The second was randomized clinical trial research involving 48 women and 36 men with obesity who reside in Madrid, Spain, instructed to do four programs consisting of strength training, endurance, strength with endurance training, and 'adhering to physical activity recommendations [2].

Another research was goaled to assess 18-35 years old college students who carried out low-intensity campaigns provided by a group they were in and older adults (>35 years old) who were put into the same program. This study aims to compare the results regarding their body weight loss. The following study was also a randomized clinical trial performed among students of Diponegoro University, Indonesia who are 19-20 in age [3].

Then, we also found extended non-randomized longitudinal research that involved LIPOXmax-trained subjects. Next, a study in Jiangsu Province, China was conducted among overweight male college students who performed training in the form of low-intensity cycling in two divided groups: the first group were general training group without blood flow restriction and the second group whose members had to do exercise with blood flow restriction [4].

Another study was conducted in September 2011 until June 2012 taking place in the department of Physiology at Indira Gandhi medical college, Puducherry, India with 70 obese people in total who are 19-35 in age. Eligible samples in studies which we found didn't have comorbidities such as diabetes, heart diseases, respiratory disorders, depression screened by Beck's Depression Inventory, under birth control pills' influence, liver or kidney disease, cancer, or autoimmune diseases. The women involved in the studies as eligible sample also had to have a regular menstrual cycle. In the first study, the participants were instructed to take foods with low energy density along with dairies, food with enriched fibers, and food with high energy density under control. They also had to step up their daily step count and have the records of their total daily step count saved [5].

The last study conducted in Iran between 2014-2015 with two separates groups which are Low Frequency (LF) one was where 50 min/d PA, 6 d/wk (300 min/wk) were counted in, meanwhile the other one High Frequency (HF) consisted of 100 min/d PA, 3 d/wk (300 min/wk). All the participants in both groups were guided to go through the same dietary weight loss program. As a result, the anthropometric measurements at 24 wk in either category decreased significantly compared to ones measured at baseline. Omcron HealthCare as a digital calibrated scale was used in measuring the participants' body weight while they were wearing light attire, and yet without footwear. However, the weight in LF category decreased even more than the weight in HF group did (mean +/- SD; LF: 9.58 +/- 3.77 kg; HF: 7.78 +/- 2.68 kg; P = 0.028), BMI (LF: 3.62 +/- 1.56; HF: 2.97 +/- 1.02; P = 0.029) and waist circumference (LF: 9.36 +/- 4.02 cm; HF: 7.86 +/- 2.41 cm; P = 0.031) [6].

Based on the studies shown [1, 2, 3, 4, 5, 6] exercise is able to help an obese person in many aspects. First and foremost, it's a chain reaction as when a person performing exercises. This will give impact to obese person in reducing their weight. Hence when weight is lost, it will provide tremendous result on the health of the obese person. The reason is once weight is reduced, the insulin level of the stated person will regulate accordingly. Moreover, all other hormones as well as the metabolism process will regulate hence the person will become more energetic. Once all the access weight is lost, the stated person will feel lighter hence more energetic to continue exercising and this will be more beneficial to the person.

In addition to that, exercising helps increase oxygen levels in the human body [4]. The heart and lungs, two of the body's major organs, work hard while you exercise. The lungs both supply the body with oxygen, which gives you energy, and eliminate carbon dioxide, which is a waste product produced when you make energy. The muscles that are exercising are supplied with oxygen by the heart. Your body needs more oxygen and creates more carbon dioxide while you exercise because your muscles are working harder. Your breathing must rise from about 15 times per minute (12 liters of air) at rest to between 40 and 60 times per minute (100 litres of air) during exercise in order to meet this additional demand. Additionally, your circulation quickens to ensure that the muscles have enough oxygen to continue working.

Table 1 Description of studies included in the review

No	Literature Study	n(participants)	Inclusion Criteria	Study Design/Intervention	Results (BMI)	Conclusion
1.	Benito, P. J, et al., 2020	84 participants 36 Male 48 Female	Ages ranging from 18 to 50 years. Overweight (BMI ≥ 25 ≤ 30 kg/m2) Normoglycemic (glucose < 100 mg/dL) Non-smokers Sedentary lifestyle (< 30' physical activity/day) No medications or drug use No history of important illness (heart, lung, or liver disease or neoplasms) Regular menstrual cycles (for females).	Randomized controlled trials for 22 weeks. CONSORT Checklist Interventions Group: Strength Training Group (S = 30) Endurance Training Group (E = 30) Strength and Endurance Training Group (SE = 30) 'Adhering to physical activity recommendations' group (control; C = 29) The duration 3 times/week (for S, E, and SE groups) The intensity percentage of 15 Repetition Maximum (RM) or percentage Heart Rate Reserve (HRR) Weeks 2-5: 50% of the 15-RM and HRR with duration of 51' and 15" Weeks 6-14: 60% of 15-RM and HRR with duration of 51' and 15" Weeks 15-22: 60% of 15-RM and HRR with a duration of 60' Subject's Muscular Strength (MS) Hypocaloric Diet	A significant reduction after 22 weeks in all groups ($p < 0.001$). The changes of body weight in SE group showed a trend toward significance with S group ($p = 0.059$)	From the study suggest that SE exercise with appropriate hypocaloric diet may be the most recommended for wight loss and reduction of body fat.
2.	LaRose, J. G., et al (2012).	6.785 participants YA: 1.562 ≤ 35 years OA: 5.233 > 35 years	Young adults age 18 – 35 years Older adults > 35 years old Overweight (BMI ≥ 25 kg/m2) 1.096 YA participants (OW/OB) 4.037 OA participants (OW/OB)	Cohort studies for 12 weeks and had 6 rounds Team-based competition of 5 – 11 members. Participants provided self-report demographic data. Participants reported their weight and height at the start and the end of campaign.	YA achieved greater percent weight loss than OA (*P < 0,001*) YA completers also achieved greater daily step changed toward OA (*P < 0,001*)	From the study suggest team-based weight loss campaign were quite promising with average result a 4,5% weight loss has big potential for public health impact.

3.	Kannan, U., et al. (2014).	51 participants	Aged group of 19 – 35 years Overweight (BMI ≥ 25 kg/m2)	Randomized controlled trials for 10 months. Exercised performed with the bicycle ergometer at the fixed weight to reach calculated target heart rate using Karvonen formula Participants were grouped into moderate intensity exercise group (n=22) and high intensity exercise group (n= 29) Complete clinical examination, ECG and echocardiogram were taken	BMI showed a significant change in the high intensity exercise group (28.3±2.4) BMI showed a reduction in the moderate intensity group (28.1±2.7)	From the study suggest moderate intensity exercise is efficient in reducing the BMI
4.	Madjd, A., et al. (2016).	75 female participants	Healthy overweight and obese participants Women aged 18 – 40 years BMI 27-35 kg/m2 Sedentary lifestyles Non-smokers Free of Stroke Diabetes Liver or kidney disease Cancer Autoimmune Keep an adequate 4-d food record Fit to participate	Single-blind randomized clinical trial for 24 weeks and 2-arm. Divided into 2 intervention groups Diet plus high-frequency physical activity (*n=38*) Diet plus low-frequency physical activity (*n=37*) Participants started the study at the same phase of their menstrual cycle HF group: 50 min/d brisk walking, 6 d/wk (300 min/wk) LF group: 100 min/d brisk walking, 3 d/wk (300 min/wk) Biweekly visits to the dietitian and exercise coach (for hypo-energetic diet and recommended PA protocol)	BMI reduction in each ggroup was in the expected direction, with significant effects over 24 wk for both groups There was a significant difference between groups in BMI reduction after 24 wk BMI LF group: 28.94 6 2.47 BMI HF group: 28.47 6 2.18	From the study suggest that spending being active across a lower frequency of PA session during a week with the recommended length of time could be associated with more weight loss than being active most days of the week.
5.	Chen, Y., et al. (2021).	37 male participants	BMI >28 kg/m2 None had participated in Regular strength Resistance Aerobic training Less than once a week For a minimum of 1 year prior to the start of the study	Randomized controlled trial for 24 times (2 times/week, 12 weeks). Divided into 2 intervention groups BFRT: Experimental Group (*n=18*) General training: Control Group (*n=19*) Low intensity cycling combined with BFRT exercises (EG) Low intensity cycling without BFRT exercise (CG)	The results in EG there was a significant difference in BMI before and 12 weeks after the intervention BMI EG: 29.0±1.45 BMI CG: 29.9±1.44	From the study conclude that cycling exercise at 40% VO2 max combined with BFRT can improve the control weight of participants.

Based on the present study shows that after 4 weeks of dietary restriction coupled with high-volume aerobic exercise in both normoxia and simulated hypoxia, there was a significant reduction in body weight in overweight and obese young girls [7]. The loss of body fat mass was the primary factor in the reduction in body weight. On the other hand, Studies that use hypoxia to assist people lose weight when they are obese or overweight are still uncommon and produce mixed outcomes. 90 minutes of low-intensity aerobic exercise performed three days a week for eight weeks under the moderate hypoxia used by LLTH with a regular diet led to 1.14 kg or 1.3% decreases in body weight and additive improvements, but there was no weight loss in the control group. In addition to lowering cholesterol, triglycerides, and LDL, LLTH may also aid to prevent HDL loss. The hypoxic group and normoxic group both saw equal weight loss which is about 2.0% after engaging in 60 minutes of aerobic exercise on three days per week for four weeks without dietary behavior intervention, but there was also a drop in body FM content. Moreover, a longer period of hypoxia exposure and dietary restriction to reduce energy intake may be necessary to reduce weight in obese people.

Another trial combined a regular exercise regimen with a dietary restriction. According to the research, a low-calorie diet for four weeks combined with six hours of exercise per week in 3000 m normobaric hypoxic conditions and sixteen hours of exercise per week in normoxic conditions resulted in much higher weight reduction than that seen in the normoxic group [7]. In fact, weight loss was noted, and the cause may be attributed to the significantly higher energy expenditure brought on by the increased exercise and significantly longer exposure to hypoxia. Following LHTLH, there was a reduced percentage of total LSM loss in the overall weight reduction. This conclusion could be explained by the lower absolute exercise effort, as well as the increased blood flow and increased capillary density in skeletal muscle following hypoxic training. One of the key goals is to use hypoxia training to lower blood lipids in obese persons. Also, in the current investigation, LHTLH did not appear to have any further effects on blood TG, LDL-C, or APO-B; however, it did interact with serum TC and APO-A1. These findings make it challenging to draw the conclusion that hypoxic exercise has extra advantages for weight loss or improved lipid metabolism in the context of obesity. The identical alterations seen might be explained by the normal levels of lipid variables among our participants and the training impact brought on by high-volume aerobic exercise, which produced a deeper stimulation than the hypoxic effect. Large individual variations in how humans respond to dietary restriction may potentially contribute to this discrepancy.

Next, effects of equal quantities of resistance and aerobic exercise (training volume and intensity) on body weight and fat mass in overweight individuals. According to the research, combining aerobic and resistance training (SE) with a healthy, personalized low-calorie diet is more successful at increasing fat loss than simply adhering to the guidelines for a low-calorie diet and physical activity or performing any other kind of exercise [2]. While the amount and intensity of exercise performed by each group was intended to be similar, it's possible that the actual energy expenditure of each group was different. In this context, earlier research has demonstrated that a combination workout routine boosts energy expenditure with less felt effort. In addition, it is possible that the SE overweight research participants, who are nearer to their optimum weight than the aforementioned obese participants, found their exercise routines less taxing and stuck to them better. Lean mass (LM) and weight loss have drawn increasing attention in recent years. Since it helps to preserve the resting energy expenditure attained with weight loss, LM maintenance is essential in preventing future weight regain. Exercise is known to be crucial for sustaining LM; however, it has a bigger impact on muscle water content than on the structural proteins themselves. The maintenance of mean TLM seen in the SE group may have been significantly influenced by the rise in the proportion of "high physical activity" respondents.

4. Conclusion

Based on the seven literatures which have been reviewed, it can be concluded that in general low-intensity training has a significant effect on weight loss, increases insulin, and also increases oxygen levels. 90 minutes of low-intensity aerobic exercise in which performed three days a week for eight weeks under the moderate hypoxia used by LLTH with a regular diet led to 1.14 kg or 1.3% decreases in body weight and additive improvements.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors acknowledge no conflict of interest involved in writing of this manuscript.

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