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THE EFFECT OF CYCLIC AEROBIC ACTIVITY ON SOME BIOCHEMICAL PARAMETERS IN WOMEN 19-30 YEARS OLD

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(Original scientific paper)

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Abstract
The research was conducted on a sample of 100 women from 19 to 30 years, all students on University "Fehmi Agani" in Gjakovica. The sample was divided into two groups: first group is the experimental group (EG), which includes 50 women undergoing three months of experimental kinesiological treatment and the second group is the control group (CG), consisted of 50 women who didn't participate in aerobic activity. Five biochemical parameters: glucose, HDL cholesterol, LDL cholesterol, triglycerides in blood and total cholesterol, were analyzed at the Center for family medicine in Gjakova with "COBAS INTEGRA 400 Plus". The experimental program, cycling ergometer, lasted 3 months and the trainings were organized three times a week. The duration of the training started with 40 minutes and increased with time to 60 minutes, while the intensity started from 50% of maximum heart rate and increased with time to 70%. The results were processed with the SPSS statistical package for Windows version 22.0 and the following statistical protocols were applied: minimum, maximum, mean, std. deviation and coefficient of variability, univariant (ANOVA) and multivariant analysis of variance (MANOVA) were used to determine the differences in the initial measurement between the experimental group and the control group, univariate (ANKOVA) and multivariate analysis of covariance (MANKOVA) were used to determine the differences in the final measurement between the experimental group and the control group and T-tests for dependent samples to determine the differences in blood parameters between the initial and the final measurement in the experimental group and the control group, separately. The results obtained showed that statistically significant differences between the initial and the final measurement in the experimental group were found in the following variables: decreasing in LDL cholesterol by 12.62%, in triglycerides by 18.03% and total cholesterol by 12.18%.

Key words: *woman, experimental group, control group, biochemical parameters, cyclic aerobic activity.*

Introduction

If we take a look at the modern-day man, we can see from the position of the modern sedentary man (homo sedentary), which is characterized by lack of movement (hypokinesis), excessive diet and stress, it can be said that movements of the aerobic cyclical character, sport and kinesiologic activities are imposed as a fundamental need (Warburton D.E.R, Whitney N. C., & Bredin S.D.S., 2006). There is no doubt that childhood hypokinesis impairs biological growth and development, in adulthood damages overall health, while inactivity in an older age is more often fatal (Gallahue D.L., & Donnelly F.C., 2003).

The best way to achieve a desired goal is with regular physical activity. Exercises consume energy reserves stored as fat and avoid loss of muscle protein (Malacko J., & Rađo I., 2004). For this reason, energy is gained from fats relative to carbohydrates. People who engage in physical activity increase their ability to use fat as a source of energy and reduce the risk of various diseases such as diabetes. In order to remove or consume excess fat, (Završnik J., 2004), suggests that two types of training should be combined: aerobic and anaerobic training. Nowadays, it is becoming increasingly evident that sport activity is one of the main factors affecting weight loss and improving the quality of life. Therefore, modern devices are used to determine body mass that provide more accurate and rapid data on the state of body mass in order to program physical activity.

Hyperlipidemia is an increase of blood cholesterol and triglyceride levels, with low HDL, leading to many vascular diseases. This disorder of increased fat in the metabolism is called dyslipidemia. Physical activity affects the reduction of body weight and total body fat, the distribution of adipose tissue, as well as the maintenance of ideal weight, changes in body composition, the attainment of energy balance and its effect is confirmed to be significant and independent of weight loss (Trejo-Gutierrez J.F., &Fletcher G., 2007).

Since the beginnings of research into the effects of regular physical activity and exercise on the prevention of atherosclerosis and the development of coronary heart disease, significant effects of exercise on blood fat levels have been reported, and above all, on the rise in HDL cholesterol levels, in lowering LDL cholesterol relative to HDL-cholesterol and a decrease in blood triglyceride levels. Given that most studies on the effects of aerobic physical activity and exercise on blood plasma lipid and lipoprotein concentrations have been performed on small subjects, meta-analyzes make an important contribution to drawing conclusions (Kelley G.A., Kelley K.S.,& Tran Z.V., 2005). The purpose of the research is to establish the ratio of body composition and some biochemical parameters in the blood, specifically lipids and blood glucose.

Material & methods

Participants

The research was conducted on a sample of 100 women from 19 to 30 years of age, all students on University "Fehmi Agani" in Gjakovica. The sample was divided into two groups. The first group is the experimental group (EG), which includes 50 women undergoing three months of experimental kinesiological treatment. The second group is the control group (CG), which consisted of 50 women who didn't participate in the treatment. The only condition that was applied in the sample determination was that the women involved in the research voluntarily agreed to be a part of this research.

Procedure/test

Five biochemical parameters: glucose (GLUC), HDL cholesterol (HDL), LDL cholesterol (LDL), triglycerides in blood (TRIG) and total cholesterol (CHOL) were analyzed at the Center for Family Medicine in Gjakova with "COBAS INTEGRA 400 Plus".

Protocol

Experimental program was applied on cycling ergometer. The trainings were organized three times a week in a period of 3 months. That means three times a week, 12 trainings per month, or a total of 36 trainings. Each training consisted of:

- An introductory part of the training which included warm-up and stretching exercises. It lasted from 5 to 10 minutes. The purpose of the introductory part of the training is to increase muscle circulation and to raise the physiological functions to a higher level;
- The main part of the training contained activities with a different intensity, which is the intensity that provides the most optimal stimulus for promoting adaptive mechanisms of the organism in duration of 40-60 minutes (increased with time from 40 to 60 minutes) and with intensity 50-70% from maximum heart rate (increased with time from 50% to 70%);
- The last part of the training lasted from 5 to 10 minutes and it was intended to calm down and cool the body.

Statistical analysis

Considering the posed problem, the subject matter and the goals of this research, the results were processed with the SPSS statistical package for Windows version 22.0 and the following statistical protocols were selected. For all variables that are applied for measurement of the biochemical parameters, for each sub-sample separately, the following statistical parameters for central tendency and variability measures were calculated:

- Basic descriptive parameters: minimal result (MIN), maximal result (MAX), mean (X), standard deviation (SD) and coefficient of variability (KV%).
- Multivariate analysis of variance (MANOVA) and univariate analysis of variance (ANOVA) were used in order to determine the differences in the initial measurement

between the experimental group and the control group in the biochemical parameters indicators.

- Multivariate analysis of covariance (MANKOVA) and univariate analysis of covariance (ANKOVA) were used in order to determine the differences in the final measurement between the experimental group and the control group in the biochemical parameters indicators.
- The differences in blood parameters between the initial and the final measurement in the experimental group and the control group, separately, were determined by T-tests for dependent samples.

Results

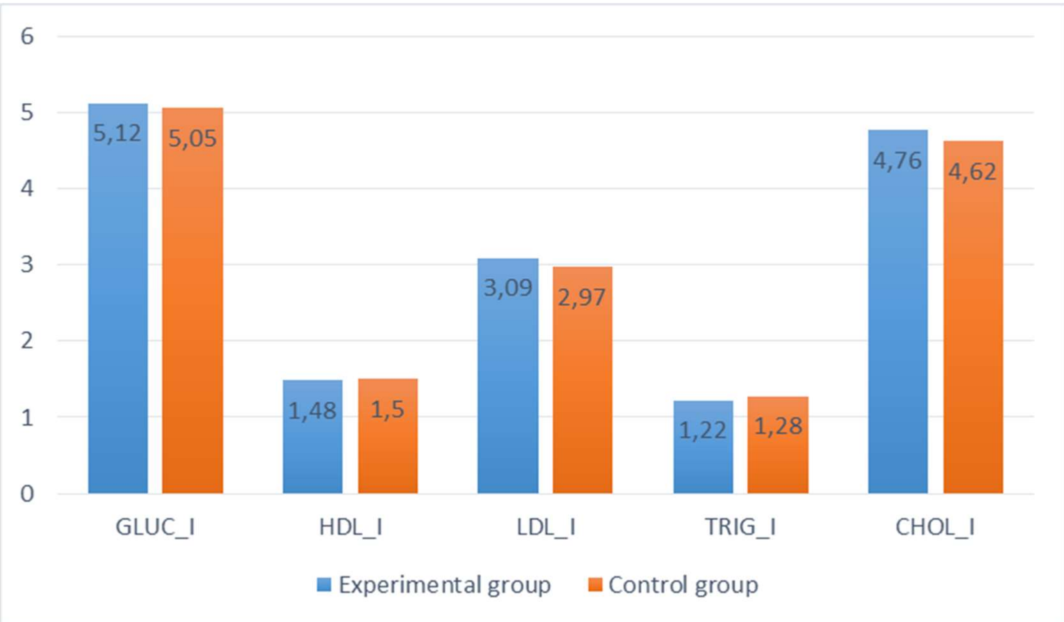
In order to determine whether the groups are homogeneous, a multivariate analysis of variance (MANOVA) with age partialization was applied in the initial measurement. The analysis of the variance (ANOVA) in the initial measurement in the biochemical parameters assessment measures of the experimental group and the control group is presented in Table 1 and Figure 1. In the initial measurement, in the biochemical parameter assessment measures, there were no significant statistical differences between the respondents from the experimental group and the control group at the multivariate and univariate level.

Table 1. Significance of differences in the biochemical parameters measures between the experimental group and the control group in the initial measurement

	Value	F	Hypothesis df	Error df	Sig.	η^2
Pillai's trace	,05	,92	5	93	,474	,05
Wilks' lambda	,95	,92	5	93	,474	,05
Hotelling's trace	,05	,92	5	93	,474	,05
Roy's largest root	,05	,92	5	93	,474	,05

	Experimental group		Control group		F	Sig.	η^2
	Mean	SD	Mean	SD			
GLUC-I	5,12	0,57	5,05	0,43	0,36	0,550	0,00
HDL-I	1,48	0,24	1,50	0,19	0,23	0,636	0,00
LDL-I	3,09	0,56	2,97	0,56	0,64	0,427	0,01
TRIG-I	1,22	0,21	1,28	0,20	2,66	0,106	0,03
CHOL-I	4,76	0,57	4,62	0,57	1,02	0,315	0,01

Figure 1. Biochemical parameters measures between the experimental group and the control group in the initial measurement



Such state suggests that both groups of respondents are relatively homogenized, whereby conditions are created to begin the experimental program from equal starting positions for the respondents from both groups.

In order to neutralize the differences in terms of age, and the results measured in the initial measurement, i.e. to prevent them leading to a “systematic error”, the groups are additionally homogenized with an appropriate statistical procedure, that is, multivariate and univariate analysis of covariance for determination of the differences in the final measurement between the experimental group and the control group.

Multivariate (MANCOVA) and univariate analysis of covariance (ANCOVA) were applied in order to determine whether there are statistically significant differences in the biochemical parameters measures in the final measurement between the experimental group and the control group. These results are presented in Table 2 and Figure 2.

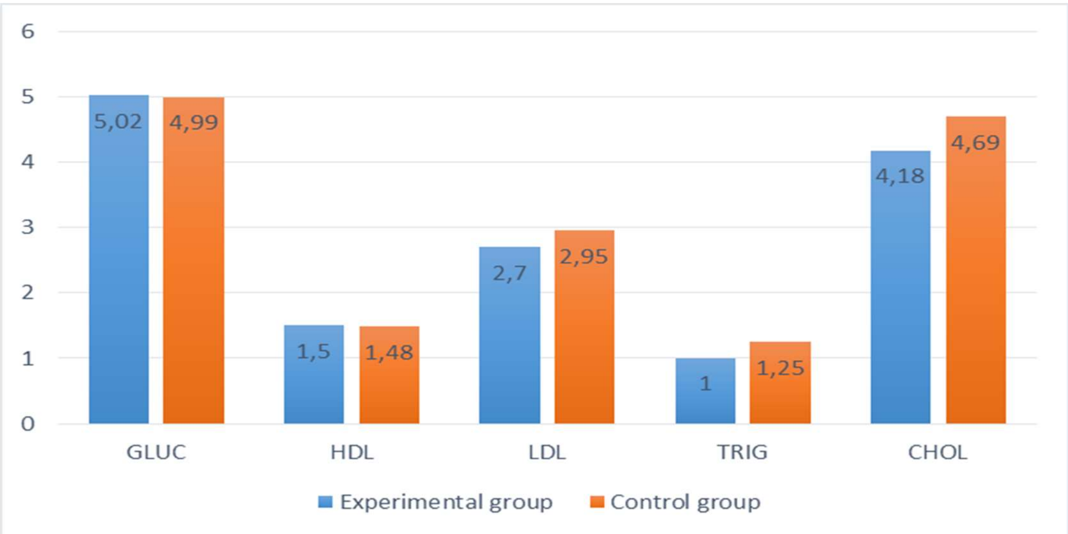
Table 2. Significance of differences in biochemical parameter measures between the experimental group and the control group in the final measurement

	Value	F	Hypothesis df	Error df	Sig.	η^2
Pillai's trace	,68	37,94	5	88	,000	,68
Wilks' lambda	,32	37,94	5	88	**,000**	,68
Hotelling's trace	2,16	37,94	5	88	,000	,68
Roy's largest root	2,16	37,94	5	88	,000	,68

	Experimental group		Control group		F	Sig.	η^2
	Mean	SD	Mean	SD			
GLUC	5,02	0,55	4,99	0,37	0,09	0,767	0,00
HDL	1,50	0,20	1,48	0,29	0,18	0,672	0,00
LDL	2,70	0,50	2,95	0,44	28,94	**0,000**	0,24
TRIG	1,00	0,21	1,25	0,18	57,90	**0,000**	0,39
CHOL	4,18	0,51	4,69	0,53	54,27	**0,000**	0,37

By applying multivariate analysis of covariance (MANKOVA), i.e. by testing the significance of the differences of the arithmetic means in the biochemical parameters measures in the final measurement in both groups of respondents, a statistically significant difference was found, because Wilks’ Lambda is .32 and for degrees of freedom df = 5/88, it gives a statistical significance at level Q=.00. The magnitude of the partial effect of the determinants (partial η^2) shows a large effect of influence .68.

Figure 2. Biochemical parameters measures between the experimental group and the control group in the final measurement



In order to determine which biochemical parameters measures have statistically significant differences, a univariate analysis of covariance was calculated individually for each in the biochemical parameters measure individually. The overview of Table 2 shows that there are statistically significant differences in 3 out of 5 variables. Intergroup differences are found in the variables: LDL cholesterol (F= 28,94; p= 0,000), triglycerides - TRIG (F= 57,90; p= 0,000) and blood cholesterol - CHOL (F= 54,27; p= 0,000). The partial effect of the determinants, partial η^2, is ranked between .24 and .39 and it shows a large effect of influence. The largest effect in determining the differences is shown by the variable triglycerides (partial - η^2 =.39), then by the variable blood cholesterol (partial - η^2 =.37) and the least by the variable LDL (partial - η^2 =.24). Statistically significant differences were not found in the biochemical parameters glucose (GLUC) and HDL cholesterol.

In order to define the differences in the biochemical parameters measures between the initial and the final measurement in the experimental group, T-tests for dependent samples were used. The test results are presented in table and Figure 3.

Table 3. Significance of differences in arithmetic means from the initial and the final measurements in the respondents from the experimental group

Variables	Initial		Final		%	R	T-test	Sig
	Mean	SD	Mean	SD				
GLUC	5,12	0,57	5,02	0,55	-1,95	0,62	1,43	0,158
HDL	1,48	0,24	1,50	0,20	1,35	0,59	-0,90	0,370
LDL	3,09	0,56	2,70	0,50	-12,62	0,84	9,25	**0,000**
TRIG	1,22	0,21	1,00	0,21	-18,03	0,75	10,55	**0,000**
CHOL	4,76	0,57	4,18	0,51	-12,18	0,88	14,94	**0,000**

Table 3 shows that there are statistically significant differences between the initial and the final measurement, which were found in the variables: LDL cholesterol, blood triglycerides (TRIG) and blood cholesterol (CHOL). Significantly significant differences between the mean achievements of the subjects in this group during the experimental program (initial-final measurement) did not occur in the variables glucose and HDL cholesterol (High Density Lipoprotein).

On the basis of the calculated percentage of the values of the arithmetic means between the initial and the final measurement, it can be concluded that 3 months after the commencement of the exercise program, the respondents from the experimental group have decreased LDL cholesterol by 12.62%, triglycerides by 18.03% and total cholesterol by 12.18%.

Figure 3. Differences in arithmetic means from the initial and the final measurements in the respondents from the experimental group

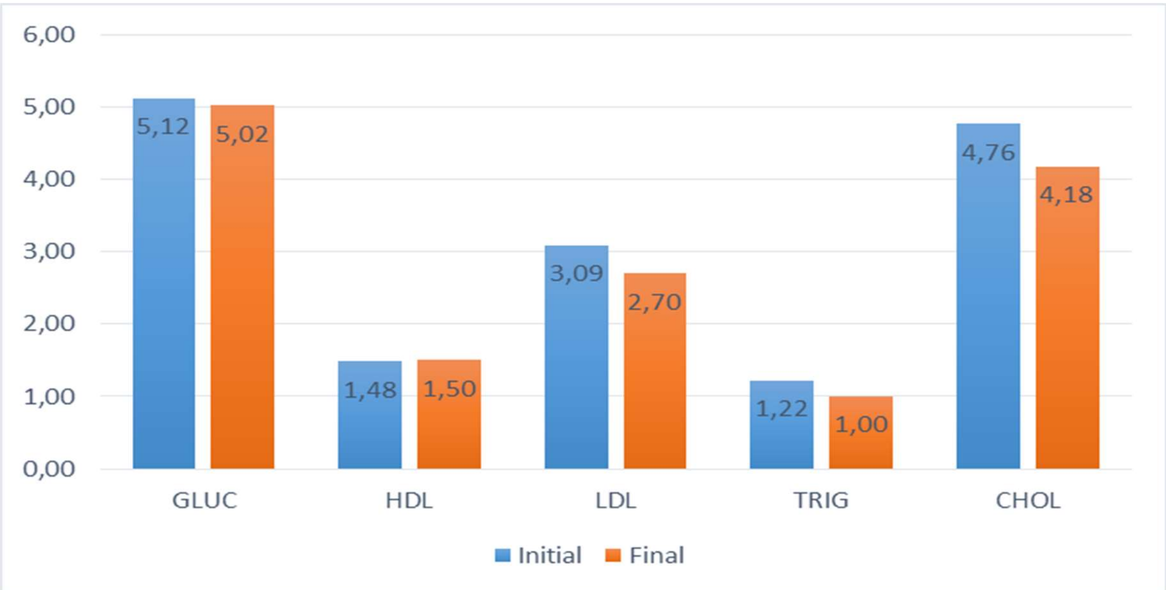


Table 4. Significance of differences in arithmetic means from the initial and the final measurement in the respondents from the control group

Variables	Initial		Final		%	R	T-test	Sig
	Mean	SD	Mean	SD				
GLUC	5,05	0,43	4,99	0,37	-1,19	0,53	1,11	0,272
HDL	1,50	0,19	1,48	0,29	-1,33	0,22	0,33	0,744
LDL	2,97	0,56	2,95	0,44	-0,67	0,44	0,31	0,761
TRIG	1,28	0,20	1,25	0,18	-2,34	0,54	1,11	0,274
CHOL	4,62	0,57	4,69	0,53	1,52	0,38	-0,84	0,406

Figure 4. Differences in arithmetic means from the initial and the final measurement in the respondents from the control group

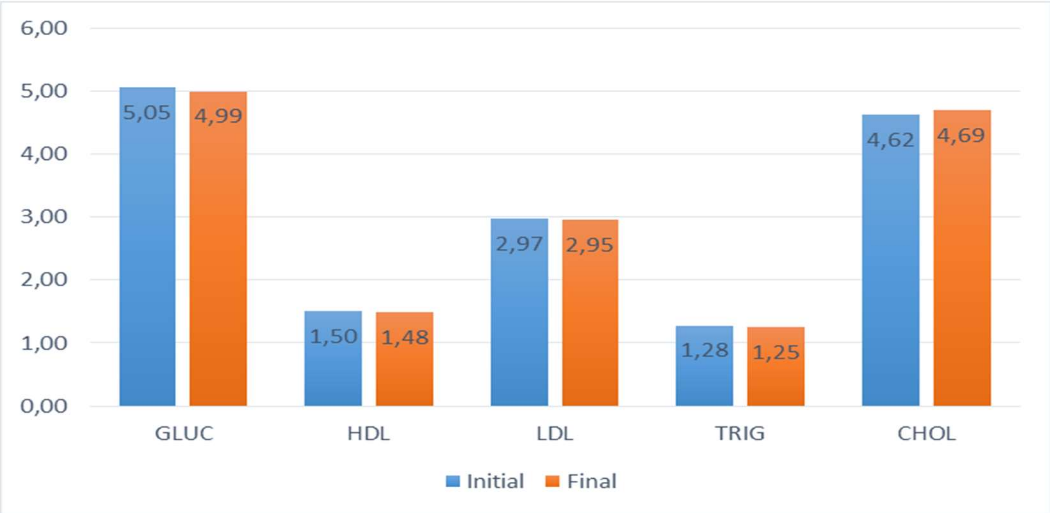


Table 4 shows that no statistically significant differences were found between the initial and final measurements in the control group after 3 months in any of the biochemical parameters (glucose - GLUC, HDL cholesterol, LDL cholesterol, Triglycerides in the blood (TRIG) and total Cholesterol in the blood (CHOL).

Discussion

With this work, we wanted to determine how aerobic program with 50 to 70% intensity affects the biochemical parameters in the blood, respectively in glucose in the blood (GLUC), lipoprotein high-density lipoprotein in the blood (HDL), lipoproteins low-density lipoprotein in the blood (LDL), triglycerides in the blood (TRIG) and the total cholesterol level (CHOL).

The study has confirmed that significant differences have been gained between the two measurements in the group of women involved in the research before and after the implementation of the cardio-respiratory program that is a testimony of the positive impact of cyclic aerobic exercises on the level of lipid and glycemic values in the blood. Physical activities applied in a quarterly period three times a week, as a special program designed for the purpose of this paper, had positive effects on lipid levels. Lowering the low-density lipoprotein (LDL) and triglycerides (TRIG) in the blood level is a consequence of activating the fat metabolism and providing energy from fatty acids in performing physical activity for a duration of 40-60 min with intensity 50-70%. According to Petrović D. (1994) this occurs several minutes after the start of the exercise. Also the triglyceride level is maintained permanently low when physical activity is applied. There is evidence that physical activity can decrease the level of total cholesterol, LDL cholesterol and triglycerides in blood (Blagajac M., & Živanović Ž., 1993). So, we can conclude that properly programmed cardio-respiratory activity should be applied to women of all ages in order to prevent various diseases resulting from high levels of lipid in the bloodstream.

Our research is consistent with many researches, like Turgut G., Genc O., & Kaptanoglu B. (1999) and Thompson P., et all. (2001), that show the positive effects of cardio-respiratory activity of medium intensity on the lipid level, while according to Boraita A. (2004) and Jovanović J., & Jovanović M. (2005) the most important effect of physical activity is benefited in fat metabolism and lipoprotein in the blood HDL. Watt M. J., et all. (2003) in their research have shown the long-term effect of aerobic (cardio-respiratory) activity in increasing lipoprotein lipase activity and thus lower levels of cholesterol and triglycerides in the bloodstream in longrunning sportspeople and Davis P. G., Bartoli W. P., & Durstine J. L. (1992) have confirmed that the intensity of training determines the pathway of metabolism and organic matter for energy, which has a high impact on the lipid level of persons involved in physical activity. These authors showed significant changes in lipid parameters during the period of sports training in terms of significant increases in HDL cholesterol and LDL cholesterol reduction after 6 months of preparation.

Conclusions

Based on the obtained results, the following conclusions can be drawn:

- In the initial measurements, in the biochemical parameters assessment measures, the respondents from the experimental group and the control group are not statistically different at the multivariate and univariate level.
- In the final measurements, in the biochemical parameters assessment measures, the respondents from the experimental group and the control group statistically differ at the multivariate and univariate level and it can be concluded that 3 months after the commencement of the exercise program, the respondents from the experimental group have decreased LDL cholesterol by 12.62%, triglycerides by 18.03% and total cholesterol by 12.18%.
- Statistically significant differences between the initial and the final measurement in the control group were not found in any of the following variables glucose - GLUC, HDL cholesterol, LDL cholesterol, triglycerides in the blood (TRIG) and total Cholesterol in the blood (CHOL).

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