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THE EFFECT OF USING MONOSODIUM GLUTAMATE (MSG) IN FOOD ON BODY HEALTH

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ABSTRACT

Background: Monosodium glutamate (MSG) is a food additive that is often used as a flavor and aroma enhancer in processed foods. Several studies have shown that consuming high amounts of MSG can affect body health and cause symptoms such as headaches, nausea, vomiting, excessive sweating, and high blood pressure in some sensitive people. In addition, several studies have also found that MSG consumption can increase the risk of obesity, type 2 diabetes, cardiovascular disease, and metabolic disorders. **Objective:** This systematic review aims to determine the effect of using monosodium glutamate (MSG) in food on the health of the body so that readers can make wise decisions in choosing foods that are healthy and safe for consumption. **Method:** Using the PRISMA method, search for journals in electronic databases published on Google Scholar, PubMed, and ScienceDirect that were published from 2013 to 2023. These articles were then extracted, taking into account the titles and abstracts to determine their suitability for the topics discussed. **Results:** Of the 8 selected articles, it shows that monosodium glutamate used in food has a bad influence on body health. Glutamic acid contained in MSG can increase body weight and damage liver and kidney function if consumed above the safe limit, which is 30 mg/kg/day of body weight. When MSG is used every day, it can cause symptoms of headache (85.8 mg/kg), increased insulin (> 143 mg/kg), and increased blood pressure (150 mg/kg). **Conclusion:** Monosodium glutamate (MSG) is an additive commonly used as a flavor enhancer in food. Consuming excessive MSG can increase the risk of various health problems, but the use of MSG in moderate and controlled amounts does not have a negative impact on the health of the body.

Keywords: Monosodium glutamate, food additive, flavor enhancer, body health
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INTRODUCTION

Monosodium glutamate (MSG) is one of the most widely used flavor enhancers and stabilizers in processed foods. MSG comes from L-glutamic acid, a natural amino acid found in various food products. Apart from its flavor-enhancing properties, MSG is also used as a food additive, either in the form of hydrolyzed protein or as pure monosodium salt. MSG is described as the fifth basic taste, which is "umami," besides the four other tastes (sweet, sour, salty, bitter). Examples of natural glutamate in foods such as stews and meat soups These amino acids and glutamic acids are naturally present in food (Kurihara, 2015; Kazmi et al., 2017; Zanfirescu et al., 2019).

In the 1960s, the use of MSG began to spread widely in the household world and began to be added to hydrolyzed protein products such as plant proteins, sodium caseinate, and autolysis yeast. In the last 30 years, with the progressive development of the food industry, the use of MSG has become more and more popular and has been used as a food additive in frozen foods, fertilizers, container tuna, soups, processed meats, dietary supplements, formula milk, salad sauces, some types of cheese and vegetables (Kazmi et al., 2017; Zanfirescu et al., 2019).

Globally, MSG production capacity is mostly concentrated in Asia, as well as the highest consumption in 2018. Specifically, China leads the production and

consumption of MSG in the world, followed by several Southeast Asian countries such as Indonesia, Vietnam, and Thailand. This growth can be seen from rising living standards, culture, and diets, the development of sustainable food processing industries, and an increase in population and urbanization. Ajinomoto is the world's largest producer of sodium glutamate with production locations in Peru, Brazil, Japan, China, and France. Other regions besides Asia account for only a small fraction of MSG consumption. Some developed countries such as Western Europe, the United States, and Canada tend to be more concerned about health, and preference for foods with a clean label is expected to reduce MSG consumption in the region (Asioli et al., 2017).

The safety of MSG is assessed by the international organization (EFSA, FDA) as safe and has defined limits, but there are still studies concerned about its side effects. Some researchers say that consumption of MSG in high doses can lead to neurotoxicity, cardio-toxication, kidney and liver disorders, as well as metabolic disturbances. This systematic review aims to provide a better understanding of the effects of MSG use on the health of the human body. This article is supported by several recent journals published over 2013 and ongoing latest research (Tomé, 2018; Thuy et al., 2020).

METHOD

Search in the database

This study uses a systematic review research method called Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA). The steps used in this study are summarized in Figure 1. In this study, articles were obtained from electronic databases published in Google Scholar, ScienceDirect, and PubMed. The keywords used for this literature search were "monosodium glutamate," effect, food, and body health. The criteria for this study are published articles spanning 2013–2023 in English, articles in full-text form, various types of research articles, and a discussion of the effect of using monosodium glutamate (MSG) in food on body health.

Data Extraction and Discovery Reports

The total article obtained from Google Scholar was 2,420 articles, Pubmed 12 articles, and ScienceDirect 393 articles. Articles published on Google Scholar, PubMed, and Science Direct have been reviewed more than once. After searching for articles, only 424 articles covered the criteria. The filtering continued by paying attention to titles that included the words "monosodium glutamate" and "body health" or that contained the keywords "MSG", "food additive", and "umami taste". After viewing the full article, you can access 56 articles. After reviewing the full article, the final article obtained a total of 16 articles then we read abstracts from a number of those articles to see the suitability to the topics discussed in this systematic review. The final results found 8 articles eligible for use in the systematic review.

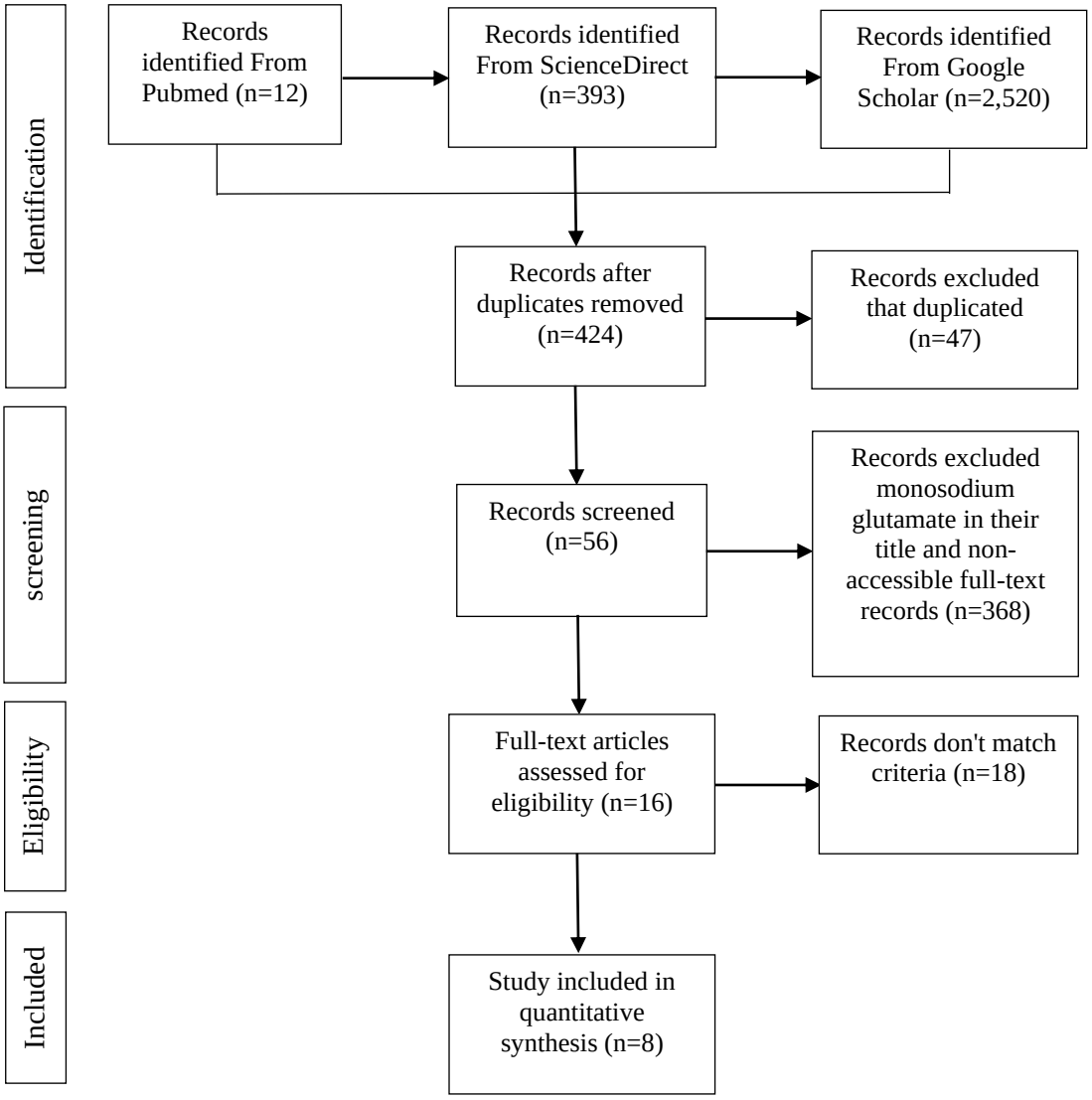

Figure 1. Research Flowchart

RESULTS

Title	Method	Respondents	Research place	Research result	Conclusion
Evidence of the protective effect of l-arginine and vitamin D against monosodium glutamate-induced liver and kidney dysfunction in rats. Eman A. Elbassuoni, Merhan M. Ragy, Sabreen M. Ahmed	Male albino rats were divided into 4 groups (control group, MSG treatment group, MSG + Vit. D treatment group, and MSG + L-arginine treatment group). Each group has 10 rats (n=10)	40 healthy adult male Sprague-Dawley albino rats aged (8-10 weeks) weighing between 140 g and 160 g	Physiology and Human Anatomy Department, Minia University Faculty of Medicine, Minia, Egypt	The MSG-treated group showed significantly higher levels of markers of kidney function (urea and creatinine), and markers of liver function (ALT and AST). After 2 weeks there was a significant increase in food intake and body weight when compared with the initial measurements.	Slightly elevated MSG above safe limits can produce changes in body weight, liver, and kidney function by inducing oxidative liver and kidney damage and should therefore be avoided during the treatment of hepatic or renal disorders.
Effects of a diet containing monosodium glutamate on organ weights, acute blood steroidal sex hormone levels, lipid profile, and erythrocyte antioxidant enzymes activities of rats. Chiedozie Onyejiaka Ibegbulem, Paul Chidoka Chikezie, Agwu Igwe Ukoha, Chinwe Ngozi Opara	Male Wistar rats were divided into 2 groups, each consisting of 6 rats. Mice from the two groups were deprived of food and water for 6 hours before the start of the feeding experiment, which lasted 33 days. At the end of the feeding period, rats from the two groups were deprived of food and water for 12 hours. After that, they were weighed and then sacrificed by cervical dislocation, and their blood samples were taken by heart puncture. Blood samples were measured for plasma estradiol and testosterone concentrations, serum lipid profile (SLP),	12 male Wistar rats aged 90 days with an average weight (of 98.2 + 1.1) g	Department of Biochemistry, Federal University of Technology, Owerri, Nigeria	Wistar rats fed monosodium glutamate (WR-MSG) showed marginal changes in blood estradiol and testosterone concentrations. Elevated serum triacylglycerol concentrations in WR-MSG are associated with 77.7%. Increased serum concentrations of very low-density lipoprotein cholesterol and low-density lipoprotein cholesterol in the WR-MSG were associated with 70.6% and 41.0%, respectively. Erythrocyte peroxidase and catalase activity showed marginal changes. Changes in the ratio of organs to visceral weight are not	Blood testosterone and estradiol concentrations did not change significantly ($P > 0.05$), which may not be related to low doses of MSG in the diet. SLP marginal changes did not show atherogenicity in WR-MSG. The visceral organs did not experience atrophy or hypertrophy due to the relatively low dose of MSG consumed by WR-MSG and the duration of the feeding experiment.

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	erythrocyte peroxidase, and catalase activity. Furthermore, the rats were dissected and the heart, kidney, liver, and spleen were cut to evaluate the weight of the visceral organs.			very large.	
Prolonged exposure to monosodium glutamate in healthy young adults decreases perceived umami taste and diminishes appetite for savory foods. Corinna A Noel, Graham Finlayson, Robin Dando	This study used a parallel group method by consuming vegetable broth for 4 weeks. Broth for the treatment group (n=28) was added with 3.8 g MSG and broth for the control group (n=30) without MSG	58 healthy men (n=16) and women (n=42), excluding those with hypertension or following a low-sodium diet, smokers, allergies to MSG, nuts, or milk, and those classified as restricted eaters (vegan, frequent consumers of Asian food, age <18 years or >55 years, and outside the healthy BMI range of 18.5-25.0)	Cornell University, Ithaca, New York	In Women increased consumption of MSG over 4 weeks reduced umami taste (8.4 units on the Commonly Labeled Magnitude Scale; 95% CI: –13.8, –3.1 units; P=0.013). Desire and intake of savory foods decreased after MSG treatment in both sexes with ad libitum food (craving: –7.7 units; 95% CI: –13.7, –1.7 units; P=0.04; intake: –36 g; 95% CI: – 91.19 g; P=0.04)	Increased food exposure to MSG decreased the umami response (selective in women) and reduced the desire and intake of flavorful foods at meals.
Testicular protective and antioxidant effects of selenium nanoparticles on Monosodium glutamate-induced testicular structure alterations in male mice.	In this study, male rats were divided into 6 groups: the first control group was given 1 ml of DMSO (1%); the 2nd group was treated with a dose of SeNPs (1.7 ppm), the 3rd and 4th groups were treated with low and high doses of MSG (MSG-	42 adult male albino rats weighing 30 g to 35 g	Zoology Department, Faculty of Science, University, Zagazig, Egypt	The results showed an increase in MDA levels in the testicular tissue of the group treated with high doses of MSG. Myeloperoxidase and Xanthine oxidase increased significantly in the group treated with high doses of	MSG in two doses either low dose (LD) or high dose (HD) significantly increases oxidative injury in testicular tissue, which causes impaired testicular histological characteristics. MSG down-regulates antioxidant enzymes

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Reham Z. Hamza, Abd El-Aziz A. Diab	LD) (17.5 mg/Kg) and (MSG-HID) (60 mg/Kg), the 5th and 6th groups were treated with MSG-LD + SeNPs and MSG-HD + SeNPs. Treatment for 30 days			MSG.	and regulates lipid peroxide.
Neonatal treatment with monosodium glutamate lastingly facilitates the spreading of depression in the rat cortex. Cássia Borges Lima, Górgia de Sousa Ferreira Soares, Suênia Marcele Vitor, Bernardo Castellano, Belmira Lara da Silveira Andrade da Costa, Rubem Carlos Araújo Guedes	Wistar rat pups received 2 or 4 g/kg MSG on days 1-14 after giving birth (groups MSG-2 and MSG-4, each; n = 9 in each group), saline (n = 10) or no treatment (naive group; n = 5) every other day. And the measurement of body weight on days 2, 10, and 45-50 after delivery.	Male Wistar rat pup	Universidade Federal de Pernambuco, Brazil	MSG treatment is associated with dose-dependent weight loss at 45-50 days of age. A significant difference ($P<0.05$) in the group given a higher dose of MSG (MSG-4) compared to the control rats	The brains of mice that were given MSG during their development were more susceptible (or less resistant) to cortical spreading depression (CSD) propagation.
Safety assessment of monosodium glutamate based on intestinal function and flora in mice. Jinzhao Xu, Mengqi Tang, Yini Liu, Jinghan Xu, Xiaoxi Xu	Animals adapted for 1 week before any treatment were then randomly divided into 5 groups (n = 12/group): The control group was given purified water by oral gavage; the MSG group was given 30 (L-MSG), 300 (M-MSG), or 1 500 (H-MSG) mg/kg MSG by oral gavage (in turn	4 weeks old male BALB/c rats weighing 17-20 g	Beijing, China	Control rats and mice in the M-MSG group showed normal ileal histological morphology, without edema, inflammatory cell infiltration, and other pathological changes. In mice in the L-MSG group, the ileum showed a healthy histological morphology, but the V/C ratio was	Intake of low doses of MSG is safe and even beneficial to the health of rats, promotes intestinal development, and regulates the structure of the intestinal flora by increasing the abundance of probiotics. In addition, elevated serum biomarkers, impaired gut morphology,

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	corresponding to 0.34, 3.4, or 17 g/day); the NaCl (NC-NaCI) group was given 100 mg/kg NaCl by oral gavage. All treatments were carried out once daily for 5 weeks. The MSG dose was chosen based on the ADI provided by EFSA and daily intake data from the literature; The NaCl dose was calculated according to the sodium ion concentration of 300 mg/kg MSG.			significantly increased. Epithelial cell structures and ileal villi were severely destroyed in the H-MSG group, with a trend towards a significant reduction in the V/C ratio. In addition, compared to the M-MSG group, the NC-NaCl group showed a significantly lower V/C ratio, accompanied by less edema of the villous epithelial cells and inflammatory cell infiltration.	worsened gut inflammation, and altered bacteria suggest that MSG excess may increase the risk of cardiovascular disease and cause gut dysfunction and microbiome disruption in mice.
Effect of monosodium glutamate on serum sex hormones and uterine histology in female rats along with its molecular docking and in-silico toxicity. Mahfoudh AM Abdulghani, Salah Abdulrazak Alshehade, Sareh Kamran, Mohammed Abdullah Alshawsh	Twelve female Sprague Dawley rats were randomly and evenly divided into two groups. The first group served as the control group and was given 10 ml/kg of distilled water and the second group was given daily MSG at a dose (2 g/kg) via oral gavage for 14 days.	12 sexually mature female Sprague Dawley rats (6 animals per group), aged 10-14 weeks and weighing 237 + 34 g	Department of Pharmacology & Toxicology, Unaizah College of Pharmacy, Qassim University, Saudi Arabia	The mean relative level of progesterone in female mice treated with MSG (144 + 11.8 ng/ml) was significantly higher ($p < 0.05$) compared to the control group (100 + 6.05 ng/ml). In contrast, the average relative level of estrogen in the MSG-treated animal group (59.6 + 2.9 pg/ml) was significantly lower ($p < 0.05$) compared to the control group (100 + 2.9 pg/ml). ml). Oral administration of female rats with MSG (2 g/kg) for 14 days showed no significant increase in rat body	Neuronal toxicity may be one of the mechanisms by which MSG affects progesterone and estrogen levels. MSG engages with inflammatory pathways and binding to human estrogen beta receptors play a role in uterine function. Therefore, precautions should be taken when using MSG, especially for women who have a high risk of hormonal disorders.

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				weight compared to the control group. However, the mean food consumption (g/day/rat) showed no difference between the MSG-treated animals and the control group.	
Protective effects of alpha stone on monosodium glutamate-induced uterine hyperplasia in female Wistar rats. Olubukola T. Oyebode, Martin E. Obiekwe, Olufunso O. Olorunsogo	Adult female rats were randomly divided into four groups: A-control, B-MSG (200 mg/kg bb), C-MSG + ASD (100 mg/kgbb), and D-ASD 100 mg/kg body weight	28 adult female mice weighing between 100 g and 120 g	Laboratories for Biomembrane Research and Biotechnology, Department of Biochemistry, Faculty of Basic Medical Sciences, College of Medicine, University of Ibadan, Nigeria	MSG administration for 14 days resulted in a heavy accumulation of collagen connective tissue in the uterine myometrial lining. Alpha stone decoction (ASD) significantly ($p<0.05$) reduced the number of fibroblast cells of animals treated with MSG and also protected against damage caused by MSG which was observed in uterine myometrium and ovaries of animals. A significant increase ($p<0.05$) in total protein content; triglyceride, progesterone, cholesterol, and estrogen in animals given MSG improved after administration of ASD	Administration of MSG increased levels of estrogen (estradiol), progesterone, triglycerides, and total cholesterol in female Wistar rats which led to an increase in myometrial cell proliferation as indicated by an increase in the number of fibroblast cells.

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DISCUSSION

While sweet, salty, and fat content have been studied routinely, umami is the least characterized taste, although it is highly relevant to our diet, food choices, and metabolic health. There is limited research on the perception of umami taste and its relationship to diet, with epidemiological studies investigating taste often lacking in umami assessment. Umami taste is thought to signal the consumption and regulation of protein and amino acids and may be related to weight maintenance, obesity, and satiety. Often described as savory or meaty, umami taste is strongly elicited by the presence of glutamate or glutamic acid. Although glutamate is naturally abundant in many foods, a common and strong umami taste stimulus in the human diet is monosodium glutamate (MSG). Some evidence suggests that the body may not effectively differentiate supplemental MSG from dietary glutamate. Although high-protein foods are naturally high in umami flavor, gustatory and hedonic responses to MSG have also been linked to dietary protein. Monosodium glutamate is naturally found in many types of food such as human milk, cow's milk, apples, almonds, eggs, onions, carrots, potatoes, walnuts, and garlic. It is now added to canned tuna, processed meats, crackers, frozen entrees, soups, salad dressings, cosmetics, formula and canned food supplements, fast food, frozen meals, and potato chips. Monosodium glutamate is still being consumed despite the controversy surrounding its safety Although high-protein foods are naturally high in umami flavor, gustatory, and hedonic responses to MSG have also been linked to dietary protein. Monosodium glutamate is naturally found in many types of food such as human milk, cow's milk, apples, almonds, eggs, onions, carrots, potatoes, walnuts, and garlic. It is now added to canned tuna, processed meats, crackers, frozen entrees, soups, salad dressings, cosmetics, formula and canned food supplements, fast food, frozen meals, and potato chips. Monosodium glutamate is still being consumed despite the controversy surrounding its safety Although high-protein foods are naturally high in umami flavor, gustatory and hedonic responses to MSG have also been linked to dietary protein. Monosodium glutamate is naturally found in many types of food such as human milk, cow's milk, apples, almonds, eggs, onions, carrots, potatoes, walnuts, and garlic. It is now added to canned tuna, processed meats, crackers, frozen entrees, soups, salad dressings, cosmetics, formula and canned food supplements, fast food, frozen meals, and potato chips. Monosodium glutamate is still being consumed despite the controversy surrounding its safety Although high-protein foods are naturally high in umami flavor, gustatory and hedonic responses to MSG have also been linked to dietary protein. Monosodium glutamate is naturally found in many types of food such as human milk, cow's milk, apples, almonds, eggs, onions, carrots, potatoes, walnuts, and garlic. It is now added to canned tuna, processed meats, crackers, frozen entrees, soups, salad dressings, cosmetics, formula and canned food supplements, fast food, frozen meals, and potato chips. Monosodium glutamate is still being consumed despite the controversy surrounding its safety (Fischer et al., 2013; Masic and Yeomans, 2014a; 2017; Kurihara, 2015; Rawal et al., 2015; Henry-Unaeze, 2017; Kazmi et al., 2017).

Vitamin D (Vit D) is one of the fat-soluble vitamins, and most foods, unless they are fortified, are poor sources of Vitamin D. The best-known role of Vitamin D is the maintenance of calcium and phosphorus homeostasis, however, research in recent decades has revealed a broad spectrum of Vitamin D activity that extends even further beyond the regulation of calcium and phosphorus metabolism. Some of these activities include the regulation of cardiovascular and renal function as well as the modulation of the immune response (Cashman et al., 2014).

One of the main elements in the human diet is L-Arginine (L-Arg) or a semi-essential amino acid that is abundant in natural foods such as dairy products. Products, nuts, wheat flour, and seeds. It serves as a precursor for the synthesis of nitric oxide (NO) by NO synthase (NOS)

and subsequently an essential biological compound involved in cellular homeostasis. This may correlate with a variety of physiological benefits reported in animals, including a reduction of the stress response, improvement of immune function, and marked improvement in markers of kidney function (Popolo et al., 2014).

Many studies show that MSG supplementation increases satiety and decreases appetite, food intake, and hunger. Several studies have reported that it does not affect appetite nor significantly affects hunger or macronutrient intake. Several studies have concluded that MSG supplements do not affect appetite. For example, healthy adults have taken 2 g/day of MSG or sodium chloride (NaCl) for 6 days; and on day 7, they consumed the same liquid standard food with MSG or NACI. MSG supplementation was found to have no significant effect on hunger and satiety, body weight, urea concentration, plasma glucose, insulin, GLP-1, and ghrelin levels compared to the NACI supplementation group (Masic and Yeomans, 2014).

The European Food Safety Authority Committee determined that there were no harmful effects in short-term studies of intestinal glutamate absorption, and reproductive, and developmental studies. Moreover, the only observed effect of MSG was an increase in spleen and kidney weight without harmful results. The possibility of MSG-induced side effects has been suggested in experimental animal models, with few data available on MSG-induced damage to different organs such as the liver, brain, and kidney. MSG contains 78% glutamic acid, 22% sodium, and water. It is metabolized in the liver and eliminated via the kidneys (Ugur Calis et al., 2016; Al-Agili, 2020).

WHO states that the daily consumption of MSG per person should not exceed the safe limit of 120 mg/kg/day. In 2017 the European Food Safety Authority determined that the allowed amount of glutamic acid per day is (30 mg/kg) of body weight. The European Food Safety Authority also clarified the amount that when used daily can cause symptoms of headache (85.8 mg/kg), increased insulin (> 143 mg/kg), and increased blood pressure (150 mg/kg). The Food and Drug Administrations state that limited use of MSG is safe and that increased consumption of MSG is associated with several potential side effects such as circulatory, cardiac, muscle, nerve, and gastrointestinal disturbances. Clinical trials on human and animal subjects have also demonstrated various potential health hazards. Extrapolation of animal models results in humans being more demanding and onerous. The use of monosodium glutamate is still considered a controversial source (Kazmi et al., 2017b; Mortensen et al., 2017; Al-Agili, 2020; Farhat et al., 2021; Rachma and Saptawati, 2021).

Administration of MSG in various generations of animals showed the expected pathophysiological signs due to MSG injection not being found in animals that consumed large amounts of MSG orally throughout their life cycle, also reported that MSG injection helped cross the blood-brain barrier and thus confirmed the incidence of MSG toxicity models. Thus, we wanted to provide a realistic assessment of the reproductive toxicity of MSG and also to confirm that MSG crosses the blood-brain barrier and thereby evaluate its adverse effects on reproductive tissues and thus the current MSG route of administration is intraperitoneal. Besides that, Diab and Hamza proved that MSG induces severe oxidative damage in sperm by affecting the sperm plasma membrane and noted a very low percentage of antioxidant enzymes which clarifies the changes that occur in sperm function, motility disorders, and possibly damage. Influence the development of spermatozoa (Diab and Hamza, 2016; Fernstrom, 2018).

Administration of MSG orally (2 g/kg) for 14 days to female SD rats with regular EC resulted in changes in serum levels of progesterone and estrogen without significant changes in uterine morphology. cells after 48 hours of treatment. Neurotoxicity and oxidative stress are the predicted mechanisms of toxicity. Treating female mice with MSG for two weeks altered serum progesterone and estrogen levels, which is comparable to the findings

of previous studies reporting abnormalities in ovarian hormones with increased serum progesterone levels. However, the estrogen levels observed in this study were inconsistent with studies reporting a significant 2-fold increase in serum estrogen levels compared to controls when Wistar rats were treated with MSG 100 mg/kg for 60 days. The effect of MSG on estradiol (estrogen) levels can be due to the long exposure time, which can be attributed to the activation of aromatase, which catalyzes the conversion of testosterone to ÿ-estradiol and aromatization of the A ring of ÿ-estradiol, resulting in increased estradiol synthesis. In addition, rats treated with MSG showed several changes in uterine morphology including lumen area and length of stroma and myometrium compared to controls (Mondal et al., 2018; Agbadua et al., 2020).

In this study, MSG appears to have an effect on oxidative stress on the liver and this was evidenced by a significant increase in hepatic MDA and a significant decrease in hepatic TAC in the MSG-treated group, these results are in agreement with several previous studies. MSG easily dissociates into sodium (Na) and L-glutamate which are transformed into glutamine. Glutamine accumulation in hepatocytes causes their damage, thereby releasing the enzymes ALT and AST by increasing their blood levels. These results are by previous studies, serum transaminase levels are used as an indicator of liver function because this enzyme is located in the cytoplasm and is released into circulation only after hepatocellular damage. Although some reports show that MSG can cause oxidative stress, lipid peroxidation, and other susceptible biomolecules in animal models. According to previous reports, MSG-induced toxicity and oxidative stress were caused by the consumption of relatively high doses and chronic use of MSG in experimental animals. MSG-induced oxidative stress tissue injury has been reported elsewhere. MSG also increases the activity of glutathione S-transferase (GST), catalase (CAT), and superoxide dismutase (SOD), decreases glutathione (GSH) levels, and causes a decrease in antioxidant homeostasis. Likewise, an MSG supplementation dose of 2 g/kg body weight/day for 7 days resulted in a significant reduction in spontaneous locomotor activity, increased lipid peroxidation and Nitric Oxide (NO), and decreased GST and CAT activity, resulting in disruption of oxidative defenses in brain tissue and changes in the histology of hippocampal neurons. MSG at the same dose and at the same time changes behavior and physiology (such as aggression, muscle weakness, and decreased locomotor activity); results in hippocampal loss, significant cerebral edema, neuronal eosinophilia, and decreased brain levels of GSH, SOD, and CAT (Shivasharan et al., 2013; Viswanatha Swamy et al., 2013; Sadek, Abouzed and Nasr, 2015).

CONCLUSION

Monosodium glutamate (MSG) is an additive that is commonly used as a flavor enhancer in food. The use of MSG in food is still a controversial topic. Many researchers argue that excessive MSG consumption can increase the risk of a variety of health problems such as neurotoxicity, cardio-toxication, kidney and liver disorders, as well as metabolic disturbances. But there are also studies that state that consuming MSG in moderate and controlled amounts does not negatively affect the health of the human body.

RECOMMENDATION

The use of monosodium glutamate (MSG) in food has several negative effects, namely disruption of liver and kidney function, cardiovascular, neurotoxicity, as well as metabolic disorders. However, although the use of more natural food additives is considered safer, it is also important to pay attention to the aspects of using such ingredients in the correct quantity and method of processing. Because if used in excessive amounts or inappropriately use, natural food additives can also have a negative impact on the health of the body.

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