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ORIGINAL ARTICLE

Effect of Mangosteen (*Garcinia Mangostana* L.) Peel Supplementation on Alkaline Phosphatase Serum in Male Students After Heavy Exercise

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ABSTRACT

Introduction: Physical exercise can increase metabolism in the liver due to the presence of alkaline phosphatase (ALP), which subsequently causes the oxidative stress. In order to reduce this effect, the consumption of natural antioxidant is commonly performed, and one of these antioxidants could be found in mangosteen peel that contains high content of Xanthone and Procyanidin. This study aims to understand the effect of mangosteen peels to alkaline phosphatase serum in male student group who have performed heavy exercises. **Methods:** A true experimental study was carried out with pre- and post-test, and 21 male students were recruited which were divided into two groups. To understand the effect, a control group which was instructed to prescribe placebo was involved, whereas the other group was invited to consume mangosteen peels with dosage of 550 mg as their supplements. Both of the groups were prescribed for two weeks before performing the exercise, in which they were invited to perform treadmill exercise which had 75%-85 of intensity for three times a week. The ALP levels were measured on the final day of treatments after performing the heavy exercise. **Results:** A significant rise of ALP levels were demonstrated by the control group with p value <0.05, in contrast the group who has consumed the mangosteen peel as their supplements had significantly lower ALP levels compared to the placebo group. **Conclusion:** It is concluded that mangosteen peels had the ability in lowering the ALP serum levels in male students who have performed heavy exercise.

Keywords: Mangosteen, Alkaline phosphatase, Heavy exercise

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INTRODUCTION

A physical exercise is defined as the physical activity performed by individual due to certain purposes for adjusting, managing, or improving the condition of body-parts, in which it is regularly performed with structured plans (1). As it is purposively planned and regularly performed, this exercise has been reported to prevent certain physical and mental diseases including hypertension, diabetes, osteoporosis and obesity; depression respectively, as well as cancer (2).

The movements performed in physical exercise increase the oxygen consumption done by the body via the muscle fibers (3). However, at the same time, blood flow and metabolism decrease significantly resulting an increase of liver oxidative stress (4), in which this biological mechanism might have affected the enzyme activities

within the liver. Oxidative stress can be measured by assessing levels of malondialdehyde (MDA), this is because MDA is the result of lipid peroxidation caused by free radicals during physical exercise (5). Several studies have reported that exercise can increase Alanine aminotransferase (ALT), Alkaline phosphatase (ALP) and aspartate aminotransferase (AST) (6,7,8).

In lowering the risk of oxidative stress caused by unbalanced features in the liver system, natural and synthetic antioxidants have been suggested to be consumed (5,9). Natural antioxidants as liver protectors have been investigated; a purple sweet potato can reduce the level of hepatitis index enzymes in serum such as aspartate aminotransferase (AST) and alanine aminotransferase (ALT) (10). The effect of natural antioxidants on several enzyme parameters in the liver has also been studied by using the ethanol extracts of *Ziziphus mauritiana* leaves in reducing the levels of AST, ALT and ALP serum levels by involving rats as the subjects (11). Furthermore, *Tulbaghia violacea* rhizomes can reduce AST, ALT and ALP levels in atherosclerotic mice that suffer from liver damage (12).

A highly antioxidants contents can be found in mangosteen fruit and skins (*Garcinia mangostana* L.). Some studies reveal that the mangosteen peel contains antioxidants of Xanthones and Procyanidin (13,14). Research on the efficacy of mangosteen rind is currently limited to health and rarely developed in the sports field. In the health field, mangosteen rind is effective as anti-cancer, anti-microbial, anti-diabetic and antioxidant (15-18). The skin of the mangosteen fruit is also efficacious as a liver protector (19).

Based on the above background, it is necessary to conduct research to see the effect of supplementation of mangosteen peel extract on ALP serum levels in male students with heavy exercise.

MATERIALS AND METHODS

The sample in this study were 21 male students in the sports faculty at the Universitas Negeri Medan (UNIMED), 19-22 years old and willing to be a sample. Samples must be healthy, not smoking, having a Body Mass Index (BMI) categories normal and not taking other supplements during the study. The samples did not do more physical exercise for 72 hours before the test. The sample in this study gave written informed consent and an explanation of the purpose and procedures of the study. Sample characteristics can be seen in Table I.

This research is an experimental study with a pretest-posttest research design with a control group and has received "Ethical clearance" from the ethical committee of the Faculty of Medicine, Universitas Sumatera Utara (approval number 186/ TGL/ KEPK FK USU-RSUP HAM/ 2019). The study was conducted at the UNIMED Physiology Laboratory, the UNIMED Physical Laboratory and the Integrated Laboratory of the Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia. The sample was divided into 2 treatment groups, the first group was the control group who received an exercise program and a placebo in the form of starch capsules, while the second group received an exercise program and mangosteen rind extract supplements. The exercise program was running on the treadmill with an intensity 75-85%, a duration of 60 minutes and frequency of 3 times a week for 2 weeks. Mangosteen rind extract supplement was given half an hour before doing the exercise as much as 1 capsule @ 550 mg. Before and after treatment, MDA levels were measured using an enzyme-linked immune sorbent assay (ELISA); Human MDA kit (Brand Mybiosource) at a wavelength of 450 nm. IFCC method was performed to measure the ALP serum levels. Afterwards, the serum

levels were analysed statistically via paired T-test and unpaired T-test, in which the $p < 0.05$ is classified as significant results.

RESULTS

This study aimed to observe the effect of supplementation of mangosteen peel extract on ALP serum levels in male students after experiencing heavy exercise. Normality test results show that the normal distribution of data (Table II). From the results of the study, the differences in MDA and ALP levels before and after exercise were obtained and shown in Table III. In detail, the differences in MDA and ALP levels after exercise were described in Table IV.

The average ALP level increased significantly in the control group. In contrast to the control group, the average ALP level decreased significantly in the treatment group. On the other hand, the average posttest of ALP levels of the groups decrease significantly (Fig. 1). Meanwhile, MDA levels increased significantly in the control group and decreased not significantly in the treatment group. The average levels of MDA posttest between the two groups decreased significantly (Fig. 2).

Table I : Characteristics of samples before treatment (mean ± SD)

Parameters	P1 (n=11)	P2 (n=10)
Age (years)	20,64 ± 0,92	20,70 ± 1,05
Height (cm)	169,18 ± 6,21	166,00 ± 2,23
Weight (kg)	65,85 ± 9,32	61,93 ± 5,35
BMI (kg/m ²)	23,00 ± 3,01	22,42 ± 1,58
Resting pulse (beat / min)	65,36 ± 2,69	65,00 ± 3,55

P1= control, P2= treatment

Table II : Normality test for Malondialdehyde (MDA) and Alkaline Phosphatase (ALP)

Parameter	Group	Normality test	
		Statistic	p-value
MDA	Pretest P1	0.972	0.908
	Posttest P1	0.982	0.979
	Pretest P2	0.905	0.214
	Posttest P2	0.930	0.414
ALP	Pretest P1	0.968	0.875
	Posttest P1	0.951	0.664
	Pretest P2	0.933	0.445
	Posttest P2	0.899	0.180

Shapiro-wilk test, P>0,05

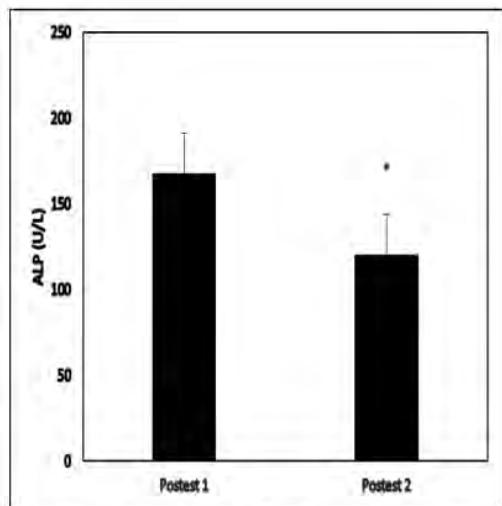


Fig. 1 : Effect of mangosteen rind supplementation on ALP levels. * p < 0,05.

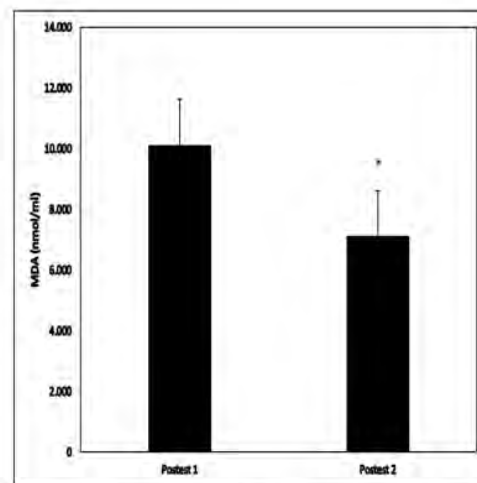


Fig. 2 : Effect of mangosteen rind supplementation on MDA levels. * p < 0,05.

Table III : The differences of Alkaline Phosphatase and Malondialdehyde before and after physical exercise on students

Parameter	Group	Average ± SD	p value
MDA (nmol/l)	Pretest P1	8.918 ± 2.72	0.001*
	Posttest P1	10.118 ± 2.90	
	Pretest P2	8.491 ± 3.65	0.175
	Posttest P2	7.110 ± 3.36	
ALP (U/L)	Pretest P1	110.73 ± 40.00	0.007*
	Posttest P1	167.64 ± 39.01	
	Pretest P2	167.00 ± 76.75	0.031*
	Posttest P2	120.36 ± 51.24	

P1 (Control); P2 (Treatment); * p < 0,05.

Table IV : The differences of Alkaline Phosphatase and Malondialdehyde after physical exercise on students

Parameter	Group		p value
	P1 (Average ± SD)	P2 (Average ± SD)	
MDA Postest (nmol/l)	10.118 ± 2.90	7.110 ± 3.36	0.036*
ALP Postest (U/L)	167.64 ± 39.01	120.36 ± 51.24	0.024*

P1 (Control); P2 (Treatment); * p < 0,05.

DISCUSSION

MDA as a result of lipid peroxidation is an indicator of oxidative stress. Lipid peroxidation occurs as a result of hydroxyl radicals that react with unsaturated fatty acids to form lipid peroxyl radicals. Decreased membrane fluidity, cell swelling, inability to maintain ionic gradients occur in cells due to this lipid peroxidation (20,21). The results of this study indicate heavy physical exercise increases levels of MDA which occur due to the high production of free radicals caused by strenuous physical exercise. Mangosteen rind supplementation in this study lower levels of MDA. Mangosteen rind has bioactive components that act as antioxidants and inhibit H₂O₂-induced ROS (Reactive Oxygen Species) production in cells (22,23). The research results show that groups which only received training experienced an increase in ALP levels, and this result is similarly reported by a study that involved treadmill activities performed by

both male and female students (24). Also, the ALP increased significantly in students who received short-term aerobic exercise (25). In regards of heavy exercise, football activities that have been performed by males for less than 90 days have been contributed to a significant increase of ALP level serums (26). Some explanations for this phenomenon are that physical activity can cause leaking of ALP from mechanically damaged muscle cells and an increase in bone mass. Another explanation is that blood flow increases throughout muscle cells during physical exercise, while blood flow decreases to the liver and portal vein (24). This causes damage to the liver by increasing the leakage of these liver enzymes into the bloodstream. Furthermore, high intensity exercise lead to the changes in liver function and the number of damaged liver parenchyma cells in mice (27).

The supplementation of mangosteen peel extract in this study reduced ALP levels due to exercise using a treadmill. Some extracts from plants have been studied for their effects on several liver enzymes. Seed extract from *Descurainia Sophia* can protect the liver from damage by reducing liver enzyme levels including ALP in experimental animals that receive Paracetamol

at various doses (28). Mangosteen peel extract can reduce the AST and ALT levels in mice that treated with physical activity; this is because the compounds contained mangosteen peel extract work as antioxidants by donating electrons to free radicals (29).

CONCLUSION

Mangosteen peel supplements as antioxidants can affect Alkaline Phosphatase (ALP) levels in male students who get heavy exercise using a treadmill.

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