

## PHYSICAL ACTIVITY AS AN IMPORTANT FACTOR FOR THE REDUCTION OF LIPID RISK FACTORS AT THE SECONDARY PREVENTION OF CORONARY HEART DISEASE IN MEN

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In people with normal or moderately elevated levels of cholesterol and triglycerides, a decrease in their values leads to positive health effects, and even at low levels of LDL-C, HDL-C levels represent an important predictor of coronary heart disease.

The aim of our study was to evaluate the changes in lipoprotein parameters and the reduction of cardiovascular risk in normolipidemic patients with myocardial infarction, under the influence of physical training.

The research included 38 normolipidemic men with coronary artery disease. The average age of the patients was  $58.01 \pm 5.31$  years. All the subjects had elevated blood pressure, 93.38 % had a positive family history and 65.31 % of them were tobacco consumers. All patients were prescribed physical activity according to the recommendations of the EAS and the ACC/AHA and the diet by NCEP ATP III recommendations.

After the six months of implementation of physical activity in patients with normal values of lipids and myocardial stroke, the non-significant reduction in triglycerides of 9.81 %, VLDL-C of 9.91 %, LDL-C of 6.21 % and total cholesterol of 24.2 %, was recorded. Non-HDL-C was significantly reduced by 7.56 % ( $p < 0.004$ ). There was a significant increase in protective HDL-C by 17.27 % ( $pc < 0.003$ ); reduction in LDL-C/HDL-C relation of 20.81 % ( $pc < 0.003$ ), the decrease of Hol/HDL-C by 17.34 % ( $p < 0.002$ ) and a significant shift from the very high and high risk for new coronary incident to the moderate risk, by using coronary risk tables ( $p < 0.05$ ).

Physical activity leads to a reduction of lipid risk factors and atherogenic index in males at the secondary prevention of coronary heart disease. The initial lipid screening indicates the presence of dyslipidemia in the majority of patients who were considered normolipidemic, so the lipid screening is recommended in all patients at the secondary prevention of coronary heart disease.

*Acta Medica Medianae 2019;58(2):22-26.*

**Key words:** Physical activity, coronary heart disease, dyslipidemia

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### Introduction

Paragh G. and associates pointed out the importance of lipid lowering therapy after myocardial infarction (MI), because it was shown that 83.3% of

patients with previous IM, before the occurrence of the incident were hypercholesterolemia (1). In spite of statistical indicators, the level of lipid accumulation in the arteries is not necessarily caused by an increase of LDL-C in plasma (2), and border level of total cholesterol (Hol), below which there is no risk for the development of coronary incident, does not exist (3).

Many authors state that people with normal or moderately elevated levels of LDL and cholesterol, also have useful effects of lowering them. Also, significant prognostic potential, especially in men, have lowered levels of HDL-C, especially in states with low levels of LDL-C (4).

The interconnection of limit low levels of HDL-C and limit high levels of LDL-C has a cumulative risk of subsequent coronary events in patients at secondary prevention of coronary artery disease (CAD). These disorders in clinical practice often remain uni-

identified and patients insufficiently acquainted with the importance of physical exercise, which is the first and often the only therapeutic step in treating these disorders (5).

### Goal of work

The aim of our study was to determine the changes of lipid parameters and reduction of cardiovascular risk in normolipidemic respondents, with the preferred or limit values of total cholesterol and triglyceride in plasma, and with the coronary disease after organized and controlled six-month physical load.

### Materials and methods

The study included 38 men with myocardial infarction, with the values of total cholesterol less than 5.2 mmol/l and triglycerides lower than 2.3 mmol/l. The mean age was  $58.01 \pm 5.31$  years. The research was made in the Cabinet for lipids at the Institute for prevention, treatment and rehabilitation of rheumatic and cardiovascular diseases, Niška Banja. The methodological approach was based on the comparison of results obtained by a prospective analysis of the patients' medical history, clinical examination findings and determining biochemical parameters. All patients were prescribed physical activity and diet according to the NCEP ATP III recommendations (6).

Blood for the analysis of lipid parameters was taken after 12 hours of fasting, at the beginning and after (24 weeks) of the examination. Total cholesterol (Hol), triglycerides (TG) and HDL-cholesterol (HDL-C) were determined by standard methodology, and LDL-cholesterol (LDL-C), VLDL-cholesterol (VLDL-C), non-HDL cholesterol (nonHDL-C) and lipoprotein relations were determined by calculation. The preferred values for each of these parameters were given by recommendations of EAS and NCEP ATP III (3.6) and the level of physical activity was determined according to the AHA recommendations (7). The research results were analyzed by statistical methods of

descriptive and quantitative analysis, with the use of appropriate tests, and the results are presented in tables and graphs.

### Results

The frequency of nonlipid risk factors in the examined patients was very high. All patients had elevated blood pressure, positive family history of the existence of coronary disease had 93.38 % of patients, and 65.31 % of patients consumed tobacco.

All patients had normal levels of lipids in plasma, 88.13 % of them had the concentration of HDL-C < 1 mmol/l, and 35.02 % the concentration of HDL-C less than 0.91 mmol/l.

By analyzing the changes in lipid and lipoprotein parameters, as well as atherogenic relations at the beginning and at end of the study, made under the influence of the applied physical activity and diet regime, the non-significant reduction in triglycerides and VLDL-C for 9.91 %, LDL-C for 21.6 % and Hol for 14.2 %, was recorded. Although the reduction in these lipid parameters was insignificant, their cumulative effect was significant and it led to a significant reduction in the amount of non-HDL-C of 7.51 % ( $p < 0.004$ ). A very important segment of physical activity, according to the AHA recommendations, was manifested by an increase in the protective HDL-C, which increased by 17.28 % ( $p < 0.003$ ).

The changes in the concentration of lipids were also examined by the changes of atherogenic indexes. Thus, the tested men were found a significant reduction in relation LDL-C/HDL-C of 20.81 % ( $p < 0.003$ ) and the reduction of relations Hol/HDL-C of 17.27 % ( $p < 0.002$ ) (Table 1).

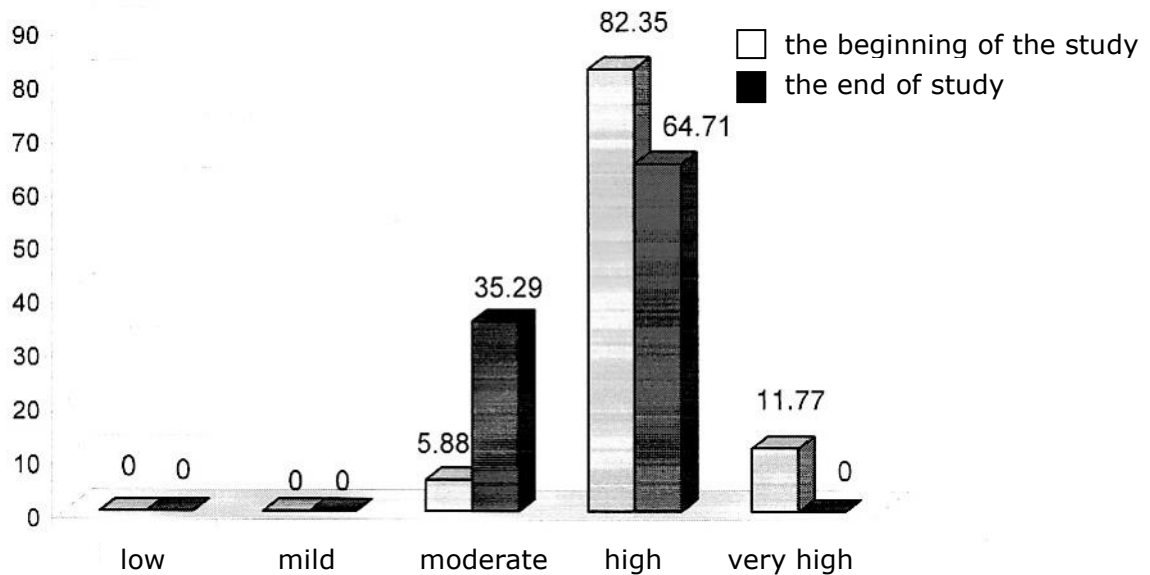
By the application of a diet and physical activity for a period of 6 months, favorable values of HDL-C and atherogenic indexes were achieved in all patients. The target values for triglycerides were achieved by 80 % and for LDL-C by 15 % of respondents.

**Table 1.** Change of lipid origin risk factors

Lipid origin risk factors	Total		Total difference (%)	P
	The beginning of testing	The end of testing		
total cholesterol (Hol)	$4.92 \pm 0.26$	$4.81 \pm 0.23$	-2.25	NS
Triglycerides (TG)	$1.91 \pm 0.35$	$1.72 \pm 0.32$	-9.81	NS
VLDL-C	$0.86 \pm 0.16$	$0.78 \pm 0.14$	-9.91	NS
LDL-C	$3.02 \pm 0.33$	$2.87 \pm 0.33$	-6.21	NS
non-HDL-C	$3.96 \pm 0.35$	$3.65 \pm 0.30$	-7.51	0.004
HDL-C	$0.97 \pm 0.15$	$1.14 \pm 0.18$	+17.28	0.003
LDL-C/HDL-C	$3.23 \pm 0.77$	$2.55 \pm 0.52$	-20.81	0.003
Hol/HDL-C	$5.16 \pm 1.00$	$4.271 \pm 0.67$	-17.27	0.002

The absolute ten-year risk in subjects at the beginning of testing was very high in 11.75 %, high in 82.14 % and moderate in 5.88 % of the respondents. After six months of the applied therapy, there

was a change in the distribution of risk in terms of reducing the very high for 11.77 % and high risk for 17.64 % ( $p < 0.05$ ) on account of an increase in moderate risk (Graph 1).



Graph 1.

## Discussion

Numerous studies have shown the clinical and angiographic benefits of reducing moderately or highly increased LDL-C in patients with the developed CAD. However, many patients with CAD have relatively normal values of total cholesterol. There are controversies concerning the attitude about the usefulness of therapy which alters the level of lipids in patients with CAD and mostly normal values of lipids. These concerns stem from the still insufficient knowledge of many pleiotropic effects of statin therapy as well as the insufficient motivation of the patients for continuous usage of these drugs. Bearing in mind that there are still no official recommendations for medicament therapeutic approach to patients, it remains to pay more attention to the struggle for the reduction of the major risk factors for atherosclerosis, which are primarily the implementation of hygienic dietary regime and increase of physical activity, regulation of hypertension, hyperglycemia and state of glucose intolerance, as well as to the fight against smoking (8).

LaRosa and colleagues report that people with normal or moderately elevated values of cholesterol (4.1 - 6.2 mmol/l) and LDL-C (2.6 - 4.1 mmol/l) have beneficial effects of lowering the same. The authors state that at low levels of LDL-C ( $< 2.84$  mmol/l), the level of HDL-C presents an important predictor of CHD, especially in males (9).

By comparison of "normolipidemic" subgroup in FATS and HARP study, it was found that the low levels of HDL-C are the benchmark for the usefulness of therapy that alters lipids (8).

Some authors point out the importance of determining the HDL-C, and its subfractions for assessing the risk of recurrence of the CD events in normolipidemic patients (10). In accordance with these findings are also the results that after 12 weeks of cardiac rehabilitation with physical training, the patients with reduced levels of HDL-C and normal triglyceride levels had a significant increase of HDL-C and decrease of LDL-C/HDL-C relation (4).

Changes in the distribution of the ten-year risk for CHD in normolipidemic patients were created under the influence of chronic physical training, they show a reduction of very high and high risk and the increase of the prevalence of lower risk categories. There is a significant difference in the structure of risk between men and women, with a significantly higher risk in men. These results justify the view that, despite the normal levels of total cholesterol and triglycerides, after an estimated lipid risk levels and the ten-year risk for new coronary incidents, even in these patients the diet should be advised, that is the proper way of eating, physical activity, education about risk factors should be provided, and the analyses of lipoprotein should be repeated after a year (11). The information of FATS studies shows that subjects with levels of LDL-C  $< 4.14$  mmol/l, have the same beneficial effects of lipid lowering as

well as those with LDL-C > 4.14 mmol/l. The values of HDL-C and triglyceride in the patients involved in the FATS study were: HDL-C = 0.88 mmol/l, Tg = 2.08 mmol/l (8).

The low concentrations of HDL-C are accompanied with the increased risk for CHD even when levels of total cholesterol and triglycerides are not elevated (10). Large epidemiological studies suggest that any increase in HDL-C for 0.02 mmol/l, reduces the risk for the new coronary incident by 2-3 % (2).

In our study in patients with myocardial infarction and normal values of total cholesterol and triglycerides, in the beginning, a high risk (> 20 %) was present in eighty-three percent of patients. Low isolated HDL-C (ILHDL-C) was defined as level HDL-C < 0.91 mmol/l, LDL-C < 4.14 mmol/l and Tg < 2.82 mmol/l (2). In our study, 35.29 % of the examined men suited these criteria. Lien and colleagues determined that patients with CHD have the prevalence of ILHDL-C, which ranges from 17-36 % (2), which corresponds to our results.

The largest number of normolipidemic respondents had the desired and limited values of cholesterol, LDL-C, and triglycerides, while the high-risk HDL-C and abnormal HDL ratio had 87.20 % of the patients with coronary artery disease. More than two-thirds of normolipidemic patients with myocardial infarction (75.11 %) had high-risk values of atherogenic relations Hol/HDL-C and 17.64 % high risk values of atherogenic relation LDL-C/HDL-C. This kind of distribution of lipid risk levels in normolipidemic patients with IM, suits the fact that, despite

relatively normal levels of total cholesterol and triglycerides, other lipoprotein fractions, non-HDL-C, and atherogenic relations may indicate the presence of dyslipidemia in these patients, which requires clinical evaluation and long-term monitoring in order to identify the subjects with an increased risk for new coronary events in the near or distant future.

## Conclusion

1. Respondents with myocardial infarction and normal values of lipids, in a high percentage, belong to the group of patients with isolated low HDL cholesterol.

2. Normolipidemic patients with myocardial infarction and two non-lipid risk factors for coronary heart disease have a very high risk for new coronary events and require hypolipemic therapy.

3. The change of the lipoprotein profile in patients with myocardial infarction and normolipidemic dyslipidemia leads to a reduction of absolute ten-year risk for new coronary events, which is accompanied by a redistribution of risk profiles with a reduction of the very high and high risk on account of moderate.

4. Physical activity and diet measures significantly affect the reduction of risks for new coronary incidents, which is followed by the decrease of patients with very high and high risk on account of the group of patients with moderate risk.

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Originalni rad

UDC: 613.73:616.1-008:577.115  
doi:10.5633/amm.2019.0204

## FIZIČKA AKTIVNOST KAO VAŽAN FAKTOR REDUKCIJE LIPIDNIH FAKTORA RIZIKA U SEKUNDARNOJ PREVENCIJI KARDIOVASKULARNE BOLESTI KOD MUŠKARACA

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Kod osoba sa normalnim ili umereno povišenim nivoima holesterola i triglicerida uočavaju se povoljni efekti prilikom njihovih smanjenja, pa čak i pri niskim nivoima LDL-C, HDL-C nivoi predstavljaju važan prediktor koronarne bolesti srca.

Cilj našeg istraživanja bio je da se pod uticajem fizičkog treninga procene promene parametara lipoproteina i smanjenje kardiovaskularnog rizika kod normolipidemijskih bolesnika sa infarktom miokarda.

Istraživanje je obuhvatilo 38 normolipidemijskih muškaraca sa koronarno-arterijskom bolešću. Prosečna starost bolesnika bila je 58,01 ± 5,31 godina. Svi ispitanici su imali povišen krvni pritisak, 93,38 % imalo je pozitivnu porodičnu istoriju, a 65,31 % bili su pušači. Svim bolesnicima propisana je fizička aktivnost prema preporukama EAS-a i ACC/AHA, a dijeta po preporuci NCEP ATP III.

Nakon šest meseci primene fizičke aktivnosti kod bolesnika sa normalnim vrednostima lipida i bolesnika sa moždanim udarom, zabeležena je značajna redukcija triglicerida od 9,81 %, VLDL-C od 9,91 %, LDL-C od 6,21 % i ukupnog holesterola od 24,2 %. Ne-HDL-C značajno je smanjen za 7,56 % (p < 0,004). Došlo je do značajnog povećanja zaštitnog HDL-C za 17,27 % (pc < 0,003); smanjenja LDL-C/HDL-C odnosa od 20,81 % (pc < 0,003), smanjenja Hol/HDL-C za 17,34 % (p < 0,002) i značajanog pomaka od veoma visokog i visokog rizika za novi koronarni incident do umerenog rizika, korišćenjem koronarnih tablica rizika (p < 0,05).

Fizička aktivnost dovodi do smanjenja vrednosti lipida i aterogenog indeksa kod muškaraca na sekundarnoj prevenciji koronarne bolesti srca. Početni skrining lipida ukazuje na prisustvo dislipidemije kod većine bolesnika koji su smatrani normolipidemičnim, tako da se skrining lipida preporučuje svima na sekundarnoj prevenciji koronarne bolesti srca.

Acta Medica Medianae 2019;58(2):22-26.

**Ključne reči:** fizička aktivnost, koronarna bolest srca, dislipidemija