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ORIGINAL ARTICLE:

Mung bean sprout extract suppresses Monosodium Glutamate (MSG) effect on the reproductive hormones (FSH and Estrogen) in female Wistar rats

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ABSTRACT

Objectives: The purpose of this study was to analyze the effects of mung bean sprout extracts on Follicle stimulating hormone (FSH) and estrogen hormone in female Wistar rats (*Rattus norvegicus*) exposed to monosodium glutamate (MSG).

Materials and Methods: This true experimental study was conducted by using post-test only control group design in the laboratory for animal experimentation of Faculty of Veterinary Medicine - Airlangga University in which Wistar rats (*Rattus norvegicus*) aged 2 months weighing 150-200 grams were used in this experiment. The samples comprised of 5 rats distributed in each group, totaling 7 groups. I Control Group (P1) was provided with Aquades for 37 days; II (P2) was provided with Aquades for 7 days + MSG 0.03 mg/g of weight on day 8-37; III (P3) was provided with extract of mung bean sprouts 72mg/200g of weight on day 1-37 + MSG 0.03mg/g of weight; IV (P4) was provided with extract of mung bean sprouts 144mg/200g of weight on day 1-37 + MSG 0.03mg/g of weight; V (P5) was provided with Aquades for 7 days + MSG 0.7 mg/g of weight on day 8-37; VI (P6) was provided with extract of mung bean sprouts 72mg/200g of weight on day 1-37 + MSG 0.7mg/g of weight; VII (P7) was provided with extract of mung bean sprouts 144mg/200g of weight on day 1-37 + MSG 0.7mg/g of weight. Serum samples were taken for Follicle Stimulating Hormone (FSH) and Estrogen with ELISA method. Data analysis to test the differences between groups was done by using one way Anova statistical test.

Results: MSG dosage 0,03mg/gBW or 0,7mg/g BW was significant difference in FSH ($p = 0,011$) and estrogen ($p = 0,008$).

Conclusion: obtained from this research that giving green bean sprout extract influence to the level of FSH and estrogen hormone.

Keywords: mung bean sprout extracts; monosodium glutamate (MSG); FSH; estrogen, female Wistar rats.

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ABSTRAK

Tujuan: menganalisis pengaruh pemberian ekstrak kecambah kacang hijau terhadap kadar FSH dan estrogen pada tikus wiatar betina (*Rattus norvegicus*) yang dipapar monosodium glutamate (MSG).

Bahan dan metode: penelitian ini merupakan penelitian eksperimental murni dengan Post Test Only Control Group Design dilakukan di laboratorium FKH Universitas Airlangga dengan hewan coba *Rattus norvegicus* galur wistar usia 2 bulan berat 150-200 gram. Sampel berjumlah 5 ekor tiap kelompok, terdiri dari 7 kelompok. I Kelompok kontrol (P1) diberi aquadest 37 hari; II (P2) aquades 7 hari+MSG 0,03 mg/gBB hari ke 8-37; III (P3) ekstrak 72mg/200gBB hari 1-37+MSG 0,03mg/gBB; IV (P4) ekstrak 144mg/200gBB hari 1-37+MSG 0,03mg/gBB; V (P5) aquades 7 hari+MSG 0,7 mg/gBB hari ke 8-37; VI (P6) ekstrak 72mg/200gBB hari 1-37+MSG dosis 0,7mg/gBB; VII (P7) ekstrak 144mg/200gBB hari 1-37+MSG 0,7mg/gBB. Sampel serum diambil untuk dilakukan pemeriksaan kadar Follicle Stimulating Hormone (FSH) dan Estrogen dengan metode ELISA. Analisis data untuk menguji perbedaan antar kelompok dilakukan dengan menggunakan uji statistik Anova one way.

Hasil: penelitian menunjukkan pada paparan MSG dosis 0,03mg/gBB maupun 0,7mg/g BB terdapat perbedaan yang signifikan pada kadar FSH ($p = 0,011$) dan hormon estrogen ($p = 0,008$).

Simpulan: pemberian ekstrak kecambah kacang hijau berpengaruh terhadap kadar FSH dan hormon estrogen.

Kata kunci: Ekstrak kecambah kacang hijau; Monosodium Glutamat (MSG); tikus Wistar betina; FSH; hormon estrogen

INTRODUCTION

Infertility is one of reproductive health problems that deserves more attention, both from medical community and the public in general. Not many people know about infertility, its causes and treatment. Apart from causing medical problems, infertility can also cause economic and psychological problems. One risk factor for infertility is an unhealthy lifestyle. The lifestyle of people who are increasingly developing now also affects changes in food consumption patterns. More and more people consume foods that use flavorings, including for household cooking. One popular flavorings is L-glutamic acid compounds used in the form of salt, the monosodium glutamate (MSG).^{1,2,3}

WHO and FAO have recommended MSG as one of the ingredients for food addition that is safe for consumption. MSG can be consumed at most 6 mg/kg of adult human body weight (no more than 2 grams per day). Consumption in excessive doses will have a negative impact on health, including reproductive health. The consumption of MSG in toxic doses will cause increasing level of glutamate in the body. High glutamate level in blood will increase the activity of glutamate receptor (NMDA) which will increase cell metabolism, which in turn produces reactive products, so that Reactive Oxygen Species (ROS) increases. Increased ROS without being compensated with antioxidants will trigger oxidative stress. Oxidative stress arising from excessive levels of glutamate in the blood will trigger cell damage to hypothalamic arcuate nucleus which will affect the pituitary gland to secrete Follicle Stimulating Hormone (FSH) and Luteinizing Hormone (LH). FSH secretion will affect the development of follicles that secrete estrogen.^{3,4}

Mung bean sprout, which is widely consumed, contain vitamin C and vitamin E which act as antioxidants that have been shown to reduce the effects of free radicals due to MSG exposure.^{5,6,7} This study was conducted to

analyze the effect of mung bean sprout extract on FSH levels and estrogen hormone in Wistar rats exposed to MSG.

MATERIALS AND METHODS

This study was a pure experimental study using post test only control group design, conducted in August-September 2017 at the Faculty of Veterinary Medicine, Universitas Airlangga, Surabaya, Indonesia. The experimental animals used were Wistar strain white rats (*Rattus norvegicus*) of 2-month-old weighing 150-200 grams. The sample consisted of 5 individuals per group, which consisted of 7 groups, I control group (P1) receiving distilled water for 37 days; II (P2) 7 days of distilled water + MSG 0.03 mg/gBW for days 8-37; III (P3) extract 72 mg/200 g WB days 1-37 + MSG 0.03 mg/gBW; IV (P4) extract 144 mg/200 g BW days 1-37 + MSG 0.03 mg/g BW; V (P5) distilled water 7 days + MSG 0.7 mg/g BW days to 8-37; VI (P6) extract 72 mg/200 g BW days 1-37 + MSG dose 0.7 mg/g BW; VII (P7) extract 144 mg/200 g BW days 1-37 + MSG 0.7 mg/g BW.

After treatment, when the rats were in estrus period, they were euthanized and the serum was taken for examination of FSH levels and estrogen hormones using the ELISA method. To determine the differences between treatment groups, the data were analyzed by one way Anova statistical test.

RESULTS AND DISCUSSION

In this study the reproductive hormones observed were Follicle Stimulating Hormone (FSH) and the hormone estrogen.

Follicle Stimulating Hormone (FSH)

Table 1. Mean Follicle Stimulating Hormone (FSH) level \pm SD and Kolmogorov-Smirnov normality test results in all groups after the administration of mung bean sprout extract and MSG exposure.

No	Groups	FSH level (pg/ml)	Normality Test
1.	P1 (Control negative)	18.46 \pm 2.12	0.905
2.	P2 (Control positive A : MSG 0.03 mg/gBW)	16.92 \pm 0.66	1.000
3.	P3 (Extract 72mg/200gBW + MSG 0.03mg/gBW)	22.71 \pm 4.41	0.983
4.	P4 (Extract 144mg/200gBW + MSG 0.03mg/gBW)	28.92 \pm 5.41	0.957
5.	P5 (Control positive B : MSG 0.7 mg/gBW)	19.03 \pm 5.07	0.943
6.	P6 (Extract 72mg/200gBW + MSG 0.7mg/gBW)	24.28 \pm 7.62	0.651
7.	P7(Extract 144mg/200gBW + MSG 0.7mg/gBW)	26.71 \pm 4.08	0.935

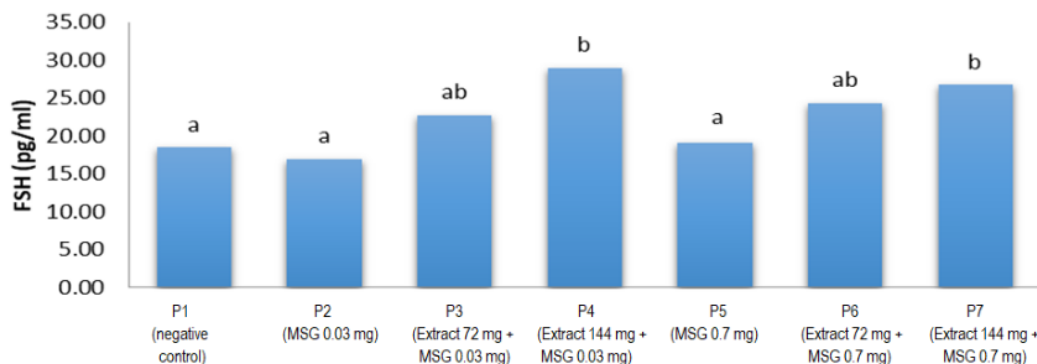


Figure 1. Mean Follicle Stimulating Hormone (FSH) level and the results of Duncan's comparative test in rats after the administration of mung bean sprouts extract and MSG exposure.

Table 2. Mean estrogen \pm SD levels and the results of Kolmogorov-Smirnov normality test in all groups after the administration of mung bean sprouts extract and MSG exposure.

NO	Groups	Estrogen Level (IU/ml) \pm SD	Normality Test
1.	P1 (Control negative)	0.77 \pm 0.16	0.936
2.	P2 (Control positive A : MSG 0.03 mg/gBW)	0.53 \pm 0.02	0.78
3.	P3 (Extract 72mg/200gBW + MSG 0.03mg/gBW)	0.66 \pm 0.11	0.993
4.	P4 (Extract 144mg/200gBW + MSG 0.03mg/gBW)	0.80 \pm 0.17	0.915
5.	P5 (Control positive B : MSG 0.7 mg/gBW)	0.48 \pm 0.05	0.852
6.	P6 (Extract 72mg/200gBW + MSG 0.7mg/gBW)	0.66 \pm 0.11	0.987
7.	P7 (Extract 144mg/200gBW + MSG 0.7mg/gBW)	0.76 \pm 0.14	0.883

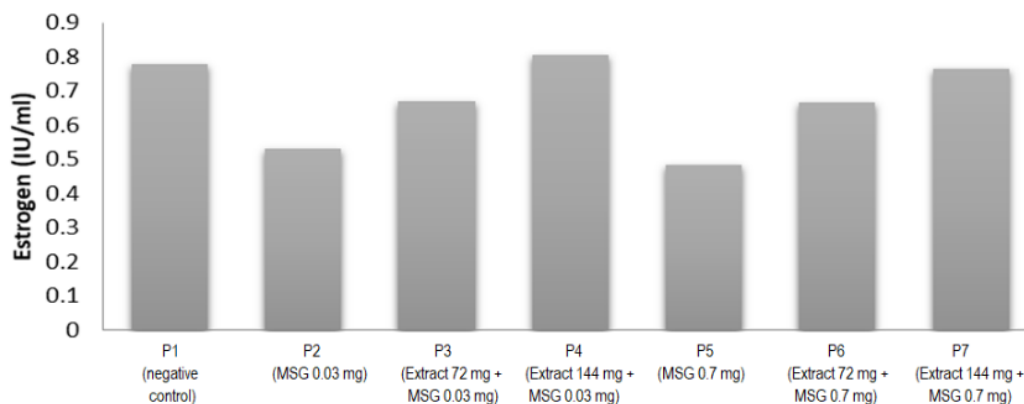


Figure 2. Mean estrogen and the results of comparative Duncan tests in the rats after the administration of mung bean sprouts extract and MSG exposure.

This study found that the administration of mungbean sprout extract, both at MSG exposure at a dose of 0.03 mg/g BW and 0.7 mg/g BW, caused an increase in FSH and estrogen hormone levels in the extracts administered of 72 mg/200 g BW and 144 mg/200 g BW. Vitamin E and vitamin C contained in green bean sprout extract act as antioxidants which suppress the effects of free radicals arising from exposure to MSG. The antioxidant effects of mung bean sprouts inhibit lipid and protein oxidation along with a decrease in deoxyribose damage by binding to metals and free radical activity. Rohmawati's (2014) study found that the administration of Vitamin C and E combination increased FSH levels in rats exposed to MSG through the improvement of oxidative stress. A study shows that vitamin E therapy during the preovulatory period can prevent excessive ROS production and increase multiple births in goats. A study suggests the consumption of some types of nuts because they have good benefits for health and prevent disease.^{8,9}

Vitamin E (α -tocopherol) is a fat soluble vitamin that has antioxidant activity which breaks the chain of oxidative stress reactions. α -tocopherol donates hydrogen ions to peroxidated fatty acids. α -tocopherol and tocotrienol play a major role in antioxidant activity because they react with lipid radicals produced during lipid peroxidation. The reaction produces an α -tocoperoxy radical which can be transformed into an active reduced form that reacts with other antioxidants, such as ascorbate, retinol or ubiquinol.^{10,11}

Vitamin C (ascorbic acid) is known as a redox catalyst which can reduce and neutralize ROS. The reduced form is maintained while reacting with GSH and can be catalyzed by disulfide isomerase and glutaredoxin proteins. Vitamin C has an anti-apoptotic effect on oocyte cell granulosa. Vitamin C supplementation affects oocytes in fighting oxidative damage from hydrogen peroxide and inhibits DNA damage due to increased ROS.^{10,12}

CONCLUSION

The administration of MSG in doses of 0.03 mg/g BW and 0.7 mg/g BW affects FSH levels and the hormone estrogen. The administration of green bean sprout extract in doses of 72 mg/200 g BW and 144 mg/200 g BW affected FSH and estrogen levels due to MSG exposure.

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