International Journal Publishing
INFLUENCE: International Journal of Science Review
Volume 5, No. 1, 2023
https://influence-journal.com/index.php/influence/index

Research Article

Potential of green tea (Camellia sinensis L.) in improving liver function in mice induced by monosodium glutamate (Msg)

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Academic Editor: Nguyen Ngoc Anh

Abstract. This study aims to examine the histological conditions of the liver given green tea in MSG-induced mice and to analyze the potential of green tea (Camelia sinensis L.) in improving liver function in MSG-induced mice. The research was conducted for 30 days with test animals in the form of male mice strain Balb / c. This study used a factorial completely randomized design (CRD). Each treatment consisted of P0 as a control given distilled water 0.5 ml / w / day, P1 given 0.015 g / w / day green tea, P2 which was given MSG 0.84 g / w / day, P3 which was given MSG 0, 84 g / w / hr and 0.015 g / bb / hr green tea. The results showed that the MSG induction dose of 0.084 g / w / hr had an impact on reducing liver weight, increasing ALT levels and hepatocyte diameter. The administration of green tea with a dose of 0.015 g / bb / day in mice induced by MSG and without induction of MSG was able to increase liver weight, decrease ALT levels and hepatocyte diameter. The interaction of MSG and green tea occurs in the diameter of the hepatocytes, so it can be concluded that giving green tea a dose of 0.015 g / w / hr is able to repair damage to hepatocytes caused by MSG induction of 0.084 g / w / day.

Keywords: *green tea, MSG, hepatocytes*

A. INTRODUCTION

Monosodium glutamate (MSG) is a synthetic additive that is widely used by humans as a flavor enhancer in food. The use of MSG continues to increase from year to year (Elpiana, 2011). The use of MSG in optimal amounts can be useful in increasing the transmission of nerve impulses to support coordination and regulatory functions, however, excessive use can have an impact on cytotoxic effects and lead to oxidative stress (Noor and Mourad, 2010).

One of the organs known to be susceptible to oxidative stress due to excessive induction of MSG is the liver (Pavlovic et al. 2007). The research evidence reports that administering MSG 400 mg / bw / day in male rats showed histological changes in the form of necrosis, hemorrhage in hepatocytes, and sinusoid congestion which was marked by an increase in the number of Kupffer cells in the liver. The effect of MSG on the liver was also investigated by Bhattacharya et al. (2011) using mice that were given MSG dose of 2 mg / bw / day for 75 days orally. The results of the study found that there were histological changes in the liver, which included damage to the nucleus of hepatocytes, inflammation, and an increase in hepatocyte diameter.

Various ways have been done in an effort to reduce the risk of decreased organ function caused by free radicals due to MSG induction. Dimitrios (2006) states that giving antioxidants can reduce the production of free radicals in the body. Various kinds of antioxidants include, superoxide dismutase, catalase, glutathione peroxidase, vitamins A, D, E, and C, but the use of these antioxidants is still constrained by limited materials and prices that are not affordable by the public. Referring to these conditions, efforts to deal with oxidative stress can be done using herbal ingredients or medicinal plants. Apart from being easy to obtain, herbal plants are also

believed to contain antioxidants that are relatively safe and have been widely used by the community for generations (Devasagayam et al. 2004). Green tea (Camelia sinensis) is a type of herbal plant originating from China. This plant is widely cultivated in Southeast Asia as raw material for making traditional medicine (herbal medicine). Regular consumption of green tea can improve the defense system and improve organ function. This is because green tea contains high amounts of polyphenols. Research evidence reports that the polyphenol content in green tea leaves is higher than black tea. The percentage of polyphenol content in green tea leaves is 30-40%, while the percentage of polyphenol content in black tea leaves is 3-10% (Zowail et al. 2009). One of the important types of polyphenols are flavonoids. There are various types of flavonoids, such as flavonols, flavones, isoflavone flavonoids, anthocyanins and catechins. As bioactive materials, anthocyanins and catechins function to capture free radicals so they can inhibit damage to cell membranes (Chaturvedula and Prakash, 2011). This mechanism is more effective than vitamins C and E (Heim et al. 2002). Based on the potency and mechanism of green tea leaves, this study was conducted with the hope that giving steeping green tea leaves could potentially improve hepatic function induced by monosodium glutamate.

B. METHOD

This study used a factorial completely randomized design (CRD), consisting of a Po group given 0.5 ml / w / day distilled water, P1 group given MSG 0.84 g / bb / day, group P2 given 0.015 g / day green tea. bb / day, and the P3 group who were given MSG and green tea. The research was started by acclimating male mice to Mus musculus strain for one week. During acclimation, experimental mice were kept in cages individually under homogeneous environmental conditions. Determination of MSG dosage refers to the dose that triggers testicular damage in rats, which is 6 g / bb / day (Eweka and Iniabohs, 2008). The MSG dose in mice was calculated using the mouse to mouse conversion table. The conversion value from rats to mice was 0.14, so the MSG dose for mice was obtained, namely 0.14 x 6 gr = 0.84 gr / w / day. Determination of the dose of steeping green tea leaves in this study refers to the dose given to rats, namely 0.108 gr / body weight / day. The dose of steeping green tea leaves in mice was calculated using the mouse to mouse conversion table. The conversion value from rats to mice is 0.14, so that the dose of green tea leaf brewing for mice is 0.108 x 0.14 = 0.015 g / body weight / day. At the end of the treatment, the mice were anesthetized using ether and followed by taking blood samples from the orbital sinus. Blood samples were inserted into the apendorf and then centrifuged to obtain serum. SGPT determination used the spectrophotometer method at a wavelength of 340 nm. At the end of the treatment, the mice were sacrificed, followed by liver isolation to be fixed in 10% formalin for 4-8 hours. The first step of making histological preparations of the liver, namely dehydration using stratified ethanol (70%, 80%, 95%, and 100%), followed by embedding, and cutting using a microtome with a thickness of 7 µm. The cutting results were then stained using hematoxylin-eosin and observed with a light microscope (Ali, 2007). The hepatocyte measurement procedure uses a light microscope with an ocular lens equipped with a micrometer (40x magnification) with 2x replications. The diameter of the hepatocytes was determined by calculating the average diameter measured by the longest and shortest portion of the hepatocytes (Zeinab et al. 2011). All research data were analyzed using descriptive tests. The data were then analyzed using two-way ANOVA test at the 5% level ($P < 0.05$) to see the real difference between the treatment groups and the interaction of the two factors of the treatment group (Hanafiah, 2012).

C. RESULT AND DISCUSSION

The results of this study indicated that giving green tea was able to increase liver weight in MSG-induced and non-MSG-induced mice. Statistical analysis showed no significant difference (P> 0.05) in liver weight given green tea in both MSG-induced and non-MSG-induced mice. The results of the analysis of liver weight between the treatment and control groups. The evidence of this study shows that administering MSG at a dose of 0.84 g / w / day resulted in a decrease in liver weight. This evidence is in accordance with the study of El-Agouza (2010) which reported that MSG induction of 400 mg / bb / day in mice caused apoptosis or death of hepatocytes which resulted in a decrease in liver weight. The results of this study also proved that the provision of steeping green tea leaves in MSG-induced and non-MSG-induced mice increased liver weight. El-Daly (2011) reported that green tea contains flavonoids which function to protect cell membranes from oxidative stress. Flavonoids play an important role in breaking the chain of free radical reactions and preventing apoptosis or necrosis of hepatocytes, so giving green tea can increase liver weight.

The results of the SGPT level test showed that giving green tea was able to reduce ALT levels in MSG-induced and non-MSG-induced mice. Statistical analysis showed no significant difference (P <0.05) in the levels of SGPT given green tea in mice, both MSG induced and without MSG induction. The results of this study indicate that MSG administration at a dose of 0.84 gr / bb / day resulted in an increase in SGPT levels. The results of this study are consistent with the research of Ibrahim et al. (2011) who reported that the induction of MSG at a dose of 60 mg / bb / day in rats caused necrosis and apoptosis in the liver as indicated by an increase in ALT levels in blood serum. Marwa and Manal (2012) reported that there are two mechanisms of glutamic acid in inducing cell death, namely through excitotoxic and oxidative pathways. The excitotoxic mechanism involves increasing the activation of glutamate receptors, namely N-methyl-D-Aspartate (NMDA) on the cell membrane which triggers an increase in Ca2 + influx, whereas the oxidative pathway is characterized by a decrease in glutathione levels as a result of excessive free radical production. This condition has an impact on mitochondrial damage so that ATP production stops. As a result, caspase activation occurs which induces apoptosis accompanied by the release of the SGPT enzyme into the serum. The apoptosis mechanism begins with the release of cytochrome c in the mitochondria into the cytoplasm, then cytochrome c binds to the apaf-1 cytoplasmic protein. The bond between cytochrome c and apaf-1 causes activation of the caspase protein as apoptotic executor (Madesh and Hajnoczky, 2001).

The results of this study also proved that giving green tea leaf steeping doses of 0.015 g / w / day in mice induced by MSG and without induction of MSG was able to reduce levels. The results of histological observations on the liver showed that giving green tea was able to reduce the diameter of hepatocytes in mice induced by MSG and without induction of MSG. 20 SGPT analysis. The decrease of these two compounds is an indicator of oxidative stress inhibition and improvement of liver function in mice that are induced by MSG excessively. This evidence is in accordance with the results of research by Godwin et al. (2010) who reported that giving green tea a dose of 3 g / w / day was able to reduce ALT levels in rat serum. Other research evidence shows that administration of green tea extract at a dose of 1.5 g / w / day results in a decrease in ALT levels in leflunomide-induced rats (Issabeagloo et al. 2012) Singh et al. (2010) reported that green tea is an herbal plant that contains polyphenols such as catechins, epicatechins, epigallocatekins. The presence of polyphenol antioxidant components is thought to inhibit necrosis and apoptosis through the inactivation mechanism of caspase protein in the cytoplasm, besides that green tea is also able to produce increased levels of endogenous antioxidants, anti-apoptotic protein content, decreased SGPT levels, cytokinins, and ROS production in the liver (Godwin et al. 2010; Akbar et al. 2012). The results of this

study proved that the administration of MSG at a dose of 0.84 g / bb / day resulted in swelling which was marked by an increase in the diameter of the hepatocytes. These results are supported by research by Bhattacharya et al. (2011) who reported that 2 mg / bb / day of MSG induction in mice caused the impact of histological structural changes, such as swelling or degeneration of hepatocytes in the liver. Hepatocyte degeneration begins with an increase in calcium ion influx, interruption of cross-membrane transport, and cell swelling. Excessive induction of MSG can also result in disruption of the balance between antioxidants and oxidants, causing damage to the hepatocyte membrane in the liver (Onyema et al. 2006). Ibrahim et al. (2011) reported that giving green tea a dose of 200 mg / bb / day in mice can prevent degeneration or damage to hepatocytes in the liver. The results of this study proved that giving green tea leaf steeping doses of 0.015 g / w / hr in MSG-induced and non-MSG-induced mice were able to improve hepatic function which was marked by a decrease in hepatocyte diameter. This is because green tea contains flavonoids which play a role in scavenging free radicals. The scavenging activity of flavonoids begins with giving hydrogen or electron groups to free radicals (R •). Giving a hydrogen group to a free radical will produce a flavonoid radical molecule (FlO •) and a stable molecule (RH). Flavonoid radicals (FlO •) have lower reactivity than free radicals (R •). The flavonoid radicals (FlO •) will bind to other radicals to become non-reactive compounds (Sandhar et al. 2011).

D. CONCLUSION

Giving MSG at a dose of 0.084 g / body weight / day had an impact on reducing liver weight, increasing ALT levels and hepatocyte diameter. Giving green tea with a dose of 0.015 g / w / day was able to increase liver weight, decrease ALT levels and hepatocyte diameter. The interaction of MSG and green tea occurred in the diameter of the hepatocytes. This shows that green tea with a dose of 0.015 g / w / day is able to repair damage to hepatocytes due to MSG induction of 0.084 g / w / day.

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