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Review Article

Effect of monosodium glutamate on salivary glands: A systematic review

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ABSTRACT:

Aim: To assess the effect of monosodium glutamate on salivary glands. M**ethods:** A review was performed using, PubMed, and Science Direct by using MeSH "monosodium glutamate and salivary gland" According to Prisma guidelines the MeSH terms were altered in each search engine. **Results:** 4 included articles showed the effects of monosodium glutamate acting on the salivary gland by increasing Na ions in saliva and increasing salivary flow. **Conclusion:** Monosodium glutamate is an artificial flavouring agent used in instant and Chinese foods which is widely consumed.MSG shows an increase in salivary flow by increasing ionic concentration and causes systemic disease

Keywords: Monosodium glutamate, salivary gland, umami taste

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INTRODUCTION

It is widely accepted that saliva composition may influence taste sensation in humans. Mixed saliva produced by the major and minor salivary glands dissolves taste substances and provides the chemical environment for the taste receptor. Umami taste is the fifth basic taste in humans. Suggested that this taste category evolved to enhance the detection of certain amino acids (e.g., glutamate, aspartate, and nucleotides) in foods. (MSG) is a prototypic umami substance used as a flavour enhancer and research tool. Mechanisms involved in detecting monosodium glutamate by human taste cells are only partially understood. Similarly, it has not been elucidated whether salivary amino acids might alter reactivity to the umami substances in humans.[1] MSG example of umami gustatory stimuli. However, it has been argued that (MSG) should not be used as a term synonymous with umami taste. The salivary response to monosodium glutamate relative to the other basic tastes has not been established. A dose-response has been reported for increasing concentrations of monosodium glutamate in chicken broth, but the level of response is also affected by the salivary response to the food. However, the salivary reaction to monosodium glutamate may be simply due to the Na+ ion concentration and not be affected by the glutamate ion.[2] Monosodium glutamate (MSG) is a possible precursor of L-glutamic acid. Literature suggests glutamic acid to be a central nervous system excitant. Psychological effects of glutamic acid on animals include:

- Hyperemotionality
- seizures
- hypothalamic brain lesions.[3]

Nowadays, the lifeline of the urban population has been formed by commercial foods due to industrialization and urbanization, the term adulteration refers to adding a compound usually not present in food. These compounds are known as food additives and food adulterants.[4] Monosodium Glutamate (MSG) is one of the most common food additives. Several studies revealed that MSG has a toxic effect on fetus development in children, adolescents and adults. Complication associated with MSG toxicity is

- hypertension
- obesity
- gastrointestinal tract problems
- impairment of the function of the brain, nervous system, reproductive and endocrine approach

The effect of MSG depends upon its dose, route of administration and exposure time. In new high-tech foods such as Japanese, Chinese, and packaged foods,

thousands of chemicals like food additives are recently being used. Most food additives act as preservatives or flavour enhancers. MSG, a food ingredient, was invented in 1908 in Japan by Kikunae Ikeda. Monosodium glutamate is the sodium salt of naturally occurring non-essential amino acids and glutamic acid. MSG contains (78%) glutamic acid (21%) sodium and (1%) contaminants and water. Generally, the natural glutamic acid found in food does not cause problems, but the synthetic glutamic acid produced during industrial processing is a toxin. Monosodium glutamate, also known as sodium glutamate, is the sodium salt of glutamic acid. Monosodium glutamate (MSG) is freely soluble in water but is not hygroscopic. It is insoluble in a common organic solvent. It is generally stable under food-processing conditions. Monosodium glutamate (MSG) does not break down during cooking. Like another amino acid, it will exhibit a Maillard reaction (browning) in the presence of sugar at a very high temperature. At room temperature, Monosodium glutamate ($C_5H_8NNaO_4 \bullet H_2O$) is a salt which typically exists as a white, odourless crystalline powder that is alcohol. It does not have a melting point; it decomposes +overheating when heated at 232ºc. the pH of Monosodium glutamate (MSG) 7.0 (0.2% solution). (FASEB) to examine the safety of Monosodium glutamate in the 1990s.

FASEB report that Monosodium glutamate (MSG) is safe. The FASEB report identified some generally mild symptoms, such as headache, numbness, flushing, and drowsiness, that may occur in sensitive individuals who consume 3 grams of MSG. The United States food and drug administration has declared Mono sodium glutamate safe when used within a limited amount. Monosodium glutamate (MSG) consumption causes headaches, flushing, upset stomach, head and neck weakness, and other discomforts commonly called Chinese restaurant syndrome. Excessive intake of Monosodium glutamate can cause several detrimental effects. A high amount of Monosodium glutamate (MSG) intake produces obesity, inactivity, and hormonal disturbances and kills oligo-dendrocytes, which secrete IL-12 and decrease IL-12 activity, leading to food allergies. However, some individuals who consume Monosodium glutamate may exhibit a hypersensitivity reaction and produce effects like a burning sensation, facial pressure, headache, nausea and chest pain . Monosodium glutamate is unlimitedly found in a wide variety of packaged foods. Monosodium glutamate is also added in unlimited amounts in restaurants and industrial food such as hospitals, retirement homes and cafeterias. According to industrial research, optimally (0.6%) Monosodium glutamate (MSG)is added to food to make people eat progressively more and faster. U.S. Environmental Protection Agency reports have disallowed Monosodium glutamate (MSG) in foods for infants and children. Neurotoxicity is associated with excitatory amino acids encountered in food, such as monosodium glutamate.More recent studies have examined other metabolic and toxic effects of monosodium glutamate (MSG), with a number of the reports showing that showing the induction of oxidative stress in different tissues of experimental animals after administration of chronic doses of Monosodium glutamate (MSG) [4]

OBJECTIVES

To assess the effect of monosodium glutamate on the salivary gland.

MATERIALS AND METHODS

INCLUSION CRITERIA

- Original articles
- Articles on the effect of Monosodium glutamate on Salivary glands

EXCLUSION CRITERIA

- Review articles
- Articles without open access

SEARCH STRATEGY

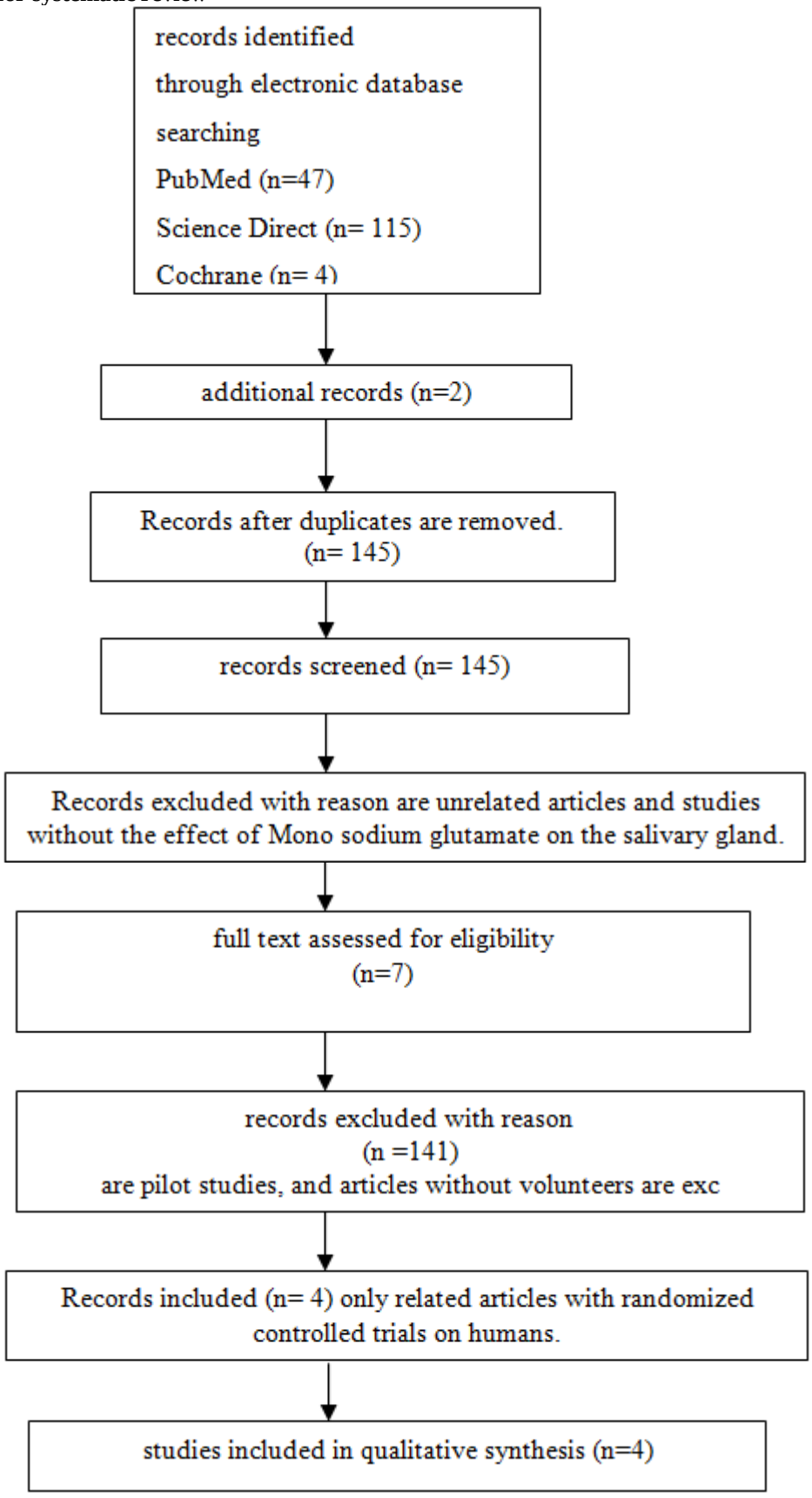
Published literature on the Effect of Monosodium glutamate on salivary glands, including original articles and research papers in databases such as PubMed Central, and ScienceDirect, were reviewed. In addition, a literature search to collect r data was performed using the MeSH terms "monosodium glutamate and salivary glands."

According to Prisma guidelines, the MeSH terms were altered in each search engine when the results were too many or too few.

RESULTS

The search yielded articles, and articles were independently assessed among the eligible pieces; figure I shows a flow diagram of the reports, identified, screened, assessed for eligibility, excluded and included for the review.

Fig1: Flow diagram showing the number of studies of studies identified, screened, assessed for eligibility and included for systematic review



The search yielded 169 articles, and 4 articles were independently assessed among these eligible articles; FIG I shows the flow diagram of reports identified, screened, evaluated for eligibility, excluded and included in the study

Table I: Characteristics of intervention in the study

Author Name	Year	Sample Size	Duration	Interventions
A. SCINSKA-BIENKOWSKA [1]	2006	43	2 Weeks	Test group: monosodium glutamate Control group: de iodized water
N.A.Hodson [2]	2006	8	One week	Test group: monosodium glutamate Control group: placebo
Shizuko Satoh – Kuri Wada [3]	2018	56	Three weeks	Test group: monosodium glutamate Control group: placebo
Subhan Kari Prasad Chakraborty [4]	2018	77	Two weeks	Test group: monosodium glutamate Control group: placebo

The features of the studies that are picked for the systematic review are displayed in Table 1. The following articles were investigated. The author's name, the year of study was conducted the sample size were all provided. The paper that was included were all exclusively oral cavity–based salivary glands. Monosodium glutamate has been used as the test group for assessing the effect of salivary glands.

Table II: Characteristics of outcome and effect measures

Author	Year	Effect Measure	Result
A. SCINSKA-BIENKOWSKA [1]	2006	Excluded subjects had oral, nasal gustatory, xerostomia, and neurological disorder. The whole project is carried out under the declaration of Helsinki of the world medical association	MSG administration has resulted in the adaptation of taste pathway to higher sodium concentration in plasma and food.
N.A.Hodson [2]	2006	All subjects were fit and healthy and were not taking any medicine causing xerostomia. World Medical Association Declaration of Helsinki.	Monosodium administration gives a result in variation in the order of taste Qualities are seen in the experimental Session The volume of the (MSG) samples, may not reflect all aspects of the gustatory responses in real-life conditions.
Shizuko Satoh – Kuri Wada [3]	2018	This study is designed and conducted in complete accordance Self-rating depression scale	MSG administration Induced the salivary reflex in the salivary gland and that salivary flow increased in a dose-dependent manner in response to (MSG).
Subhankari Prasad Chakraborty [4]	2018	Self-evaluation test Subjects were given 100 mg MSG/kg and	MSG directly causes diabetes, triggers epilepsy, obesity destroys eye tissues, and exhibit genotoxic effect in many organs

Table 2 shows the impact measures that the tests are taken to analyze the effects of monosodium glutamate in salivary glands.

Table III: Characteristics of bias in different studies taken for review

AUTHOR'S NAME	RANDOM SEQUENCE	ALLOCATION CONCEALMENT	BLINDING OF OUTCOME	INCOMPLETE OUTCOME	SELECTIVE BIAS
A. SCINSKA-BIENKOWSKA [1]	+	+	+	-	+
N.A.Hodson [2]	+	+	-	+	+
Shizuko Satoh – Kuri Wada[3]	+	+	?	+	+

Subhankari Prasad Chakraborty [4]	+	+	+	+	+

+: Low-risk bias
-: high-risk bias
?: unclear risk of bias

Table 3 shows the bias analysis of the studies included, which were categorized as high risk of bias, low risk of bias, and unclear risk of bias.

DISCUSSION

In this systematic review, four studies have been considered for assessing the effect of monosodium glutamate on salivary glands. Monosodium glutamate-containing foods are taken into consideration. Visual and comparative studies, along with scales such as the self-rating depression scale, were used to assess the salivary gland's Secretion and saliva flow.

A. SCINSKA-BIENKOWSKA (2006) conducted a randomized control trial with 43 subjects. Each subject participated in a test for tasting conducted between 10 a.m. and 2 p.m. in a quiet, well-ventilated room. The Session lasted for 60 minutes and started with a saliva sample collection. The subjects were asked to rinse their mouth thoroughly several times with distilled water. After five minutes, delivery of the MSG samples started. The subject received an additional 1 ml sample of deionized water. MSG preference has resulted in the adaptation of the taste pathway to higher sodium concentrations in foods and plasma[1]

N.A. Hodson (2006) conducted a randomized control trial with 8 subjects. 8 subjects (5 females and 3 males, participated in the study. All subjects have previously taken part in similar experiments and are familiar with the experimental protocol. All experiments were performed under King's College London Ethics Committee approval, and each subject was informed of the purposes and risks of this study and provided. All subjects were fit and healthy and were taking no medications causing xerostomia. All experiments were performed following the standards set in the Declaration of Helsinki.Test stimuli were conducted using a solution of monosodium glutamate (MSG). Some variation in taste qualities across the experimental sessions was present. MSG shows an increased flow of saliva with increasing concentration of the test stimulus (MSG).

Shizuko Satoh – Kurri Wada (2018) In total, 64 participants, MSG was administered in a syringe, and umami tastes produced by (MSG) evoked, Secretion of saliva than did the other flavours, MSG Induces the gustatory and salivary reflex in the salivary gland, and the salivary flow increases dose-dependent in response to umami taste (MSG).

Subhan Kari Prasad Chakraborty (2018) conducted a placebo-controlled study with 77 subjects in a nonblind study, subjects were given 100 mg MSG/kg and SixSubjects reported subjective symptoms. The symptoms were not related to plasma glutamate levels MSG ingestion, but that the classic, it was found that symptoms were felt after the CRS combination between the appearance of symptoms and blood glutamate.

It was found that all materials MSG showed symptoms of burning, tightness or pain in the chest, neck, face or arms, or numbness were reported in two subjects after ingestion of a 2% MSG solution. MSG was found not to be in producing discomfort; MSG directly causes obesity, and diabetes, triggers epilepsy, destroys the eye tissues and has a genotoxic effect on many organs.

CONCLUSION

The study concludes that monosodium glutamate, which is a presentation component that acts as an artificial flavouring agent used in instant foods and Chinese foods, shows an effect on the salivary gland.MSG effects in salivary glands show an increase in salivary production by increasing sodium ions and altering taste pathways and sensation

The normal level of MSG is 0.55 grams per day. When there is increased uptake of monosodium glutamate causes monosodium glutamate toxicity.

MSG directly causes obesity, diabetes, epilepsy (triggering), and destroys eye tissue. Remerging the cons eques of MSG, its application should be avoided and restricted to the forthcoming generation

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