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The Effect of Zinc Supplementation on *Malondialdehyde* (MDA) Levels in First Year Students of The Faculty of Medicine Universitas Pattimura

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ABSTRACT

An imbalance between free radicals and antioxidants in the body causes a condition called oxidative stress, which can be caused by several factors, one of which is psychological stress. Various studies have shown that medical students tend to experience psychological stress, especially in first year. Psychological stress tends to increase SO conditions due to increased ROS and free radicals in the body. Zinc can reduce ROS and free radicals through several mechanisms. This study aims to determine the effect of zinc supplementation on MDA levels in first year students of the Faculty of Medicine. This study used a true experimental analytic study with pretest-posttest control group design. The sample amounted to 22 people in intervention group and 22 people in control group. This study used TBARS method to measure MDA levels. The results showed a decrease in MDA levels in intervention group (p=0.000), while in the control group there was an increase in MDA levels (p=0.006). In addition, lower MDA levels were found in intervention group compared to control group measured after 10 days (p=0.000). This study concluded that there was an effect of Zinc supplementation on MDA levels in first year students of the Faculty of Medicine, Pattimura University.

KEYWORDS:

Oxidative Stress, Malondialdehyde (MDA), Zinc Supplements

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INTRODUCTION

Free radicals is group atomic molecules that do not stable Because contain electrons that don't pairs in their outermost orbits so that For reach its stability molecule the must look for partner electron from other molecules. The results of this process cause molecules that have taken the electron will become radical new so that form reaction chain. Amount radical free in the body that exceeds capacity antioxidant will cause stress oxidative (SO). Stress oxidative is condition when body experience imbalance between free radicals and antioxidants that can cause damage local consequence radical free to react with fats, proteins and acids nucleic mobile. Damage caused by SO conditions can cause disturbance metabolism body as well as give rise to disease[1,2,3,4]

One of the factors that causes an increase in free radicals is psychological stress which occurs at various age and occupational levels, including students. Various studies show that medical students tend to experience high levels of stress.[5] In general, the proportion of medical students who experience psychological stress before starting their education is the same as the general population, but this proportion increases to 21-56% during their education and doubles in the first year due to the many demands of changes in learning methods so

that they need to adapt. themselves with the learning environment at the faculty.[6,7] This is in line with research at *Zainudin Medical The University* stated that there was a reduction in the stress levels of medical students in the first, second, third and fourth years respectively, namely 73%, 66%, 49% and 47%.[5]

Stress psychological tend can increase condition SO consequence enhancement rate radical free Which happen through track epinephrine, cortisol and activity excessive neutrophils so that form radical hydroxyl ($OH^{\bullet}$) which is toxic that can be cause disturbance health. Healthy students disturbed will give less effect good at the learning process nor his achievements.[5,8]

Lots of substance biology that can made as your pen biological (biomarker) conditions SO, one of the frequent ones used is *malondialdehyde* (MDA).[9] *Malondialdehyde* is results end from resulting lipid peroxidation disconnected chain fatty acids and properties toxic to cell.[10,11] *Malondialdehyde* is used as an initial marker for the occurrence of SO conditions because its constant production is in line with the proportion of lipid peroxidation that occurs, so that if there is an increase in free radicals, it will be followed by an increase in MDA accumulation, or vice versa.[12]

Molecules that can deactivate free radicals before they attack the body are antioxidants.[10] Function antioxidant that is for prevent oxidation or neutralize oxidized compounds with give hydrogen or the electron. Excessive free radicals will stabilized by antioxidants, so protect cells from effect toxic as well as prevent appearance disease.[2,12]

Antioxidant divided become antioxidant enzymatic substances produced by the body like *glutathione peroxidase* (GPx), *catalase* (CAT), and superoxide *dismutase* (SOD), and non-enzymatic antioxidants obtained from food nor supplement such as vitamin C, vitamin E, vitamin D, omega-3, omega-6 fatty acids, flavonoids, anthocyanins, zinc, and others.[13,14]

Zinc including in antioxidant functional exogenous For synthesize proteins as well protect cell from damage consequence condition SO. Zinc is a *trace mineral* that requires little but has many roles for the body.[14,15,16]

The role of zinc as an antioxidant among others, namely zinc is a cofactor for the SOD enzyme and maintains its structural integrity. Zinc also inhibits it happen reaction *Fenton* and *Haber*-Weiss can produce product radical inside body, and so on. Intake lack of zinc cause body experience deficiency zinc can cause increase in fat levels and lipid peroxidation so that happen enhancement rate MDA.[15,17] Study previously conducted by Guo *et al*[18] (2013) obtained exists decline free radicals (ROS and MDA) as well enhancement activity antioxidant enzymatic (SOD and GPx) of giving supplement Zinc for two months.

Based on description above, researcher interested to know the influence from giving zinc supplements against rate *malondialdehyde* (MDA) in first year students of the Faculty Pattimura University of Medicine.

METHOD

This research uses a *true analytical type experimental with a pre-* research design approach *and post test controls groups design*. The research was conducted for 10 days in April-May 2024 in the Clinical Pathology laboratory and Biochemistry laboratory, Faculty of Medicine, Pattimura University and in the Marine Science Laboratory, Faculty of Fisheries, Pattimura University , with research subjects of 44 first year students of the Faculty of Medicine, Universitas Pattimura.

Before being given zinc supplements, *screening is carried out based on* inclusion and exclusion criteria , namely having a normal BMI (18.5-24.9 kg/m2), not consuming alcohol or smoking in the last 1 month, not regularly consuming antioxidants, not suffering from disease. severe or allergic, not undergoing a diet program or food restrictions, and willing to take part in research by signing *the information consent* . Subjects who met the criteria were divided into two groups using a *simple method random sampling*. The intervention group will be given *Zinc* supplements *Sulphates Monohydrate* 20 mg/day, while the control group was not given treatment.

Blood samples were taken by laboratory staff one day before giving zinc supplements. Testing for MDA levels is carried out in the laboratory using the TBARS method

The independent variable in the study was zinc supplementation and the dependent variable was MDA levels. The collected data is entered into a file *Microsoft Office Excel* , then the data will be processed using the SPSS program. Hypothesis testing uses the *Wilcoxon test* and *the Mann - Whitney test*. MDA levels are said to be significant if the *p value* is <0.05.

This research has received ethical recommendations from the Ethics Committee of the Faculty of Medicine, Pattimura University number 013/FK-KOM.ETIK/VIII/2024.

RESULTS AND DISCUSSION

In this study, there were no restrictions on the food consumed or physical activity carried out by the sample. The participating subjects were 6 men (13.6%) and 38 women (86.4%) as shown in Figure 1.

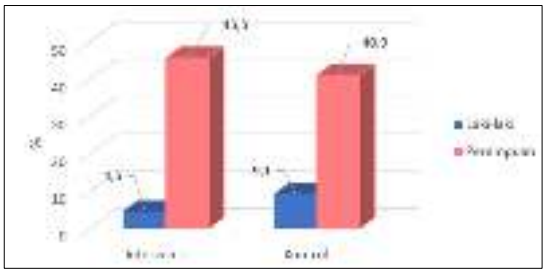

Figure 1. Sample frequency distribution based on gender

From table 1, it was found that in the intervention group there was a significant reduction in plasma MDA levels after giving zinc supplements (p<0.05). Meanwhile, the control group (without treatment)

showed a tendency to increase plasma MDA levels at the end of the study (p<0.05).

Table 1. Results of analysis of initial data and final data on plasma MDA levels in the intervention group and control group

Group		MDA Median	*p*
Intervention	Preliminary data	22.9 nmol/mL	0,000*
	Final data	9.05 nmol/mL	
Control	Preliminary data	21.9 nmol/mL	0.006*
	Final data	22.5 nmol/mL	

* ***Wilcoxon* test**

Table 2 shows that before giving zinc supplements to the intervention group, there was no difference in plasma MDA levels between the two groups (p>0.05), whereas at the end of the study there was a significant difference in plasma MDA levels between the intervention group and the control group (p<0.05). In the intervention group, plasma MDA levels were found to be lower after giving Zinc supplements for 10 days compared to the control group's plasma MDA levels measured at the same time.

Table 2. Results of analysis of differences in initial data and final data on plasma MDA levels between the intervention group and the control group

	Group	MDA Median	*p*
Preliminary data	Intervention	22.9 nmol/mL	0.222*
	Control	21.9 nmol/mL	
Final data	Intervention	9.05 nmol/mL	0,000*
	Control	22.5 nmol/mL	

* ***Mann-Whitney* test**

Zinc is a type of *trace mineral* that is required for the activity of more than 200 enzymes involved in most of the body's main metabolic pathways.[19,20,21] Zinc has several functions as a zinc-*metalloenzyme,* including catalytic, structural and regulatory functions. The catalytic function of zinc is directly related to the work of enzymes. If zinc is removed by chelates or other substances, the enzyme becomes inactive. In structural functions, zinc is needed to stabilize the structure of protein clusters and maintain the integrity of SOD enzyme molecules and cell membranes. Zinc also plays a role in regulating gene expression as a transcription factor and increasing body endurance. Zinc functions to produce antioxidant molecules, namely *metallothionein*, which protects the body from radiation exposure, the effects of anti-cancer drugs and other SO conditions.[14]

This is in line with research conducted by Mazani *et al*[22] (2013) on hemodialysis patients which showed a significant increase (p=0.003) in serum zinc levels, total antioxidant capacity (TAC), glutathione (GSH) and SOD enzyme activity after administration. zinc supplement 100 mg/day for 2 months and there was a decrease in MDA levels after the same period.

One of the reasons for the increase in plasma MDA levels in the control group was the influence of psychological stress. It is known that increasing SO conditions due to increased levels of free radicals through the epinephrine, cortisol and excessive neutrophil activity can be caused by psychological stress which can later disrupt a person's health.

Antioxidants are needed to protect body cells from oxidative damage which can cause disease in the body, one of which is zinc.[2,12] Zinc as an

antioxidant has roles, including competing with Fe and Cu which can produce free radicals from the *Fenton* and *Haber-Weiss reactions*, protecting SH groups and proteins from oxidation, and inhibiting the synthesis of XO and NO.[15]

Another study that shows the role of zinc in SO conditions is research conducted by Kara *et al*[23] (2010) which was conducted on 40 male subjects consisting of 20 athletes and 20 non-athletes. Subjects were divided into 4 groups, namely group 1; athletes given zinc supplements, group 2; athletes without zinc supplementation, group 3; non-athletes who were given zinc supplements, and group 4; people are not athletes without zinc supplementation. Measurements taken at the end of the study showed that groups 1 and 3 (given zinc supplements) had high levels of GSH, GPx and SOD . These results indicate that zinc supplementation can prevent the production of free radicals by activating the antioxidant system.

Zinc supplementation can also control glucose levels, improve lipid metabolism, prevent lipid peroxidation and act as an anti-inflammatory agent.[20] In accordance with the opinion of Himoto *et al*[24] (2007) who stated that zinc supplementation is able to inhibit SO conditions and provide a cytoprotective effect on liver cells by inducing *zinc-metalloenzyme*, one of its functions is as a ROS *scavenger.* yang menyatakan bahwa dengan pemberian suplementasi zink mampu menghambat kondisi SO serta memberikan efek sitoprotektif pada sel hati dengan menginduksi *Zinc-metalloenzyme* yang salah satu fungsinya sebagai *scavenger* ROS.[16] Zinc needs can be obtained from food or with supplements. Providing zinc supplements has little effect on zinc status in individuals whose zinc needs are met through food. If zinc deficiency occurs in the long term, it will be characterized by immune system disorders, impaired wound healing, and will cause an increase in fat levels and lipid peroxidation resulting in an increase in SO conditions in the body.[15,25,26]

CONSLUSIONS AND SUGGESTIONS

Giving zinc supplements of 20 mg /day for 10 days can reduce plasma MDA levels in students. It is hoped that further research will pay more attention to diet, physical activity and other bias factors that can influence MDA levels in samples.

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