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Effects of Weight Training with Aerobic Glycolysis System (CHO) Reference on Waist Circumference

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ABSTRACT
Physical fitness or fitness center and gymnastics studio as a business event, to improve the quality of human life through community sports. Maintain, maintain, and improve health, by using the facilities and infrastructure offered at the fitness center such as free weight equipment, and weight training. The aim is to see the results of weight training (free weight) through the analysis of the aerobic glycolysis system (CHO) on waist circumference. The treatment was given weight training with a duration of one minute (1 minute), using isotonic contractions, performed with 3 repetitions of sets, each set resting 30 seconds. Does it have a significant effect on the waist circumference of the perpetrator? The research method uses a one-Group Pretest-Posttest design. Isotonic exercise affects waist circumference.

Keywords: *Weight Training; Aerobic Glycolysis; Waist Circumference.*

INTRODUCTION

Recently, people have been more concerned about their health, as evidenced by the increasing number of people participating in weight training programs at various fitness centers. Weight training programs can aim to beautify muscle shape and tone muscles or beautify body shape to maintain appearance, especially for women. Another goal of doing weight training, of which is to beautify the shape of the muscles and tighten the muscles or beautify the body shape to maintain appearance so that overweight does not occur. Women complain more about fat deposits in the abdominal area around the waist. When the body's metabolism changes, women have a problem with fat deposits in the waist area that make the woman's body unattractive. Obesity can be a major problem inviting various diseases (Huan et al., 2015). As stated by Valeh et al. (2020) who said that women approach menopause when their body metabolism begins to change, women

have problems with fat deposits generally in the waist area, which makes a woman's body unattractive as a result of menopause, ovarian estrogen decreases significantly, and signs and symptoms of estrogen deficiency include mood swings, being overweight.

In weight training based on muscle contraction, there is an isotonic training method. In isotonic contraction the muscle contracts and shortens, Isotonic which means "equal tension". Isotonic exercises create muscle contractions and cause movement. Isotonic exercise generally serves as the basis for almost all exercises. In isotonic movements, concentric contractions occur when the muscles shorten and develop tension (Collins, 2009). Isometric and isotonic exercise programs appear to be effective in reducing pain and improving function for Greater trochanteric pain syndrome (GTPS) (Clifford et al., 2019). This weight training in an energy system can be classified as a phosphagen system, this energy system in the metabolic process produces the fastest ATP. It is anaerobic. This will fuel the activity that occurs very explosively in 1-30 seconds. This system does not need carbohydrates, fats, or oxygen for this energy system to work. The supply of ATP and Creatine Phosphate in the muscles is low, so the energy availability of this system is very limited.

The term phosphagen system is a chemical process that occurs in muscles. The energy used in carrying out bodily functions comes from ATP (Adenosine Triphosphate) (Brooks & Gladden, 1900). The use of energy through the phosphagen system quickly runs out in seconds and the process is also fast, so there must be a further reserve to be used as energy, namely from the breakdown of glucose without oxygen, which is also called "anaerobic glycolysis". The aerobic analysis system (CHO) has a slightly longer duration than the phosphagen system. Energy is obtained from carbohydrates, fats, and proteins, glucose is a direct source of energy, fat represents long-term energy stores, protein can be used as an energy source, usually, only a small amount of the body's energy needs can be used (Campbell, 2013). Another potential explanation is a shift in substrate utilization from carbohydrates (mostly used during anaerobic training such as weight training) to lipid oxidation (mostly used during aerobic training) due to exercise-induced adaptation involving increased mitochondrial content in muscles so that a short-term aerobic response can result from long-term anaerobic training (Mekary et al., 2015).

We need to know how the types of physical activity and how the energy system can work. Thus we can use physical activity based on this energy system to change Waist Circumference and body weight, especially when one activity replaces another activity at a certain time (Mekary et al., 2015). Another trial showed weight training was effective in

reducing visceral fat in overweight and obese premenopausal women (Schmitz et al., 2007) and sedentary men and women with type 2 diabetes (Moghaddasi et al., 2010). This simultaneous loss of fat and muscle gain has been shown to prevent and treat many chronic diseases including obesity, diabetes, heart disease, and osteoporosis (Wolfe, 2006; Weinheimer et al., 2010); Therefore, given our weight training results on changes in Waist Circumference and moderate to vigorous aerobic activity on changes in Body Weight, it would be ideal to combine moderate to vigorous aerobic activity (eg, jogging/running) with any type of weight training activity to achieve changes in body composition. which is useful (Mekary et al., 2015). Thus, this study is an attempt to determine the effect of Weight Training with the Aerobic Glycolysis System (CHO) reference on the Waist Circumference.

METHOD

The method used in this research is an experiment with a one-Group Pretest-Posttest design. Treatment of lifting weights 3 kg doing strength training with twist movements, sidebands, and good morning, the duration of each movement is one minute with 30 seconds of rest, performed in 3 sets in a row. According to the relationship between one variable and another, it can be divided into the dependent variable (the dependent variable) in this case the waist circumference, and the independent variable (the independent variable) isotonic contraction. The research sample was 30 students of FPOK UPI Class of 2019.

RESULTS AND DISCUSSION

Results

General Linier Model-Repeated Measures

Table 1.
Test of Normality

		Isotonic first measurement	Isotonic second measurement	Isotonic Third measurement	Isotonic Fourth measurement
N		60	60	60	60
Normal Parameters[a,b]	Mean	76.765	76.072	75.478	74.875
	Std. Deviation	10.5891	10.4266	10.3644	10.7294
Most Extreme Differences	Absolute	.090	.097	.110	.101
	Positive	.061	.052	.051	.055
	Negative	-.090	-.097	-.110	-.101
Test Statistic		.090	.097	.110	.101
Asymp. Sig. (2-tailed)		**.200**[c,d]	**.200**[c,d]	**.068**[c]	**.200**[c,d]

Based on table 1, the results of the p-value of each dependent variable (repeated observation time) are > 0.05. It means that the assumption is fulfilled where p-value > 0.05, this means that all variables have normal data distribution.

Assumption Test

Table 2.
Covariance Homogeneity Test

Box's Test of Equality of Covariance Matrices[a]	
Box's M	72.428
F	6.701
df1	10
df2	16082.869
Sig.	0.380

The Box's Test results obtained a value of sig = 0.380 where sig > 0.05. Thus the assumption of covariance homogeneity is fulfilled.

Table 3.
Variance Homogeneity Test

		Levene Statistic	df1	df2	Sig.
Isotonic first measurement	Based on Mean	.139	1	58	.710
	Based on Median	.229	1	58	.634
	Based on Median and with adjusted df	.229	1	54.354	.634
	Based on trimmed mean	.176	1	58	.677
Isotonic second measurement	Based on Mean	.034	1	58	.855
	Based on Median	.080	1	58	.779
	Based on Median and with adjusted df	.080	1	54.087	.779
	Based on trimmed mean	.052	1	58	.820
Isotonic Third measurement	Based on Mean	.009	1	58	.925
	Based on Median	.039	1	58	.843
	Based on Median and with adjusted df	.039	1	54.958	.843
	Based on trimmed mean	.015	1	58	.904
Isotonic Fourth measurement	Based on Mean	.001	1	58	.970
	Based on Median	.012	1	58	.912
	Based on Median and with adjusted df	.012	1	52.513	.912
	Based on trimmed mean	.001	1	58	.979

Based on the results of Levene's Test, the sig value> 0.05 was obtained at all levels of observation. Thus the assumption of homogeneity of variance is fulfilled.

Table 4.
Sphericity Test

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b] Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Time	.184	96.105	5	0.065	0.492	0.510	0.333

Mauchly's Test results obtained a value of sig = 0.065 where sig > 0.05. Thus the sphericity assumption is met.

Table 5.
Analysis GLM-RM

Within-Subjects Factors	
Time	**Dependent Variable**
1	Isotonik_first_measurement
2	Isotonik_second_measurement
3	Isotonik_Third_measurement
4	Isotonik_Fourth_measurement

Based on table 5, Within-Subject Factors explains the dependent variable, namely the time of repeated observations (4 times): before treatment, weeks 1, 2, and 3 treatments.

Table 6.
Between-Subjects Factors

		Value Label	N
Group	1	Isotonic	30
	2	control	30

Based on table 6, Between-Subjects Factors explains the independent variables consisting of 2 treatment groups, namely isotonic (30 people) and control (30 people).

Table 7.
Descriptive Statistics

	Group	Mean	Std. Deviation	N
Isotonic first measurement	Isotonic	77.753	10.4510	30
	control	75.777	10.8111	30
	Total	76.765	10.5891	60
Isotonic second measurement	Isotonic	76.610	10.1554	30
	control	75.533	10.8373	30
	Total	76.072	10.4266	60
Isotonic Third measurement	Isotonic	75.720	10.1132	30
	control	75.237	10.7773	30
	Total	75.478	10.3644	60
Isotonic Fourth measurement	Isotonic	74.767	10.1780	30
	control	74.983	11.4278	30
	Total	74.875	10.7294	60

Based on table 7, it can be seen that there was a decrease in the average waist circumference between the isotonic and control groups between each level of observation.

Table 8.
Tests of Within-Subjects Effects

Tests of Within-Subjects Effects		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Sphericity Assumed	117.846	3	39.282	27.839	0.00	0.324
	Greenhouse-Geisser	117.846	1.475	79.892	27.839	.000	0.324
	Huynh-Feldt	117.846	1.530	77.005	27.839	.000	0.324
	Lower-bound	117.846	1.000	117.846	27.839	.000	0.324
Time * Group	Sphericity Assumed	38.871	3	12.957	9.182	.000	0.137
	Greenhouse-Geisser	38.871	1.475	26.352	9.182	.001	0.137
	Huynh-Feldt	38.871	1.530	25.400	9.182	.001	0.137
	Lower-bound	38.871	1.000	38.871	9.182	.004	0.137
Error (Time)	Sphericity Assumed	245.523	174	1.411			
	Greenhouse-Geisser	245.523	85.554	2.870			
	Huynh-Feldt	245.523	88.761	2.766			
	Lower-bound	245.523	58.000	4.233			

Based on the table above, it can be seen in the observation time variable, the sig value on the Sphericity Assumed <0.05. This means that there is a difference in the average waist circumference between levels of observation time. The difference in the average waist circumference between levels of observation time can only be explained by 32.4%, the rest is influenced by other factors.

In the interaction variable between the observation time and the treatment group, the sig value on the Sphericity Assumed <0.05. This means that there is a difference in the average waist circumference between the levels of observation time between the isotonic groups. The difference in the average depression score between levels of observation time between the isotonic groups can only be explained by 13.7%, the rest is influenced by other factors.

Table 9.
Tests of Within-Subjects Contrasts

Source	Time	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Level 1 vs. Level 2	28.843	1	28.843	24.541	.000	.297
	Level 2 vs. Level 3	21.123	1	21.123	14.761	.000	.203
	Level 3 vs. Level 4	21.841	1	21.841	13.786	.000	.192
Time * Group	Level 1 vs. Level 2	12.150	1	12.150	10.338	.002	.151
	Level 2 vs. Level 3	5.281	1	5.281	3.690	.060	.060
	Level 3 vs. Level 4	7.350	1	7.350	4.639	.035	.074
Error (Time)	Level 1 vs. Level 2	68.167	58	1.175			
	Level 2 vs. Level 3	82.997	58	1.431			
	Level 3 vs. Level 4	91.889	58	1.584			

Based on table 9, it can be seen in the observation time variable, there is a significant difference in the decrease in the average waist circumference which lies in contrast to 1, which is between before treatment and the second month of treatment (p-value < 0.05), contrast 2, which is between the second week and the third week of treatment (p-value = 0.001), and contrast 3 which is between the third and fourth week of treatment (p-value = 0.001).

Meanwhile, in the interaction variable between the time of observation and the isotonic group, there was a significant difference in the decrease in the average waist circumference between the observation time before treatment and the first week between the isotonic treatment group and the control group (p-value = 0.002).

Table 10.
Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	344715.660	1	344715.660	3095.691	0.001	.982
Group	10.334	1	10.334	.093	0.002	.145
Error	6458.496	58	111.353			

Based on table 10, the treatment group variable obtained p-value = 0.002. This means that there is a difference in the average waist circumference between the isotonic treatment group and the control group. The difference in the average depression score between the isotonic treatment group and the control group can only be explained by 14.5%, the rest is influenced by other factors.

Table 11.
Parameter Estimates

Dependent Variable	Parameter	B	Std. Error	t	Sig.	95% Confidence Interval		Partial Eta Squared
						Lower Bound	Upper Bound	
Isotonic first measurement	Intercept	75.777	1.941	39.035	.000	71.891	79.662	.963
	[Group=1]	1.977	2.745	.720	.474	-3.519	7.472	.009
	[Group=2]	0[a]	.	.	.	.	.	.
Isotonic second measurement	Intercept	75.533	1.917	39.394	.000	71.695	79.371	.964
	[Group=1]	1.077	2.712	.397	.693	-4.351	6.504	.003
	[Group=2]	0[a]	.	.	.	.	.	.
Isotonic Third measurement	Intercept	75.237	1.908	39.432	.000	71.417	79.056	.964
	[Group=1]	.483	2.698	.179	.000	-4.918	5.885	.001
	[Group=2]	0[a]	.	.	.	.	.	.
Isotonic Fourth measurement	Intercept	74.983	1.976	37.954	.000	71.029	78.938	.961
	[Group=1]	-.217	2.794	-.078	.000	-5.809	5.376	.000
	[Group=2]	0[a]	.	.	.	.	.	.

Based on the table above, at the time of observation before treatment, there was no difference in the average waist circumference between the isotonic treatment and control groups (p-value = 0.474). Meanwhile, at the time of observation in the third and fourth weeks of treatment, there was a difference in the average waist circumference between the isotonic treatment and control groups (p-value = 0.001; 0.001; 0.001).

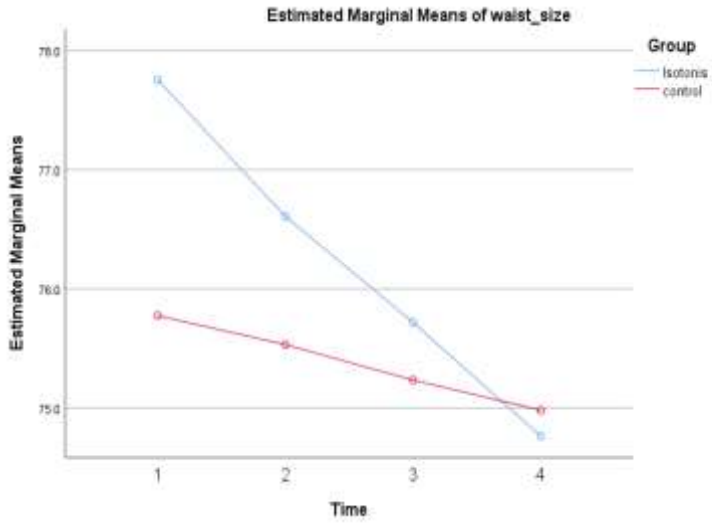

Image 1.
Plot Analysis

Based on plot analysis, it can be seen that isotonic treatment is better in reducing waist circumference compared to control (without treatment). The decrease in waist circumference in the isotonic treatment group was fastest in the third to fourth week of treatment, as seen from the steeper slope.

Discussion

Weight training using the isotonic exercise model has been carried out by many groups, both athletes and the public. This exercise has been confirmed to have a positive effect on many factors in older adults including increased muscle mass, strength, and endurance (Schott et al. 2019). Although weight training with free weights or machines is commonly used to provide resistance to working muscles to increase strength, various devices currently exist for strength training (Colado et al., 2010). It is known that muscle strength can be increased by a strength training program (Colado et al., 2010). But apart from the goal of weight training to increase muscle mass, some people have more varied training goals. Starting from wanting a good body shape or even to losing weight. Several studies have compared the effects of equal amounts of aerobic and resistance exercise on body mass and fat mass in overweight adults (Willis et al., 2012). Strength training twice

a week to avoid increasing the percentage of body fat and intra-abdominal fat (M. Schmitz et al., 2007).

This study showed the results of a decrease in the average waist circumference between the groups who did exercises with isometric and isotonic models in each level of observation. Mohr (1965) in his research found that people who followed six forms of isometric abdominal contraction exercises performed for 6 seconds each, had a significant reduction in thickness and subcutaneous fat at the waist and navel level of the abdomen. While medically purposeful isometric exercises in the initial treatment and management of in-season pain for tendinopathy have become a recent trend, clear evidence to support this approach is lacking (O'Neill et al., 2019). Meanwhile, Dennison et al. (1961) obtained results in their research showing that isometric and isokinetic exercise can reduce intraocular pressure in ophthalmologically normal subjects with a direct relationship with exercise intensity and total energy consumption. Since the pressure-lowering effect of isokinetic exercise is more significant, it may prove useful for glaucoma patients.

This study observed the treatment group for 4 weeks, the results of this observation showed that there was no significant difference in the decrease in the average waist circumference from both the isometric and isotonic groups. A similar thing has been found by Dennison et al. (1961) who said that the value of intraocular pressure measured before exercise, the level of exercise applied, and total energy consumption did not differ significantly between groups, both isometric and isotonic exercise in lowering intraocular pressure.

The results of this study indicate that isotonic exercise affects waist circumference. Thus isotonic exercise is very beneficial for reducing waist circumference, even in other aspects, as in the study of Clifford et al. (2020) who say that isometric exercise can be used as part of a progressive loading program because it may benefit certain individuals. A study conducted by Yalfani et al., (2020) stated that isotonic core stabilization exercises can improve lumbopelvic control by reducing the width of the Linea Alba and thereby reducing lumbopelvic pain and disability in people with diastasis recti.

CONCLUSIONS

Conclusions of this study based on the results of data analysis, it can be concluded that isotonic strength training concerning the aerobic glycolysis system (Cho) affects waist circumference. Isotonic exercise done regularly can help reduce waist circumference.

Suggestions of this research can be used as a reference for fitness trainers to provide strength training using the isotonic method concerning the aerobic glycolysis system (Cho) to reduce waist circumference.

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