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Effects of Monosodium Glutamate on the Weight Gain of Experimental Rats

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ABSTRACT

Background: Obesity, as defined by the WHO is an abnormal fat consolidation or excessive fat deposit. Those excessive fat deposits have been known to be the risk factors for cardiovascular diseases. One such additive is known to improve the taste of the food is Monosodium Glutamate (MSG). The purpose of the study is to determine the effects of MSG on weight gain.

Methods: This is a simple experimental design with a pretest-posttest design. The study was conducted in the Animal House laboratories of the Faculty of Mathematics and Natural Sciences Universitas Sumatera Utara between October and November of 2019. The sample in this experiment is male Wistar rats aged 10-11 weeks that will be fed with standard animal feed mixed with MSG. There are 2 groups of rats (each group 16 rats), one group 1 (non-MSG), and group 2 (MSG). The rats were fed with animal feed (ad labium) for 31 days. The feed given every single day will be weighed and documented. The subcutaneous fat was taken from the abdominal and axillary regions.

Result. After 31 days of treatment, re-weighing of both groups of animals was carried out. The initial weight, final weight, total weight gain, total fat extracted and total feed consumed was not different significant (p>0,05).

Conclusion. The feeding of MSG for 31 days, did not have significant effects on weight gain. A longer time is needed for evaluation of MSG effect on weight gain

Keywords. Obesity, MSG, Rat

ABSTRAK

Latar Belakang: *Definisi obesitas oleh WHO adalah konsolidasi lemak abnormal atau deposit lemak yang berlebihan didalam tubuh. Timbunan lemak yang berlebihan dikenal*

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sebagai faktor risiko penyakit kardiovaskular. Salah satu aditif yang dapat meningkatkan rasa makanan adalah Monosodium Glutamat (MSG). Tujuan dari penelitian ini adalah untuk menentukan efek MSG pada penambahan berat badan.

Metode: *Ini adalah penelitian eksperimental sederhana dengan desain prates-posttest. Penelitian ini dilakukan di laboratorium Rumah Hewan Fakultas Matematika dan Ilmu Pengetahuan Alam Universitas Sumatera Utara antara bulan Oktober dan November 2019. Sampel dalam percobaan ini adalah tikus Wistar jantan berusia 10-11 minggu yang diberi makan pakan ternak standar yang dicampur dengan MSG. Ada 2 kelompok tikus (masing-masing kelompok 16 tikus), satu kelompok 1 (non-MSG), dan kelompok 2 (MSG). Tikus diberi makan dengan pakan ternak (ad labitum) selama 31 hari. Pakan yang diberikan setiap hari akan ditimbang dan didokumentasikan. Lemak subkutan diambil dari daerah perut dan aksila.*

Hasil. *Setelah 31 hari perawatan, penimbangan ulang kedua kelompok hewan dilakukan. Berat awal, berat badan akhir, kenaikan berat badan total, total lemak yang diekstraksi dan pakan total yang dikonsumsi tidak berbeda signifikan (p>0,05).*

Kesimpulan*. Pemberian MSG selama 31 hari, tidak memiliki efek yang signifikan pada kenaikan berat badan. Waktu yang lebih lama diperlukan untuk mengevaluasi efek MSG pada penambahan berat badan*

Kata kunci*. Obesitas, MSG, Tikus*

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1 Introduction

Obesity was defined by the WHO as an abnormal or excessive fat accumulation. Obesity is a risk factor for chronic diseases such as diabetes, cardiovascular disease, and an increased risk of cancer.[1] For a time, obesity was not regarded as a problem in developing countries such as Indonesia but it certainly became more concerning when the Department of Health of The Republic of Indonesia released the statistics of the rate of obesity among Indonesian adults have reached 21,8 percent while the WHO's 2016 data indicated that 650 million adults worldwide have obesity.[2] This was caused by the rise of sedentary lifestyles. Obesity itself has been called the Millennium Disease where 300.000.000 adults and 42.000.000 children worldwide and has been the second most common contributor to early deaths worldwide after tobacco use by the International Obesity Task Force.[3] These concerning developments are also due to advancements in nutritional technology, especially addictive substances. These substances not only increased the shelf life or help the food retain its looks but also made them more palatable. One of them is monosodium glutamate (MSG) that gave the taste called umami when applied to a dish. They are usually in crystal form packaged in many brands or trademarks. In recent years, it has become more popular for its effectiveness in making food more palatable. In the nerves,

MSG has properties as an excitotoxin which can damage the brain if consumed without food. The mechanism of the neurotoxin effect of MSG can be traced to an increase in extracellular glutamate levels. MSG also changes the activity and sensitivity of the rat hypothalamus-pituitary-adrenocortical shaft which can also cause neurotoxicity.[4] In the liver, MSG caused the induction of oxidative stress and hepatotoxicity in rats. It was also reported that MSG caused changes in the liver's parenchyma and on the central vein with sinusoid dilatation, inflamed cells, and pyknotic shapes. Moreover, the administration of MSG affected the peripheral hepatocyte in the central lobules of the hepatic tissues that caused hepatocellular degeneration.[4]

To show significant effects, MSG has to be administered in very large bolus doses. For it to be detected in the bloodstream, doses of more than 30 mg/ kg body weight needed to be administered and on adults 150 mg/ kg/bw needed to be administered to observe the rise in plasma glutamate.[5] On rats and mice, the doses that are needed on the rate of lethality on fifty percent of subjects (LD50) is about 15.000–18.000 mg/kg body weight.[5] Nucleotides and MSG have been known to have a synergistic effect even though the way it works can be known. Other studies also concluded that umami peptides interact with bitter taste receptors. Besides that, there were 52 umami peptides found which concluded the interaction of umami peptides with other substances or substances. On the other hand, the umami receptor is a T1R1 or T1R3 heterodimer taste receptor. Other studies suggest research models binding umami receptors with glutamic acid and inorganic acids with fluorosis gilding to detect Ca2 + levels through homologous models and crystal structure analysis.[6]

2 Method

The study was conducted in the Animal House laboratories of the Faculty of Mathematics and Natural Sciences Universitas Sumatera Utara between October and November of 2019. The sample in this experiment is male Wistar rats aged 10-11 weeks that will be fed with standard animal feed mixed with MSG. This experiment was approved by the Health Research Ethical Committee of the Medical Faculty of Universitas Sumatera Utara with the serial number: 203/TGL/KEPK FK USU- RSUP HAM/ 2019.

The sample in this experiment is male Wistar rats aged 10-11 weeks that will be fed with standard animal feed mixed with MSG. There are 2 groups of rats (each group 16 rats), one group 1 (non-MSG) and another group 2 (MSG). The rats were fed with animal feed (ad lubitum) for 31 days. The feed given every single day will be weighed and documented. The subcutaneous fat was taken from the abdominal and axillary regions.

All of the animals will be euthanized using cervical dislocation, subcutaneous fat will be gathered from axilar or abdominal caps. The acquired data from the experiments will be analyzed using the Fisher Exact Test dan T-test.

3 Results

Based on the table, after 31 days of treatment, re-weighing of both groups of animals was carried out. The initial weight, final weight, total weight gain, total fat extracted and total feed consumed was not different significant.

Table 1 Comparison weight gain between Non-MSG group and MSG group Parameter

Parameter		Group 1 (n=16)	Group 2 (n=16)	*P-value*
Total Initial Weight	gr	3.06	3.06	
Average Initial weight	gr	191.25	191125	0.990
Total Final weight	gr	3.08	3.34	
Average Final weight	gr	192.63	208.87	0.053
Total Weight gain	gr	176	294	
Average Weight gain	gr	11	18.38	0.261
Total Fat Extracted	gr	59.93	55.68	
Average Fat mass	gr	2.85	2.65	0.733
Total Feed consumed	gr	8285.63	8107.46	
Average Feed Consumed	gr	520.80 gr	509.64	0.741

4 Discussion

MSG itself works on glutamate receptors which play a vital role in physiological and pathological processes. In a study conducted on the inflammatory profile of MSG-induced obesity, it was shown that MSG provoked the expression of interleukin-6 (IL-6) mRNA and tumor-alpha necrosis factor (TNF-α), as well as resistance and leptin in visceral adipose tissue. This effect can cause an increase in the concentration of resistin, leptin, and insulin in the circulatory system which can end in glucose tolerance. Injection of MSG, however, can cause bradycardia, an increase in mean blood pressure, and a decrease in heartbeat variability.[7]

In another study, no significant increase in body weight, food consumption, and fat accumulation was found. In the same study, weight loss was also found in the treated group of mice. After 4 weeks in the study, also found no significant differences in body weight in the control and treatment groups. At calorie intake and feed, the treatment rats experienced an increase in feed intake in the 9th week and slowly declined after some stagnation.[8] In the same study, subcutaneous fat accumulation in experimental animals was more positively correlated to diet and feed intake and not to additives such as MSG.[8] While in another study of 1282 respondents in China, no significant effect was found by MSG on weight gain or changes in BMI.

MSG has also been found to change fat metabolism in the body in the conduct of several studies. It should also be noted, these studies inject MSG directly into the body of experimental animals. In several studies also found differences in concentrations of free fatty acids and fasting triglycerides, but these studies are doubtful about their usefulness and relationship. Other studies have also found that MSG does not affect visceral fat findings.[9] In 349 Thai subjects, it was found that high consumption of MSG caused the emergence of metabolic syndrome where the findings were independent of factors such as physical activity and daily calorie consumption. In another study, it was found that the oral administration of MSG in pregnant mice, which causes birth weight reduction, indicates that MSG should be avoided as an additive.[10]

In this study, the feeding of MSG did not have significant effects on initial weight, final weight, total weight gain, total fat extracted and total feed consumed. A longer time is needed for the evaluation of MSG's effect on weight gain.

5 Conclusion

The feeding of MSG for 31 days, did not have significant effects on weight gain. A longer time is needed for the evaluation of MSG's effect on weight gain.

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