

The Effect of Monosodium Glutamate on Estradiol Levels in Pregnant Rats

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ARTICLE INFO

Keywords:
Estradiol
MSG

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ABSTRACT

Monosodium glutamate (MSG) is a form of the glutamic acid salt. The purpose of this study to analyze the effect of MSG on estrogen levels in pregnant rats. This research is an experimental study was conducted at January in the Biomedical Laboratory of the Faculty of Medicine, Andalas University, Padang. Total of samples consist of 18 pregnant Wistar rats which were divided into three groups, namely control, treatment one and treatment two. Blood sampling and surgery were performed on day 20 to assess male estrogen levels. Estrogen levels were measured by using the One Way ANOVA. There were significant differences on serum estrogen levels between the control group and treatment group one ($p = 0.012$) and treatment two ($p < 0.01$) and between treatment group one and treatment group two ($p < 0.001$). The conclusion, there is an effect of MSG on estrogen levels in pregnant rats.

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1. Introduction

Monosodium glutamate (MSG) is a form of glutamic acid salt. Glutamic acid can be found in food products that contain high protein, such as meat, fish, cheese and vegetables (tomatoes, mushrooms, and broccoli).[1] Statistical data in 2007, the average Indonesian people consume MSG as much as 0.65 g / person / day, Japanese people 1.9 g / person / day, American people 1 g / person / day and Canadian people 0.57 g / person / day.[2] Meanwhile in Indonesia there are no specific rules for consuming MSG. [3]

Intense glutamate exposure can result in nerve swelling. [4] Normally, the brain is protected by a blood brain barrier that prevents excess glutamate in the brain. However, there are several some places in the brain that are not protected by the blood brain barrier, including the hypothalamus.[5] Excess glutamate accumulation in the brain will damage the hypothalamic arcuate nucleus which can change the hormonal feedback pattern in pregnant women, where high glutamate can increased secretion of Gamma Amino Butyric Acid (GABA) as a neurotransmitter in the hypothalamus.[6]

The research on rats given MSG 0.2 g / kg for 14 days showed that there was severe damage to the ovaries of rats.[7] MSG can also damage testicular morphology, affecting testosterone levels and sperm count. We recommend to no consume MSG in high doses because it can cause partial infertility in men.[8]

The research on male rabbits found that MSG given to rabbits as much as 1 g / kg for 56 days can decreasing levels of luteinizing hormone (LH), decreasing testosterone but can not cause pathological lesions in the testes.[9] MSG impairs ovarian function by inducing the secretion of LH and follicle stimulating hormone (FSH) from the anterior pituitary and estradiol from ovarian follicles. It is happened because MSG acts as a neurotransmitter.

Monosodium glutamate that given 0.08 mg / kg for 14 days on female rats can cause degenerative and atrophic changes in the fallopian tubes.[10] In other that, MSG given 100 mg / kg for 30 days in rats can cause fibroids in the rats uterus with increasing levels of estradiol.[11] The purpose of this study to analyze the effect of MSG on estrogen levels in pregnant rats and anogenital distance in male rats.

2. Method

This research was conducted in the Biomedical Laboratory of the Faculty of Medicine, Andalas University, Padang. This experimental research was conducted from April 2019 to February 2020. This research has passed the ethical review of the Research Ethics Committee team, Faculty of Medicine, Andalas University, Padang. 18 pregnant Wistar rats weighing 170-190 grams from the animal house of the Faculty of Medicine, Andalas University, Padang. Rats were kept in cages at

temperature 20°C-25°C. The rats were randomly divided into three groups. Control group, treatment group one and treatment group two with 6 rats/group.

The control group was fed pellets and water. The first treatment group was given pellets and MSG 2 mg / g BB / day and the second treatment group was given pellets and 4 mg / g BB / day MSG every 10 am using oral gavage for 19 days. On the 20th day the animals were put to sleep using ketamine 0.15 ml and xylazil 0.25 ml intra-peritoneally. Then 2 ml of blood is drawn through the heart. Blood was put into a vacutainer then centrifuged at 3000 rpm for 15 minutes to separate the serum. Then the serum is placed in a freezer at -20 ° C for testing serum estrogen levels.

This data was analyzed using SPSS-16. The results of estrogen testing were tested using ANOVA and continued with the Bonferoni type post-hoc test. P value <0.05 was considered statistically significant.

3. Result and Analyse

The mean serum estrogen of the treatment group two was higher, 70.23 compared to the control and treatment group one. The control group had a lower mean serum estrogen of 30.32 compared to treatment group one and treatment group two. Based on the One Way ANOVA statistical test, it is known that there is a significant effect of MSG on serum estrogen levels in female rats with p-value <0.005 with p value of 0.001. Based on the results of the Bonferoni type post-hoc test, it can be concluded that there is a significant effect of serum estrogen in the control group with treatment group one and treatment group two because p <0.05.

Estrogen is a natural hormone produced by the ovaries. There are 3 dominant types of estrogen in the body, namely estradiol (estradiol-17 β , E2), estrone (E1), and estriol (E3). Estradiol is the main estrogen produced by the ovaries. Estrone is formed by estradiol. Estriol is produced in large quantities during pregnancy and is a breakdown product of estradiol. Before menopause, estradiol is the body's predominant estrogen, after menopause estrogen levels decrease so that estrone becomes the predominant estrogen [12].

MSG impairs ovarian function by increasing the secretion of LH and FSH from the anterior pituitary and estradiol from ovarian follicles. This happens because MSG acts as a neurotransmitter. The glutamatergic neurons found in the hypothalamus can increase the neurons responsible for the synthesis and release of LHRH and FSHRH which increase the secretion of LH and FSH from the anterior pituitary through a positive feedback mechanism.[13]

The results of this study are in same way with research conducted by Obochi [11] with a sample of 15 Wistar rats weight 170-300 grams. In the group of rats given MSG of 100mg / kgBB orally for 60 days, it was found that MSG could increase estradiol levels in rats.

This is in same way with other studies conducted on 117 female rats with an average weight of 120 grams. The rats were given oral MSG at a dose of 1 mg / gBB, 2 mg / gBB and 4 mg / gBB for 21 days. The results of the study, it was found that there was an increase in serum estrogen in rats given MSG. [14]

4. Conclusion

Conclusion, there is an effect of MSG on serum estrogen levels in pregnant Wistar rats.

Tables

Table 1
Estrogen Serum Between Groups After Treatment

| Group | n | Estrogen Levels (pg / ml) Average | P * |
|-------------|----|--------------------------------------|-------|
| Control | 12 | 31.32 \pm 6.90 | 0.001 |
| Treatment 1 | 12 | 42.50 \pm 7.54 | |
| Treatment 2 | 12 | 70.23 \pm 11.37 | |

Table 2
Significance Level Estrogen Serum Between Groups After Treatment.

| Group | Estrogen Significance Level | | |
|-------------|-----------------------------|-------------|-------------|
| | Control | Treatment 1 | Treatment 2 |
| Control | - | 0.012 * | 0.001 * |
| Treatment 1 | 0.012 * | - | 0.001 * |
| Treatment 2 | 0.001 * | 0.001 * | - |

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