

## The Influence On Bodyweight In Male Mice (*Mus Musculus*) Induced By Monosodium Glutamate (Msg)

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### Abstract

The used of monosodium glutamate (MSG) oftenly found in almost every food that we consumed everyday. It suggested that MSG can increase appetite, can caused intake much foods, and increased the bodyweight. The aim of study is to prove the changes that occur in male mice by induce of MSG.

The experimental study used 24 male mice, 30-45 gram, 12-14 weeks divided into 4 groups, ie group-I (negative control/placebo given aquadest 0.2 cc/20gBW mice); group-II, MSG with the dose of 5 mg/gBW mice); group-III, MSG with the dose of 10 mg/gBW mice and group-IV, MSG with the dose of 20 mg/gBW mice. All of these treatments were administered orally for 14 days. Permanent cervical fracture execution was performed at the end of the study. The body weight measured in pre and post treatment. The significant difference of data between different groups was compared by ANOVA followed by Tukey test. The compared of between pre –post treatment used paired test to analyze the changes of bodyweight

This study proved that the comparison of mean values  $\pm$  SEM of body weight between groups were not significantly different; group I (39,83 $\pm$ 3,26), group II (39,33 $\pm$ 2,04), group III (38,00 $\pm$ 1,39) and group IV (38,33 $\pm$ 1,76) ( $p = 0.930$ ) and the changes of bodyweight pre and post treatment also not significantly different, whereas  $p > 0.05$ .

The study concluded that no changes in the body weight between groups and pasca induced by MSG. In the future studies, we consider to examining the effects MSG with longer of duration and more variations doses in MSG.

### Keywords

Monosodium glutamate, bodyweight, MSG, mice.

### Introduction

Monosodium -L-glutamate is a sodium salt from glutamic acid which is widely used as flavoring ingredients (as flavoring food). The opinions related to the adverse effects of consuming monosodium glutamate (MSG) had we found from few of studies. Much of the adverse effects on human organs because of MSG. Although, it has been known to have bad side effects such as damage to the liver, kidneys, brain, reproductive organs and effect to the body weight. The researcher reported their results, some argue that MSG can increase body weight (Kim et al., 2005), some argue can lose weight (Merrett, 2008), there are even studies that do not find the effect of giving MSG for weight (Tordoff, Aleman and Murphy, 2012). As we all known if the body weight uncontrolled for in alongtime, it can caused various diseases such as dyslipidemia, insulin resistance, diabetes mellitus which can cause complications and even death.

### Monosodium glutamate

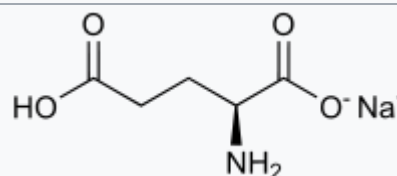


Figure 1. Molecule Structure of Monosodium Glutamate



Body weight is regulated by neural and endocrine components that affect energy input and expenditure. Changes in body weight due to overfeeding or lack of food intake (food deprivation) triggers physiological changes that counteract these two things, for example due to overfeeding, decreased appetite and increased energy expenditure (Longo et al., 2012).

Glutamate provides umami flavor which is the basic taste of sweet, salty, sour and bitter taste (Mallick, 2007). The optimal concentration of monosodium glutamate which can produce delicious effects is 0.2-0.8% and can be used in calorie reduction which can reduce its deliciousness. The maximum dose of MSG that can provide a taste enhancing effect on humans is 60 mg/kgBB.

MSG compounds consist of 78% glutamate, 12% sodium and 10% air. Monosodium glutamate when dissolved in air or saliva will dissociate into free salt and form glutamate anions. Glutamate will open Ca<sup>2+</sup> channels in neurons which are located in the sense of taste which allows Ca<sup>2+</sup> to move into the cell and fill the receptor depolarization and potential actions that lead to the brain as a delicious taste (Iswara & Yonata, 2016).

## Methods

The experimental study used 24 mice, male, 20-40 gram body weight, 10-12 weeks, were divided into 4 groups, ie group-I (negative control/ placebo given aquadest 0.2 cc/mice); group-II, MSG with the dose of 5 mg/gBW mice; group-III, MSG with the dose of 10 mg/gBW mice and group-IV, MSG with the dose of 20 mg/gBW mice. All of the treatment were administered orally for 14 days. Permanent cervical fracture execution was performed at the end of the study. The body weight measured in pre and post treatment.

## Data analysis

The results were analyzed using SPSS and ANOVA followed by Tukey's post hoc to see differences between groups. If the data is not normally distributed, it was analyzed by Kruskal wallis. To see the difference between pre and post in the same group using paired test, if the data is not normally distributed, continue with Wilcoxon.

## Results And Discussion

The effect on bodyweight induced MSG during 14 days treatment, displayed in Table 1

| Body weight male mice |                  |              |              |              |
|-----------------------|------------------|--------------|--------------|--------------|
| No.                   | Groups           | Pre test     | Post test    | *paired test |
| 1                     | Controle/placebo | 37.33 ± 2.53 | 39.83 ± 3.26 | P=0.053      |
| 2                     | 5 mg msg         | 38.00 ± 2.62 | 39.33 ± 2.04 | P=0.191      |
| 3                     | 10 mg msg        | 37.00 ± 1.59 | 38.00 ± 1.39 | P=0.332      |
| 4                     | 20 mg msg        | 38.50 ± 0.76 | 38.33 ± 1.76 | P=0.918      |
|                       | *anova analyze   | P=0.939      | P=0.930      |              |

**Table 1.** Mean of Body Weight on 4 groups male mice (gram)

\*the number of each group n=6

Both of the ANOVA and Paired analysis test were no significantly difference in all treatment groups ( $P \geq 0.05$ ). Therefore it can be reported that there is no difference in mean weight both between groups and differences in each group pre and post induced by MSG.

This study proved that there were no differences in body weight changes before and after treatment, although from the mean pre and post test it seemed to increase, but it was not statistically significantly different ( $p > 0.05$ ). This supports the research conducted by Tordoff, Aleman and Murphy (2012) which states there is no evidence that MSG is influence body weight, energy intake, or body composition. Glutamate and disodium 5'-ininate (IMP) are 2 amino acids that can be relied upon as stimulants for appetite and oral metabolism. Addition of glutamate and IMP to high protein has a significant effect on appetite and has no effect on energy. It can have no impact on body weight.

Penelitian Paramudita (2017) reported there was significantly different between mean of bodyweight mice induced MSG (2 mg/gBB) compare to control group ( $p = 0.005$ ) during 28 days treatment. It maybe cause of addition of glutamate to food increases the quality of umami flavor. The metabolism of the body of glutamate added to food and natural glutamate in food in the same way The limit of MSG metabolism is 30mg / kg / day which means it is enough in 2.5-3.5 grams per day. -70kg. MSG enters the body through digestion. MSG binds to the cell receptor (TRC) in taste. TRC together with chemicals and guidance in the brain. Glutamic acid is produced by several receptors, namely ionotropic (iGluR) and metabotropic (mGluR). Pharmacologically, iGluR is defined as NMDA, AMPA and Kainate receptors. Glutamate receptors are found in the central, oral, pulmonary, intestinal and muscular nervous systems (Mallick, 2007). L-glutamate binds to mGluR4 (metabotropic glutamate receptor). mGluR4 breaks down the L-glutamate bond, then liberates L-glutamate from being sent to the brain and binds to the glutamate receptors in the brain which will be served as umami flavors. In addition, L-glutamate can also continue ionization which can affect certain receptors such as amino acids or other glutamate receptors that induce umami taste (Mallick, 2007). Olney's research in 1969 first reported this association, in which male and female rats experienced weight loss after being given high-dose MSG during the initial life of up to 4 months compared with the control group. Damage to the hypothalamus found on animal study. Researchers thought that regulate fat have more influence on the incidence of obesity, compared to the effects of appetite. Recently, the MSG-obesity hypothesis has provided, for example, MSG consumption can deliver neurons to the arcuate nucleus and highlight signal delivery by leptin, which causes leptin resistance and also obesity (He et al., 2008).

An alternative analysis about MSG and obesity is that MSG may have an effect on guest compliance. Adipin is synthesized and secreted by adipocytes. Decreased provisions of adipin are considered to be related to obesity in experimental animals. Mice given MSG have 50% lower adipine serum and have body fat performance that is greater than the muscle mass of the control group (He et al., 2008).

Kim et al. (2005) reported mice given MSG (4 g/kg subcutaneously) occurred obesity, hypophagia, and decrease thermogenic activity that occurs as a result of sympathetics, which correlates with increase of body weight in this study. Furthermore, MTII (intracerebroventricular melanocortin receptor agonist) was performed intracerebroventricularly for 7 days, which was expected to give leptin effects as in fat mice. There is an anorexigenic and thermogenic effect in the treatment group. Provides MTII and increases MC4R expression, and decreases AGRP expression (Kim et al., 2005). Nagata's study was conducted on mice with 2 mg / g subcutaneous MSG dose. The body weight did not have a significant effect, but there was a significant increase in organ weight (VWAT / visceral white adipose tissue, IBAT / inter-scapular chocolate, aorta, and cerebral adipose tissue) which weighed at week 54 compared to the control group. There are no polyphagia or polydipsia during 6 weeks. This shows that obesity is not expressed by polyphagia (Nagata et al., 2006). The arcuate nucleus is the largest part of the hypothalamus from nerve damage due to MSG exposure.

## Conclusion

Our study demonstrated that there are increasing of body weight on mice male induced by MSG, although in statistical there were no significantly different increasing of the body weight the mice, In future study, we consider to examining the effects MSG with longer of duration and more variations doses in MSG.



we are interested to do new research on different gender (female) or combination in a larger number of mice and more parameters to prove whether there is/not hormonal linkages with weight gain.

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