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Original Article

Effect of aerobic exercise on stress reduction and weight loss in obese students using circuit training

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Abstract
Weight problems are a multifactorial persistent disease that develop from social interactions, behavioral elements, and psychological, metabolic, cellular, and molecular factors. Obesity can cause systemic oxidative stress and be associated with the production of irregular adipokines, which contributes to the development of metabolic syndrome. Physical exercise is an important modulator of cytokines and oxidative stress, and for greater than a decade, attention has been centered on the potential of workouts to save a person and help deal with illnesses that involve inflammatory additives by modulating cytokine production. The purpose of this study was to test aerobic exercise in students via circuit training for stress reduction and weight loss. This study involved a randomized pretest–posttest control group design using 20 obese students who were 19–24 years of age. The experimental method involved two stress groups, and only the weight loss group was treated with aerobic exercise via circuit training with 16 meetings a week of three exercises for more than 2 months with a pre-test and post-test design. Study groups were designed for various populations. In total, 40 students consisting of n = 20 for the group experiencing high stress and n = 20 for the group with above normal weight. The distribution of this sample used a proportional sampling technique based on criteria. Data analysis using independent samples t test using the statistical software packet for social science (SPSS) version20. The results of this study indicate that by using an independent sample t test analysis, the 2-way (t tailed) significance value was 0.00 < 0.05. Thus, there was an effect of aerobic exercise upon using circuit training exercises in the stress group and in the overweight group. Conclusions from other studies show that there are significant changes. Therefore, there is an effect of aerobic exercise via circuit training to produce stress reduction and weight loss in obese students. Thus, aerobic exercise using circuit training is effective for reducing weight and stress levels in sports students at the Universitas Negeri Jakarta.
Keywords: weight loss, stress, aerobic exercise, circuit training

Introduction

Physical exercise induces metabolic modifications inside the organism, which results in the activation of adaptive mechanisms with the goal of organizing a new dynamic stability (Accattato et al., 2017). One of the tremendous changes in this regard takes place in muscle tissues, where the extended need for power after exercising generates higher usage of oxygen through mitochondria (Barbieri et al., 2012). Skeletal muscle is the main supply of oxygen unfastened radical species due to the fact that during muscle contraction, a multiplied switch of unpaired electrons from complexes I and III within the electron transport chain ends in the manufacturing of radical superoxide (O_2^-), a main reactive oxygen species (ROS) (Accattato et al., 2017). Reactive oxygen species (ROS) arise underneath physiological conditions and in many diseases and can cause direct or oblique harm to various organs; consequently, oxidative strain (OS) is involves in pathological issues, such as weight problems, diabetes, cardiovascular sicknesses, and atherogenic issues. Weight problems can result in a systemic OS, and, in turn, the OS is associated with irregular production of adipine, which contributes to the improvement of metabolic syndrome (Esposito et al., 2006).

The toxin fabricated from this contractile activity is converted into hydrogen peroxide (H_2O_2) via superoxide dismutase (SOD), and this is the first defense in opposition to radicals and is successively detoxified by way of other enzymes, which include catalase, glutathione peroxidase (GPX) and glutathione reductase (GR) (Sakellariou et al., 2014; Powers et al., 2011). The stability of ROS manufacturing and the expression and interest of antioxidant enzymes is vital to provide muscle redox homeostasis, to maintain ROS under threshold stages, and to maintain its function as a signaling molecule while also decreasing its toxic consequences (Barbieri et al., 2012). On the other hand, the pastime and potential of ROS and antioxidants are correlated so that they can be used as replacement markers (Prior, 2004; Ghiselli et al., 2000). The antioxidant status of the blood may also replicate an expanded need for oxygen in muscle groups at some point in a physical workout

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(Berzosa et al., 2011; Pialoux et al., 2009; Ashton et al., 1998). Therefore, the circulatory level of this marker of oxidative stress increases after acute and regular physical exercise (Berzosa et al., 2011; Serrano et al., 2010; Trachootham et al., 2008), possibly as a redox-mediated adaptation mechanism to protect against cellular oxidative damage (Powers et al., 2010). However, to have an impact on various bodily workout protocols, antioxidant stability has no longer been absolutely defined. Meanwhile, a few studies have mentioned that individuals with weight problems have more growth in oxidative biomarkers after acute workout in comparison to individuals who are ordinary obese (Vincent et al., 2005; Vincent et al., 2004). Other studies show conflicting results (Vincent et al., 2006). Consequently, how acute a workout is influences the discount of oxidative pressure, which still requires study.

Weight problems are a multifactorial persistent disease that develop from social interactions, behavioral elements, and psychological, metabolic, cellular, and molecular factors. It is a circumstance under which adipose tissue will increase and may be defined as overweight effects via excessive fat accumulation (Fernández et al., 2011). The World Health Organization (WHO) defines obesity as a body mass index (BMI) > 30 and defines excess overweight as a BMI of 25 (Manna & K. Jain, 2015). Obesity is essentially the result of excessive energy consumption in comparison to the energy expended; in youngsters, expanded intake of fat and sugars and a shortage of bodily exercise had been associated with obesity (Sikaris K. A., 2004).

Obesity can cause systemic oxidative stress and be associated with the production of irregular adipokines, which contributes to the development of metabolic syndrome. The sensitivity of CRP and different biomarkers of oxidative harm is higher in people with weight problems and is immediately correlated with BMI and body fat percentage, LDL oxidation, and triglyceride tiers (Pihl et al., 2006). In an evaluation, decreased antioxidant markers corresponded to the amount of body fat and principal obesity (Chrysohoou et al., 2007). A study showed that a diet high in fat and carbohydrates induces a significant increase in oxidative stress and inflammation in people with obesity (Patel et al., 2007).

Loose radicals can be the reason for the incidence of infection, lipid peroxidation, and chromosomal harm, which is associated with the onset of numerous pathological conditions, together with cardiovascular disorders, diabetes mellitus, persistent obstructive pulmonary ailments, and most cancers (Accattato et al., 2017). Mental health problems can impair a person's learning, including the ability to think, feel, and perform (Raiola, 2019). Oxidative stress is closely related and interconnected with hypoxia, a condition often exacerbated by increased production of oxygen radicals in various diseases (Trayhurn et al., 2008). Current research has taken the crucial position of hypoxia in the pathogenesis of obesity and weight problem-associated disorders, which cause adipose tissue disorder and abnormal gene expression, and finally turning into a systemic continual, mild inflammatory state (Messineo et al., 2016; Ye, 2009).

Hypoxia will be generated at some point in the overgrowth of adipose tissue during obesity. Adipose tissue produces 25% of systemic IL-6; therefore, this adipose tissue can cause decreased tiers of systemic infection in humans with excess fat on their frames. It has been confirmed that compared to macrophages, fat cells have an ability that is the same as or is more than inflammatory cells, and it has been discovered that an increase in compounds launched by adipocytes may be mediated in systemic infections (Bastarrachea RA, López-Alvarenga JC, Bolado-García VE, et al., 2007). Innate muscular endurance and resistance to hypoxia significantly determines the post-stress neuro-endocrine and metabolic parameters as well as injuries of myocardium and gastric mucosa (Zukow et al., 2022). It is known about the close relationships between the nervous, endocrine and immune systems within the framework of the triune neuro-endocrine-immune complex.

Physical exercise is an important modulator of cytokines and oxidative stress, and for greater than a decade, attention has been centered on the potential of workouts to save a person and help deal with illnesses that involve inflammatory additives by modulating cytokine production (Accattato et al., 2017). A significant increase in people looking for sports and physical exercise practices, as the practice of physical exercise is an effective way to promote health, being also of fundamental importance for the improvement of self-esteem, in addition to be a valuable resource in the prevention of bad habits and in the fight against pathologies related to a sedentary lifestyle (zanini, 2022).

The effectiveness of sport can improving body components, making significant increases in physical health (Raiola, 2019). Although the positive effects of exercise on inflammation are well documented (La Gerche & Heidbuchel, 2014; Pedersen, 2006), the molecular mechanisms by which exercise exerts this effect are still unclear, and there is no consistent information in the literature on variations in markers related to physical exercise.

Some studies have reported that physical exercise can induce an acute phase response characterized by an increase in some circulating cytokines, such as interleukin-1 (IL-1), interleukin-6 (IL-6), tumor necrosis factor α (TNFα) (La Gerche et al., 2016; Pedersen & Febbraio, 2008), and increased levels of malondialdehyde (MDA) as a marker of oxidative stress (Park & Kwak, 2016; Bhutia et al., 2011). However, different studies has proven no massive adjustments in cytokines or MDA stages after workout, confirming the complexity of adaptive mechanisms during physical exercise. Consequently, this study examined the impact of aerobic exercise by using circuit training on stress reduction and weight reduction in obese students.

Material & Methods

This study involved a randomized pretest–posttest control group design using 20 obese students who were 19–24 years of age. Acute aerobic exercise intervention was carried out with a circuit training intensity of 60–70% HR_{max} for 40 min / exercise session. The intensity of the exercise was controlled by monitoring H-10. Circuit training was performed in 16 meetings a week of three exercises for more than 2 months with pre-test and post-test designs. Study groups were designed for various populations. First, 40 students involved n = 20 from a group experiencing high stress and n = 20 from a group having above normal weight. The distribution of this sample used a proportional sampling technique based on criteria.

Data analysis using independent samples t test using the statistical software packet for social science (SPSS) version20. The normality test involved the Shapiro–Wilk test. Data that were normally distributed were tested using an independent sample t-test with a significance level (P<0.05), while if the data were not normally distributed, a non-parametric test was carried out using the Wilcoxon rank sum test and the Mann–Whitney u test with a significance level (P<0.05).

Research Results

1. Frequency distribution data

For the first stage, the frequency distribution data from the pre-test and post-test are shown in Table 1 below.

Table 1 Pre-test and post- test data

	Group	N	Mean	Std. Deviation	Std. Error Mean
Pretest	Group overweight	20	38.2750	.22682	.05072
	Group stress	20	38.5550	.38862	.08690
Posttest	Group overweight	20	36.4200	.23079	.05161
	Group stress	20	36.7900	.21250	.04752

Table 1 shows both groups of 20 samples each. The results for the stress group 36.79 were higher than that of the overweight groups with averages of 36.42.

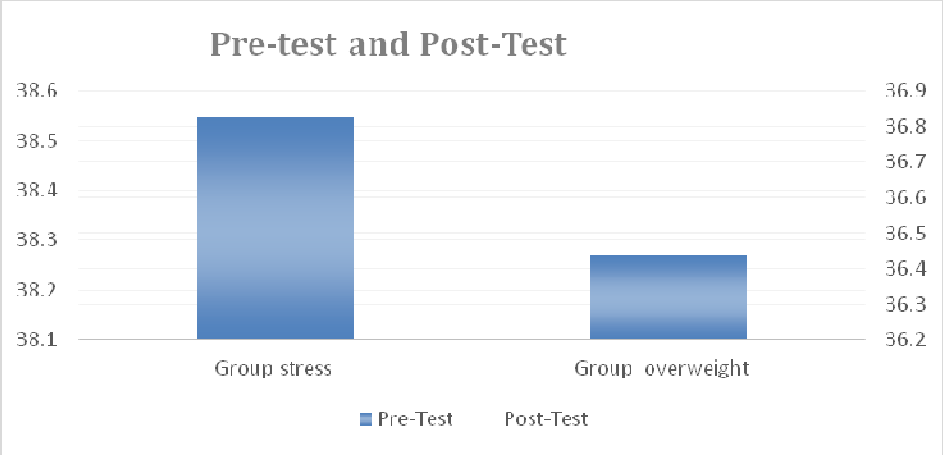

Figure 1. Pre-test and post-test group means

1. Homogeneity Test

Table 2 Pre-test and post-test homogeneity data

Test of Homogeneity of Variances					
		Levene Statistics	df1	df2	Sig.
Pre-Test	Based on trimmed mean	4.539	1	38	0.849
Post-Test	Based on trimmed mean	4.042	1	38	0.840

Table 2 shows that the homogeneity of initial test variables significance was 0.840 (≥0.05) and indicates that the final test variables in the stress and overweight groups are homogeneous, with a Levene statistic of 4.042.

2. Normality Test

Table 3 Pre-test and Post-test normality data

		Pre-test	Post-test
N		40	40
Normal Parameters	Mean	38.4150	36.6050
	Std. Deviation	0.34459	0.28819
Most Extreme Differences	Absolute	0.159	0.158
	Positive	0.159	0.117
	Negative	−0.130	−0.158
Statistical Test		0.159	0.158
Asymp. Sig. (2-tailed)		0.131	0.141

Table 3 shows that the normality of the final test variable significance was 0.141 (≥0.05), which indicates that the final test variables in the stress and overweight groups were normal.

3. Effect Test Between Pre-test and Post-test of Stress and Overweight Groups

Table 4 Pre-test and post-test differences for the

independent sample t test

	Levene's Test for Equality of Variances		t-test for Equality of Means
	F	Sig.	Sig. (2-tailed)
Pre_test	4.539	0.849	0.00
Post_Test	4.042	0.840	0.00

Table 4 shows the independent sample t test analysis. As shown, the 2-way significance (t-tailed) was 0.00 < 0.05. There was a significant difference in point scores between the stress group and the overweight group. Based on the descriptive value, the stress group scored higher compared with the overweight group.

Discussion

The results show data from the pre-test and post-test. The value of 2-way significance (t-tailed) was 0.000 < 0.05. There was a significant difference in point scores between the stress group and the overweight group. Based on its descriptive values, it showed that the stress group scored better compared with the overweight group, despite the fact that the wonderful consequences of workouts on irritation have been well documented (La Gerche & Heidbuchel, 2014; Pedersen, 2006). The molecular mechanisms by way of which exercise exerts this effect are still uncertain, and there are no consistent statistics in the literature on variations in markers associated with exercise. Some studies have mentioned that physical workouts can set off an acute segment response characterized an increase in a few circulating cytokines, such as IL-1, IL-6, and TNFα (La Gerche et al., 2016; Pedersen & Febbraio, 2008) and increased levels of Malondialdehyde (MDA) as markers of oxidative stress (Park & Kwak, 2016; Bhutia et al., 2011).

This research can be used as an update on the importance of circuit training exercises, especially aerobic exercises to reduce stress and reduce weight in students who are overweight. Research should be carried out in the future to serve as a novel reference in this field and to provide information related to exercises to reduce various lifestyle issues and to foster the spirit of physical activity.

Conclusion

In this study, there was an effect of aerobic exercise via circuit training on stress reduction and weight loss in obese students. The results for the stress group 36.79 were higher than that of the overweight groups with averages of 36.42. The homogeneity of initial test variables significance was 0.840 (≥0.05) and indicates that the final test variables in the stress and overweight groups are homogeneous, with a Levene statistic of 4.042. The normality of the final test variable significance was 0.141 (≥0.05), which indicates that the final test variables in the stress and overweight groups were normal. The independent sample t test analysis. As shown, the 2-way significance (t-tailed) was 0.00 < 0.05. There was a significant difference in score points between the stress group and the overweight group, showing that the stress group scored higher than the overweight group. Thus, aerobic exercise using circuit training is effective for reducing weight and stress levels in sports students at the Universitas Negeri Jakarta. This study can be used to show the importance of circuit training, particularly aerobic exercise for stress reduction and weight loss in overweight students.

Conflicts of interest - The authors declare no conflict of interest.
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