# The Effect of Administration of Honey on Maximal Physical Activity in Malondialdehyd (Mda) Levels of Male Mice (*Mus musculus* L.)

Pudia M. Indika[1(✉)], Randi Kurniawan[1], Ridho Bahtra[1], and Elsa Yuniarti[2]

[1] Sport Science Faculty, Universitas Negeri Padang, Padang, Indonesia
pudia_dr@fik.unp.ac.id

[2] Biology Department, Faculty of Mathematics and Natural Sciences, Universitas Negeri Padang, Padang, Indonesia

**Abstract.** Maximum physical activity creates an imbalance between the production of free radicals and the body's antioxidant defense system known as oxidative stress. Maximum physical activity increases the need for oxygen, which leads to an increase in reactive oxygen species (ROS) and free radical products. Thus causing increased levels of malondialdehyde (MDA), this can be overcome by consuming honey which contains antioxidants. The purpose of this study was to determine the effect of honey administration on maximal physical activity of MDA levels in male mice *(Mus musculus* L.). The research used is experimental in vivo laboratory which was selected because both the sample and the treatment are more controlled, and measurable, and the effect of the treatment can be trusted with a Completely Randomized Design (CRD). Mice were then divided into 4 groups, namely K− (negative control), K+ (positive control), P1 (giving 0.5 ml of honey before maximum physical activity), and P2 (giving 1 ml of honey before maximum physical activity) (honey by a dosage of 100 ml) mg/kg BW which was induced with a volume of 0.5 ml and 1 ml. Each group consisted of 7 mice and was subsequently treated. The examination was carried out in the form of MDA levels of male mice using the MDA Kit PP. The maximum physical activity treatment was swimming and giving honey for 7 days which had previously been acclimatized for 7 days. The data were analyzed in one-way variance (One Way ANOVA) followed by a further LSD test with a level of 5%. The results of this study showed that feeding honey was effective ($p < 0.05$) in reducing the amount of malondialdehyde (MDA) levels in male mice by 2.68 nmol/ml. The most effective administration of honey was at the highest dose of P2 (concentration 100 mg, dose 1 mL) with a malondialdehyde 2.87 nmol/ml. This research was conducted as an effort to provide the ideal dose for mice so that the dose of honey used could be converted to human needs as a recommendation for providing honey in the area of physical activity.

**Keywords:** Malondialdehyde · Maximal physical activity · Honey


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## 1 Introduction

Physical activity has both positive and negative impacts. Physical activity that is done properly, true and measurable Physical activity that is regularly, correctly, correctly measured, and performed according to to exercise rules is adapted to the cardiovascular system, thus having a positive effect on physical physiology and enabling optimal functioning of physical function [1].

Physical interest additionally has a bad impact, inflicting an imbalance among reactive oxygen species (ROS) and antioxidants that end in fatigue. Physical activity can also It cause an imbalance between the production of free radicals and the body's own antioxidants called oxidative stress. Maximum Physical activity can increase oxygen consumption in the body by a factor of 20. While the consumption of oxygen by muscle fibers is estimated to increase up to 100-fold. Increased oxygen consumption is what results in an increase in the production of free radicals that can cause cell damage.

Maximum physical activity can cause the appearance of free radicals because the production of endogenous antioxidants in the body is lower. Physical activity, especially heavy physical activity, can increase the production of free radicals in the body. If the body's antioxidants are insufficient to neutralize free radicals, oxidative stress can occur that negatively affect the health and performance of athletes. One way to avoid oxidative stress due to strenuous physical activity is to consume antioxidants [2].

Free radicals are molecules that lose electrons, so they become unstable and always try to take electrons from other molecules or cells. Free radicals in the body can have implications for various diseases of damage to cells, tissues, liver, kidneys, and heart as well as degenerative conditions, such as aging, arthritis, cancer, and others. Free radicals are atoms or molecules with one or more unpaired electrons in their outermost orbit. The presence of unpaired free electrons results in free radicals being highly reactive and unstable. To stabilize themselves, free radicals tend to react with other compounds to gain electron pairs.

The free radical's similar properties to oxidants lie in their tendency to attract electrons. So just like oxidants, free radicals are electron receivers. That is why in medical literature, free radicals are classified in oxidants. Keep in mind, however, that free radicals are oxidants but not every oxidant is a free radical. Free radicals are more dangerous than oxidants that are not radicals [3]. Oxidative stress is an imbalance between free radicals (peroxide) and antioxidants triggered by two common conditions: lack of antioxidants and overproduction of free radicals.

One of the most commonly used biomarkers to measure the degree of oxidative stress is malondialdehyde (MDA), the final result of lipid peroxidation [4]. Increased formation of free radicals in the body begins after 1224 h of physical activity, meaning stops after 4872 h, and returns to normal after 72 h, depending on the intensity and duration of physical activity.

Cancer prophylaxis is a substance that the body needs to neutralize free radicals and predict the damage they can cause. Cancer prophylaxis stabilizes free radicals by satisfying the electron demand for free radicals and interfering with the chain reaction of free radical aggregates that can cause oxidative elongation.

Honey placement is expected to avoid weaknesses and maintain premature execution. [4] After the introduction of cancer prophylaxis with high-intensity physical activity

some time ago, MDA levels decreased to maximum.. Another study conducted by [5] showed an average decrease in MDA levels occurred in accordance with the increase in honey doses.

Based on the explanations found above it is known that physical activity causing endogenous antioxidants can not neutralize free radical levels that will impact the onset of oxidative stress, therefore researchers are interested in researching the effect of administration of honey on maximum physical activity in MDA levels of male mice *Mus musculus* L.

## 2 Literature Review

### 2.1 Malondialdehyde (MDA)

Oxidative starch is a state of imbalance between the body's free radical production and antioxidants, which can lead to compulsory conditions such as maturation, inflammation, cardiovascular disease, neurodegenerative diseases and cancer. The relationship between physical activity and oxidative stress is deeply dependent on its escalation and length [6].

Strenuous exercise will produce excess Reactive Oxygen Species (ROS) thereby lowering antioxidant defenses in the body and the result is oxidative stress [7]. One of the most common biomarkers used to measure the level of oxidative stress is MDA, the final product of lipid peroxidation. [8].

### 2.2 Honey

The World Health Organization (WHO) definition of honey is a natural sweetener made by *Apis mallifera* bees extracted from plants, collected, stored, and dried in a honeycomb [9]. Honey is one of the ingredients that has long been used by people as a source of nutrition for foods, ceremonial ingredients, medicines, and health support [10].

Honey has a fairly complete nutritional content. Honey contains various types of sugar, namely monosaccharides, disaccharides, and trisaccharide. Monosaccharides consist of about 70% glucose and fructose, about 7% disaccharides, namely maltose and sucrose between 1–3%, while trisaccharides are between 1–5%.

Honey also contains many amino acids, vitamins, minerals, acids, enzymes, and fiber. There are 18 types of amino acids in honey. The vitamins in nectar are thiamin, riboflavin, niacin, pantothenic corrosive, folate, vitamins B6, B12, C, A, D, and vitamin K. The chemicals contained in nectar incorporate invertase, amylase or diastase chemicals, glucose oxidase, catalase, and corrosive ph. Honey contains about 15 types of acid so the pH of honey is around 3.9 [11].

Based on the mechanism of preventing the negative impact of oxidants, vitamin C and vitamin E are included in chain-breaking antioxidants Vitamin E as a hydrogen benefactor can change over peroxyl radicals (the result of the lipid peroxidation process) into tocopherol radicals which are less reactive so they are unable to attack fatty acids [12].

The human body has an antioxidant framework to neutralize the reactivity of free radicals that are ceaselessly shaped by the body. When the amount of reactive oxygen

compounds exceeds the number of antioxidants in the body, the excess will attack the components of lipids, proteins and DNA, causing damage called oxidative stress [1].

These antioxidants cannot continuously be fulfilled their needs so that antioxidants from outside are needed through supplements, food or vitamins as exogenous antioxidants. Physical movement as body development created by skeletal muscles and requires vitality [13]. Various physical activities such as walking, running, lifting weights, cycling and various other physical exercises. Physical activity that is carried out until fatigue can eliminate the expected beneficial benefits because it will cause muscle damage as evidenced by an increase in creatine kinase or lactate dehydrogenase.

Endurance is very dependent on oxygen, because the muscles used during sports activities require oxygen intake so as not to quickly experience fatigue [1]. So oxygen is very vital role, not only for breathing but also for supply to muscles when a person is doing sports activities. Physical activity that is not in accordance with sports rules will have a negative impact, especially physical exercise with high intensity and long duration causing oxidative stress. The effect of maximal exercise can increase MDA levels in the blood [2].

The high rate of the digestive system and the need for oxygen supply during intense physical activity lead to integrated free radicals, especially reactive oxygen species (ROS) superoxide radicals, which can damage cells and tissues. Stimulates the release of [14]. Antioxidants need to play the role of antioxidants because they can suppress the oxidative reaction by binding free radicals to highly reactive molecules and preventing cell damage.

Due to the low production of antioxidants in the body, maximum physical activity can cause the appearance of free radicals. Physical activity, especially intense physical activity, can increase free radical production in the body. If the body's own antioxidants are inadequate to neutralize free radicals, oxidative stress can occur, which adversely affects the health and performance of athletes. One way to avoid oxidative stress from strenuous exercise is to take antioxidants. [15].

## 3 Method

The study is an experimental laboratory in vivo with a complete randomized design that uses tested animals. This research was conducted at the Animal Physiology Research facility of the Division of Science FMIPA UNP and the Organic chemistry Research facility of the Staff of Pharmaceutical (FK) Andalas College. The free variable in this ponder is the organization of nectar sometime recently doing greatest physical action whereas the factors bound in this ponder are MDA levels.

The tools used in this study are box-shaped mice cage complete with feed and drink, scales and weighing containers, mice, mice swimming pool, measuring glass, microhematocrit, centrifuge, micropipette, micro tube, centrifuge tube, honey storage bottle, handspun, veterinary surgical device (scalpel, tweezer, surgical guning, needle, candle table), vortex mixer, spectronic (specophometer), micro lab 300, and spuit. The material used is mice, EDTA tubes, honey, aquades, rice husks, squeak feed in the form of pellets and drinking water. The method used to test this is PP Nair.

The study was conducted for 15 days, namely 7 days of adaptation and 7 days of treatment, and 1 day of MDA test examination. Before randomly dividing the entire

sample, weight weighing is done first. Each sample is given a sign to distinguish between one and the other. The sample used in this study was 28 min of males aged 2–3 months with a weight of 20–30 g who were randomly divided into 4 groups, namely the control group (−) that was not given any treatment, the control group (+) which was only given maximum physical activity. The treatment I is the group given honey 0.5 ml and maximum physical activity, while treatment group II is the group given honey 1 ml maximum physical activity. On the last day of treatment, all samples were taken blood to be checked for MDA levels to be carried out in the Biochemical Laboratory of the Faculty of Medicine, Andalas University.

The study was conducted for 15 days, namely 7 days of adaptation and 7 days of treatment, and 1 day of MDA test examination. Before randomly dividing the entire sample, weight weighing is done first. Each sample is given a sign to distinguish between one and the other. The test utilized in this think was 28 min of guys matured 2–3 months with a weight of 20–30 g who were haphazardly partitioned into 4 bunches, specifically the control bunch (−) that was not given any treatment, the control gathers (+) which were as it was given greatest physical movement. At that point treatment, I is the gather given nectar of 0.5 ml and most extreme physical movement, whereas treatment gathers II is the gather given nectar 1 ml greatest physical action. On the final day of treatment, all tests were taken blood to be checked for malondialdehyde (MDA) levels to be carried out within the Biochemical Research facility of the Workforce of Pharmaceutical, Andalas College.

## 4 Research Result

Research on the provision of honey at maximum physical activity to the levels of MDA of male mice (*Mus musculus* L) for 7 days obtained the following results. Before the data analysis test, the data normality test is first conducted using the Shapiro-Wilk normality test because the data is less than 50 samples ($n < 50$). After the normality test, the homogenesis test of the data variant was carried out using the Test of Homogenity of Variances Levene Statistics. Typical and homogeneous information was at that point conducted parametric investigation with the OneWay Anova test and proceeded with the Post Hoc Test utilizing Slightest Noteworthiness Diverse (LSD) with a importance esteem of $p < 0.05$.

The normality and homogeneity test of the amount of malondialdehyde (MDA) data obtained the distribution of normal and homogeneous data in all groups. In the Shapiro-Wilk test of normality, the significance values for each group are all >0.05, Likelihood values (P) are more pronounced than 0.05 ($P > 0.05$), the information is "normally" distributed, and the uniformity of change is four to test that the likelihood ($p > 0.05$) indicates. The test bundle has the same variation or "homogeneous". The measurable values for one-way ANOVA are accompanied by a centrality value of 0.000 ($p < 0 > F$ table shows that the number of nectar concentrations affects the number of MDA male mice.

Then the ANOVA (Post hoc test) using the LSD test at a significance level of 5% is to find out if there is a difference in each treatment, where the same letter shows no real difference. In the K1 group MDA males showed no real disssure to the P1 and P2 groups,

but different from the K2 group. While the K2 group is real different from K1, P1 and P2. In the P1 group is not real different from the K1 and P2 groups, but it is different from K2. Furthermore, P2 is not really different from K1, P1, but different from K2.

Based on the rundown of LSD test comes about, it can be known that there's a discernible distinction in each treatment of honey administration against MDA levels of male mice, the lowest reduction in MDA levels in male mice is found in P2 treatment, namely honey administration with a dose concentration of 100 mg, with a dose of 1 mL.

Greatest physical action can trigger an awkwardness between free radical generation and the body's antioxidant defense framework, known as oxidative push [16]. Strenuous physical movement can increment the event of the method of free radical arrangement, the arrangement of free radicals can increase oxidative stretch within the body [17]. This recommends that greatest physical movement is one of the contributing variables to expanded oxidative push. Strenuous physical movement in people new with physical work out, will result in oxidative harm as well as harm to the muscles.

Expanded utilize of oxygen is basically by contracting muscles, causing an increment in electron spillage from mitochondria that would gotten to be Responsive Oxygen Species (ROS). At the typical time free radicals frame gradually, free radicals shaped 2–5% of the body's oxygen utilization utilized in metabolic forms will ended up free radicals (superoxide particles) [18]. At that point neutralized by cancer prevention agents found within the body. Be that as it may, in the event that the arrangement of free radicals increments by more than 5% since of strenuous and debilitating physical activity will result within the number of free radicals shaped surpassing the capacity of the body's antioxidant defense framework [19]. So that expanded physical movement will increment the generation of free radicals.

Free radicals can be defined as molecules or groups of atoms of atoms with one or more unpaired electrons in the outermost orbit. These atoms or molecules are very unstable and accept electrons from nearby substances or compounds. The uptake of electrons from a substance or other compound by free radicals will result in the substance or other compound being deficient in electrons, and thus becoming a radical substance or compound. Thus, this reaction will continue to chain, until the final product can be removed by the body. The uptake of electrons by free radicals can be referred to as oxidation events. Oxidative push could be a condition of lopsidedness between the production of free radicals and antioxidants within the body so that it'll trigger obsessive conditions. The connect between physical work out and oxidative stretch depends generally on its escalated and term [16].

The results of the study [20] show oxidative stress is one of the factors causing increased levels of malondialdehyde. Numerous ponders appear that intemperate physical action can result in oxidative stretch. One study on the testes of mice renned with high intensity and long duration showed high levels of MDA and conjugated dienes (CD) followed by decreased enzymatic antioxidants such as glutathione (GSH), superoxide dismutase (SOD), catalase, glutathione-s-transferase (GST) and peroxidase.

Based on data obtained the average amount of malondialdehyde in normal mice (K1) that is not treated by 3.22 nmol/ml, whereas positive control (K2) given greatest physical action treatment within the shape of swimming but not given honey has a malondialdehyde amount of 5.55 nmol/ml. From K1 and K2 data there was an increase

in MDA levels of 2.33 nmol/ml. This is in line with research conducted by [11] that there was an increase in the amount of malondialdehyde in the group given maximum activity only (K2).

According [20] physical activity always requires energy obtained from the body's metabolic processes that require oxygen. The more strenuous the physical activity performed; the more oxygen is required for digestion system. Expanded utilize of oxygen leads to an increment in electron spillage from mitochondria that will gotten to be receptive oxygen species (ROS) free radicals that are exceptionally destructive to the body.

Malondialdehyde (MDA) is an aldehyde compound that's the ultimate item of lipid peroxidation within the body, through enzymatic or nonenzymatic forms. Tall concentrations of MDA show the nearness of oxidation forms in cell layers. In arrange to ensure against ROS assaults, the human body has an organized framework of cancer prevention agents, both enzymatic cancer prevention agents and nonenzymatic cancer prevention agents, that work synergistically. Cancer prevention agents secure the body's cells against oxidative harm and can anticipate the generation of oxidative items [21]. An awkwardness between oxidants and cancer prevention agents, i.e., in case ROS generation surpasses antioxidant capacity, it has the potential to cause damage, called oxidative stretch. Among the biomarkers (markers) of oxidative push, the foremost commonly utilized as research facility parameters are lipid peroxide and carbonylated proteins. These markers can be found in blood, urine and other biological fluids that can provide diagnostic value.

Based on the results of the MDA test it can be known that maximum physical activity can increase MDA levels compared to the control group that is only fed and drank. Various ponders have appeared that MDA could be a steady and exact component of lipid peroxidation, and has made a difference clarify the part of oxidative push. The advantages of MDA measurement over other lipid peroxidation products are cheaper methods with easier-to-obtain materials and MDA element in the absence of normal values [22]. So that the control group is very useful as a reference for the normal value of malondialdehyde (MDA) levels.

The average decrease in the amount of malondialdehyde (MDA) levels in male mice after honey administration showed the lowest result in the P2 group of 2.87 nmol/ml with a decrease of 2.68 nmol/ml when compared to K2. After testing One Way ANOVA, it is known that there is an effect of honey on reducing levels of malondialdehyde (MDA) of male mice and it can be concluded that the treatment that can reduce malondialdehyde (MDA) levels significantly is the P2 treatment. But in P1 also experienced a decrease in levels of malondialdehyde (MDA). Decreased levels of malondialdehyde in men's mice after being given honey is caused by catechins as natural antioxidants found in honey that can restrain oxidation reaction by authoritative to free radicals [23]. Catechins are polyphenol compounds that have the potential as antioxidants and antibacterial. These natural antioxidants serve as a defense system in the body to ward off damage to the body's cells caused by free radicals.

Honey contains a variety of essential nutrients, such as indigestible oligosaccharides (NDOs), antioxidants, vitamins and minerals. The dietary substance of nectar that serves as an antioxidant is vitamin C, natural acids, phenolic acids, flavonoids and beta-carotene.

Concurring to [24] flavonoids can moreover be anti-inflammatory and stabilizer responsive oxygen species (ROS). The impacts of flavonoids as cancer prevention agents by implication bolster the anti-inflammatory impacts of flavonoids. The nearness of free radicals can pull in a assortment of fiery go between and flavonoids can stabilize ROS by responding with responsive compounds from radicals so that radicals gotten to be inactivated.

Honey contains many ingredients known to act as antioxidants such as polyphenols, vitamin E, vitamin C, enzymes (catalase, peroxidase, glucose oxidase), phenols, carotenoids (vitamin A) [11]. Honey also contains the minerals selenium and zinc that act as antioxidants. The results of other studies show that honey components, especially flavonoids and phenolic acids, contribute significantly to antioxidant capacity [18].

Various antioxidants contained in honey with their respective mechanisms can reduce the negative impact of free radicals. So that honey can reduce plasma MDA levels which are used as a natural source to ward off free radicals.

Based on the comes about of the LSD test, it was concluded that the treatment that can decrease malondialdehyde (MDA) levels is a treatment in P2 which is 2.87 nmol/ml, because it has a significant effect on the amount of malondialdehyde (MDA). This shows to consume honey with a dose concentration of 100 mg as much as 1 mg/kg BB converted into a dose for humans equivalent to 37.8 g/kg of human body weight it is proven effective to reduce the amount of malondialdehyde (MDA) levels of mice. Due to of the high levels of catechins contained in honey, it is able to make honey have strong antioxidant activity so that it can help the process of flavonoid formation from phenol compounds (natural antioxidants) and make the amount of malondialdehyde (MDA) decrease.

## 5 Conclusion

It can be concluded that the treatment which reduce malondialdehyde (MDA) levels is the treatment in P2 which is 2.87 nmol/ml, because it has a significant effect on the amount of malondialdehyde (MDA). The most effective administration of honey is at the highest dose with a concentration of 100 mg, with a dose volume of 1 mL.

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