**An-Najah National University**

**Faculty of Agriculture & Veterinary Medicine**

# ***"Monosodium glutamate and its relationship to food safety"***

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## ➢ ABSTRACT

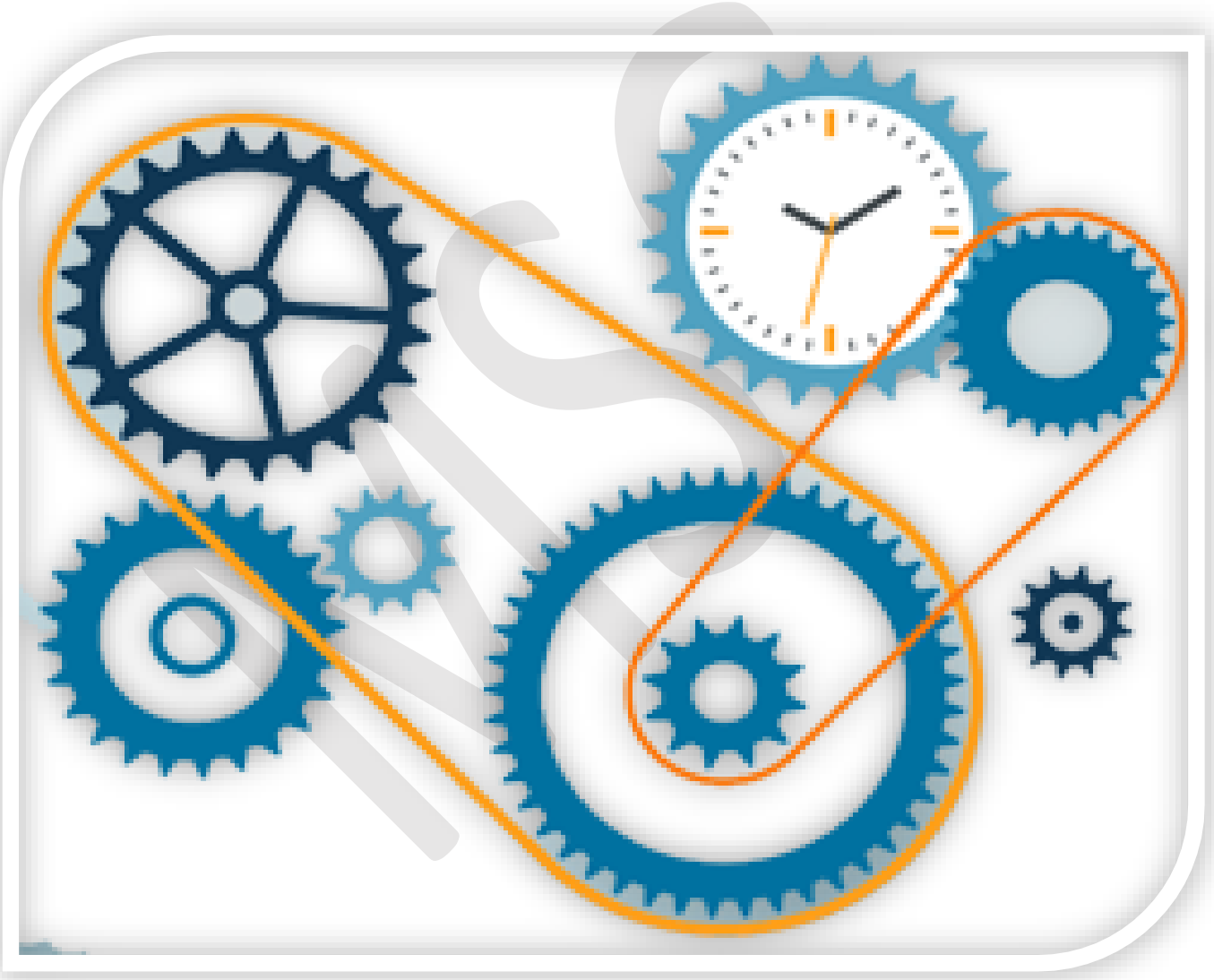
Monosodium glutamate (MSG) is one of several forms of glutamic acid found in foods, in large part because glutamic acid (an amino acid) is pervasive in nature. MSG is used in the food industry as a flavor enhancer with an umami taste that intensifies the meaty, savory flavor of food, as naturally occurring glutamate does in foods such as stews and meat soups. Scientific studies have repeatedly indicated that MSG is safe at ordinary levels of consumption for the general population.

## ➢ الملخص باللغة العربية

الغلوتامات أحادية الصوديوم (MSG) هي واحدة من عدة أشكال من حمض الغلوتامات الموجود في الأطعمة، لأن حمض الغلوتامات (وهو حمض أميني) منتشر في الطبيعة. يستخدم الغلوتامات أحادية الصوديوم في صناعة الأغذية كمحسِّن للنكهة يزيد من نكهة الطعام اللذيذ، كما يحدث في الغلوتامات التي تحدث بشكل طبيعي في الأطعمة مثل شوربات اللحم. وقد أوضحت الدراسات العلمية بشكل متكرر أن الغلوتامات أحادية الصوديوم آمنة في المعتاد لكن ضمن مستويات استهلاك معينة مقارنة بفترة زمنية.

# CHAPTER 1:

# Study Framework



# 1. Study Framework

## 1.1 Introduction:

Glutamate is one of the most common amino acids found in nature. It is the main component of many proteins and peptides, and is present in most tissues. Glutamate is also produced in the body and plays an essential role in human metabolism.[1]

## 2.1 Research problem:

What the negative effect of the MSG substance on the human body?

## 3.1 Objectives of the study:

- Understand the difference between natural and manufactured glutamate
- Acknowledge the potential relationship between MSG & appetite
- Learn the effects of MSG during pregnancy & in offspring
- Know how much MSG is consumed & where it is hidden

## 4.1 Methodology of the study:

The research includes displaying the practical study design by using descriptive analytical approach in collecting data through questionnaire

[1] https://www.foodinsight.org/Content/76/Glutamate-and-Monosodium-Glutamate.pdf

## 5.1 Research Tools:

1. Computer software, include Microsoft word, SPSS.

2. Questionnaire.

3. Internet.

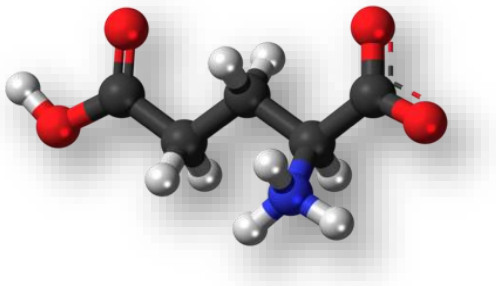
## 6.1 Data sources:

a. Primary resources: reports and questionnaires.

b. Secondary resources: journals and internet.

# CHAPTER 2:

## 2. Definition, Effects of monosodium glutamate

## 1.2 Definition of MSG:

Monosodium glutamate (MSG) is the sodium salt of the non-essential amino acid glutamic acid. Glutamic acid is one of the most abundant amino acids found in nature and exists as both free glutamate and bound with other amino acids into protein.

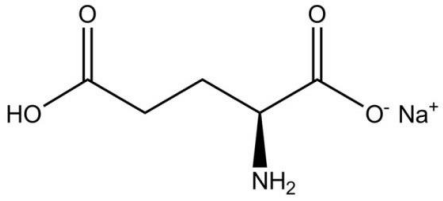
Animal proteins may contain about 11 to 22% by weight of glutamic acid, with plant proteins containing as much as 40% glutamate (Giacometti 1979). Glutamate is thus found in a wide variety of foods, and in its free form, where it has been shown to have a flavour enhancing effect, is also present in relatively high concentrations is some foods such as tomatoes, mushrooms, peas and certain cheeses.

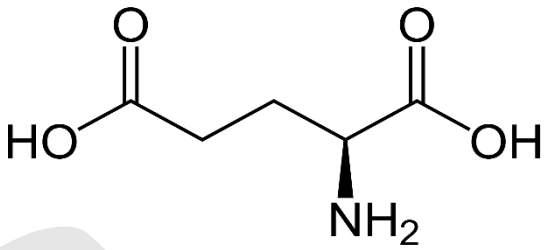
As a result of its flavour enhancing effects, glutamate is often deliberately added to foods – either as the purified monosodium salt (MSG) or as a component of a mix of amino acids and small peptides resulting from the acid or enzymatic hydrolysis of proteins (e.g. Hydrolysed vegetable protein or HVP).

Other substances, such as sodium Caseinate and "Natural Flavourings" are also added to many Savoury foods and these can contain considerable amounts of free glutamate.[2]

[2] MONOSODIUM GLUTAMATE
A Safety Assessment

## 2.2 Chemical structure of MSG:




Glutamate and Monosodium Glutamate Monosodium Glutamate and Glutamate are the monosodium salt of the glutamic acid. However, the totally dissociated form of L- (+)-glutamic acid merely exhibits the umami effect. The percentage of dissociation at various pH values are shown in the Table 02 and the pH dependent ionic forms of the glutamic acid. It is apparent from the data in table that only at pH 6 to 8 does glutamic acid show its optimal umami effect.[3]

## 3.2 Production of Monosodium glutamate

Manufacturers obtain Monosodium glutamate through a process involving fermentation of carbohydrates with a nitrogen source. For this to happen, manufacturers use certain species of bacteria or yeast such as microbacterium, brevibacterium, corynebacterium, arthrobacter and micrococcus. Originally, manufactures prepared Monosodium glutamate from wheat gluten that has approximately 25 percent glutamic acid. Then, manufacturers started preparing Monosodium glutamate from acrylonitrile and today, fermentation is the method of choice for manufacturing Monosodium glutamate[4].

[3] Uses, effects and properties of monosodium glutamate (MSG) on food & nutrition
[4] https://www.livestrong.com/article/495019-monosodium-glutamate-benefits/

## 4.2 Sources of MSG:

Glutamate occurs naturally in virtually all foods, including meat, fish, poultry, breast milk and vegetables, with vegetables tending to contain proportionally higher levels of free glutamate. Various processed and prepared foods, such as traditional seasonings, sauces and certain restaurant foods can also contain significant levels of free glutamate, both from natural sources and from added MSG.[5]

The typical glutamate content of various foods is given in Table 1.

Table 1: Natually occurring glutamate in various foods ,

| Food | Bound glutamate (mg/100g) | Free glutamate (mg/100g) |
|---|---|---|
| Milk/dairy products: Cow's milk | 819 | 2 |
| Human milk | 229 | 22 |
| Parmesan cheese | 9847 | 12 00 |
| Poultry products: | | |
| Eggs | 1583 | 23 |
| Chicken | 3309 | 44 |
| Duck | 3636 | 69 |
| Meat: | | |
| Beef | 2846 | 33 |
| Pork | 2325 | 23 |
| Fish: | | |
| Cod | 2101 | 9 |
| Mackerel | 2382 | 36 |
| Salmon | 2216 | 20 |
| Vegetables: | | |
| Peas | 5583 | 20 0 |
| Corn | 1765 | 13 0 |
| Carrots | 218 | 33 |

[5] https://www.foodstandards.gov.au/publications/documents/MSG%20Technical%20Report.pdf

| | | |
|---|---|---|
| Spinach | 289 | 39 |
| Tomatoes | 238 | 14 |
| | | 0 |
| Potato | 280 | 18 |
| | | 0 |

## 5.2 Advantages and disadvantages of monosodium glutamate in food:

### 5.2.1. Advantages:

- **Flavor**

Monosodium glutamate brings out the flavor of savory dishes. According to the European Food Information Council, or EUFIC, it is also added to processed foods, frozen foods, canned soups and broths, salad dressing and spice mixes. Monosodium glutamate, or MSG, also goes by the names hydrolyzed soy protein and autolyzed yeast. Cooks worldwide still favor this food additive, according to a March 2008 article published in the "New York Times." It adds a "fifth flavor" to food called "umami." The taste monosodium glutamate imparts to food has been described using many positive adjectives: meaty, hearty, rounded, savory and "broth-like."

- **Sodium Reduction**

Monosodium glutamate can replace other sodium-heavy seasonings in food. MSG has one-third the amount of sodium that table salt does. Cooks who use this additive to flavor dishes can decrease the amount of table salt they use by up to 40 percent—and the dish will still taste good.

- **Replacing salt with MSG May also reduce the risk of stomach and esophageal cancer**: By preventing HTN, replacing salt with MSG may also reduce the risk of kidney cancer.

### 5.2.2. Disadvantages:

- **MSG Effect In The Brain**

there are a lot of disadvantages of msg in food. One of them is a big. It is a nuero toxin, which means it can be very toxic to the brain and cause nervous system problems. Studies show some people who were diagnosed with multiple sclerosis, whom stopped using msg recovered from there symptoms. It was made by the Japanese to make food taste better. I believe if the food does not taste good from the start, it should not be eaten![6]

- **MSG also promotes liver inflammation and dysplasia:**

Chronic inflammation is a common theme in a variety of disease pathways, including autoimmune diseases. It is a concern due to its increasing prevalence in the westernized world and its direct correlation with lifestyle factors, particularly the diet. Diet caused liver damage may lead to liver cancer. In a study reported in the February-March, 2008 edition of the Journal of Autoimmunity, researchers reported that injecting MSG in mice leads to significant liver inflammation along with obesity and type 2 diabetes. To address the long-

[6] http://qa.answers.com/Q/What_are_the_advantages_and_disadvantages_of_monosodium_glutamate

term consequences of MSG on inflammation, they performed serial analysis of MSG injected mice and focused in particular on liver pathology.

- **Food Allergirs**

Are an abnormal response by body's immune system to certain components of food, usually specific proteins?

- **Study finds using MSG can make you fat**

The study, reported in the August edition of Obesity examined the association between MSG intake and weight gain in humans. Researchers conducted a cross-sectional study involving 752 healthy Chinese people ages 40-59. These people were randomly sampled from three rural villages in north and south China. Forty-eight percent were women. The great majority of the participants prepared their foods at home, without use of commercially processed foods. For the study, participants were told to add quantified amounts of MSG when preparing their foods. Eighty-two percent of the participants were MSG users. Their average intake was 330 milligrams per day.

After adjusting for confounders including physical activity and total energy intake, the researchers found that MSG consumption was positively related to increases in body mass index. Weight gain was significantly greater in MSG users than in nonusers. For the third of

participants using the highest amount of MSG, the odds of reaching overweight status were between 2.10 and 2.75 greater than for nonusers.[7]

## 6.2 Is MSG safe?

In general, the use of MSG is not a health hazard to consumers. Regulatory authorities and scientists worldwide, including Health Canada, have reviewed the safety of MSG. However, some individuals who consume MSG may exhibit an allergic-type reaction or hypersensitivity. For those people, the effects of consuming food containing MSG may include a burning sensation, facial pressure, headache, nausea and chest pains appearing about 20 minutes after consumption and disappearing about two hours later. Such reactions have generally been reported to be temporary and not associated with severe adverse health effects. People sensitive enough to be affected are advised to avoid the use of this substance.[8]

## 7.2 Is it safe during pregnancy?

There is no evidence that MSG during pregnancy has any effect on the developing baby. MSG does not cross the placenta if you eat it during pregnancy. When you are nursing, it is not associated with elevated levels in breastmilk. Moreover, it is not associated with any risk of infertility.

[7] https://www.naturalnews.com/025353_MSG_food_brain.html
[8] https://www.canada.ca/en/health-canada/services/food-nutrition/food-safety/food-additives/monosodium-glutamate-questions-answers.html

If you like, foods containing MSG, you can continue to enjoy them in moderation. However, if you do feel sensitive to MSG outside of pregnancy, it makes sense to continue to avoid the foods that trigger your symptoms.[9]

[9] https://baby-pedia.com/msg-artificial-sweeteners-during-pregnancy/

## 3. Questionnaire and questionnaire analysis:

### 1.3 Questionnaire

An-Najah National University
Faculty of Agriculture & Veterinary Medicine

I am the student Malak Mansour and Aisha Natoor , I am conducting this questionnaire to complete the requirements of the graduation project to obtain a Bachelor's degree in Nutrition and food processing Subject:

**"*Monosodium glutamate and its relationship to food safety*"**

I hope that you will give me some of your precious time to answer the questions of this questionnaire. I hope that you will be able to read the attached questionnaires and read all the paragraphs contained in the questionnaire carefully and carefully, and then answer the questions carefully and objectively. The subject of care, attention and confidentiality, and will be used only for the purposes of scientific research.

**Thank you and appreciate your good cooperation**

**Now, I would like to collect some of your personal particulars for the sake of aggregate analysis. The information provided will be kept strictly confidential.**

- Record the sex of the respondent : ☐ Male ☐ Female
- Job Title : ☐ Student ☐ employee
- How many years in the university? ☐ 1-2 years ☐ 3-4 years ☐ 5-6 years ☐ more than that
- Accommodation type? ☐ Student housing ☐ University housing ☐ Family housing

**Measuring the amount of food consumption containing monosodium glutamate among individuals**

- Food habits associated with monosodium glutamate, Eat the following:

| **Food** | **Daily** | **weekly** | **monthly** |
|---|---|---|---|
| Milk/dairy products: Cow's milk<br>Parmesan cheese | ☐ Once<br>☐ Twice<br>☐ more than that | ☐ Once<br>☐ Twice<br>☐ more than that | ☐ Once<br>☐ Twice<br>☐ more than that |
| Poultry products:<br>Eggs<br>Chicken<br>Duck | ☐ Once<br>☐ Twice<br>☐ more than that | ☐ Once<br>☐ Twice<br>☐ more than that | ☐ Once<br>☐ Twice<br>☐ more than that |
| Meat:<br>Beef<br>Pork | ☐ Once<br>☐ Twice<br>☐ more than that | ☐ Once<br>☐ Twice<br>☐ more than that | ☐ Once<br>☐ Twice<br>☐ more than that |
| Fish:<br>Mackerel<br>Salmon | ☐ Once<br>☐ Twice<br>☐ more than that | ☐ Once<br>☐ Twice<br>☐ more than that | ☐ Once<br>☐ Twice<br>☐ more than that |
| Vegetables:<br>Peas<br>Corn<br>Carrots<br>Spinach<br>Tomatoes<br>Potato | ☐ Once<br>☐ Twice<br>☐ more than that | ☐ Once<br>☐ Twice<br>☐ more than that | ☐ Once<br>☐ Twice<br>☐ more than that |

***Effect of monosodium glutamate on the human body***

- I feel pain in my head when I eat monounsaturated sodium glutamate ☐ Yes ☐ No
- I feel nausea after eating mono-sodium glutamate ☐ Yes ☐ No
- I feel pain in the stomach after eating monounsaturated sodium glutamate ☐ Yes ☐ No
- I have an allergy to food containing mono sodium glutamate ☐ Yes ☐ No
- Eating monosodium glutathione increases body weight ☐ Yes ☐ No
- You feel addicted to foods that contain monosodium glutamate? ☐ Yes ☐ No
- Does MSG ingested in the diet affect the nervous system? ☐ Yes ☐ No
- Can MSG help to reduce salt intake? ☐ Yes ☐ No

## 2.3 questionnaire analysis

The study was conducted on a sample of (40) questionnaire distributed to students from An - Najah National University. The sample was randomly selected. Tables (1) (2) (3) (4) describe the sample of the study according to its independent variables

Table (1): Distribution of sample of study according to Sex variable

| Sex | Frequency | Percent |
|---|---|---|
| Male | 24 | 60,0 |
| Female | 16 | 40,0 |
| Total | 40 | %100 |

Table (2): Distribution of the study sample according to Job Title variable

| Job Title | Frequency | Percent |
|---|---|---|
| Student | 38 | 95,0 |
| Employee | 2 | 5,0 |
| Total | 40 | %100 |

Table (3): Distribution of the sample of the study according to the variable years in the university

| years in the university | Frequency | Percent |
|---|---|---|
| years 2-1 | 9 | 22,5 |
| years 4-3 | 15 | 37,5 |
| years 6-5 | 10 | 25,0 |
| more than that | 6 | 15,0 |
| Total | 40 | %100 |

| accommodation type | Frequency | Percent |
|---|---|---|
| student housing | 21 | 52,5 |
| university housing | 9 | 22,5 |
| family housing | 10 | 25,0 |
| Total | 40 | %100 |

Stability of the resolution:

In order to measure the stability of the questionnaire, the researcher used the equation Kronbach Alpha, and Table (5) shows the stability of the scale of the tool.

Table (5) shows the stability equation of the tool

**Reliability Statistics**

| Cronbach's Alpha | N of Items |
|---|---|
| 0.683 | 23 |

Table 6: Percentage and degree of impact Monosodium glutamate and its relationship to food safety.

| Percentage | degree of impact |
|---|---|
| Less than 50% | very low |
| From 50-59.9% | Low |
| From 60.69.9% | Medium |
| From 70-79.9% | High |
| 80 and over | Very high |

Table 7: the Mean, standard deviation, and percentages of Food habits associated with monosodium glutamate

| Rank | the number | the question | Mean | standard deviations | Percentage | degree of impact |
|---|---|---|---|---|---|---|
| 12 | 1 | Milk/daily | 1.6250 | 0.58562 | 54,1% | Low |
| 9 | 2 | Milk/weekly | 1.7000 | 0.56387 | 56,6% | Low |
| 7 | 3 | Milk/monthly | 1.7750 | 0.65974 | 59,1% | Low |
| 6 | 4 | Poultry products/daily | 2.2500 | 0.66986 | 75% | High |
| 5 | 5 | Poultry products/weekly | 2.3000 | 0.64847 | 76,6% | High |
| 4 | 6 | Poultry products/monthly | 2.3250 | 0.65584 | 77,5% | High |
| 3 | 7 | Meat/daily | 2.5750 | 0.67511 | 85,3% | Very high |
| 2 | 8 | Meat/weekly | 2.6000 | 0.59052 | 86,6% | Very high |
| 1 | 9 | Meat/monthly | 2.6750 | 0.52563 | 89,1% | Very high |
| 9 | 10 | Fish/daily | 1.7000 | 0.85335 | 56,6% | Low |
| 8 | 11 | Fish/weekly | 1.7250 | 0.84694 | 57,5% | Low |
| 8 | 12 | Fish/monthly | 1.7250 | 0.87669 | 57,5% | Low |
| 10 | 13 | Vegetables/daily | 1.6750 | 0.72986 | 55,8% | Low |
| 11 | 14 | vegetables_weekly | 1.6500 | 0.73554 | 55% | Low |
| 10 | 15 | Vegetables/monthly | 1.6750 | 0.72986 | 55,8% | Low |
| Total score | | | 1,9983 | 0.41138 | 66,6% | Medium |

Table (7) shows that the total score was (medium). This indicates that the majority of respondents agree on the responses of the paragraphs of the questionnaire. The percentage reached 66.6%, while the largest percentage of the paragraphs was 89.1%, 6750) and the meat monthly is compared to the general arithmetic mean (1, 9983).

Table 8: The Mean, standard deviation, and percentages of Effect of monosodium glutamate on the human body

| Rank | the number | the question | Mean | standard deviations | Percentage | degree of impact |
|---|---|---|---|---|---|---|
| 3 | 1 | I feel pain in my head when I eat monounsaturated sodium glutamate | 1.4750 | 0.50574 | 73,7% | high |
| 1 | 2 | I feel nausea after eating mono-sodium glutamate | 1.6500 | 0.48305 | 82,5% | Very high |
| 5 | 3 | I feel pain in the stomach after eating monounsaturated sodium glutamate | 1.4000 | 0.49614 | 70% | High |
| 4 | 4 | I have an allergy to food containing mono sodium glutamate | 1.4500 | 0.50383 | 72,5% | high |
| 8 | 5 | Eating monosodium glutathione increases body weight | 1.1500 | 0.36162 | 57,5% | low |
| 6 | 6 | You feel addicted to foods that contain monosodium glutamate? | 1.2750 | 0.45220 | 63,7% | Medium |
| 7 | 7 | Does MSG ingested in the diet affect the nervous system? | 1.2250 | 0.42290 | 61,2% | Medium |
| 2 | 8 | Can MSG help to reduce salt intake? | 1.5750 | 0.50064 | 78,7% | high |
| Total score | | | 1,4 | 0.39141 | 70% | high |

Table (8) shows that the total score was (high).

This indicates that the majority of respondents agree on the responses of the question paragraphs where the percentage reached 70% while the largest percentage of the paragraphs 82.5% with an average of (1.6500) For paragraph I feel nausea after eating mono-sodium glutamate. Compared to the general accounting average…(%1.4)

Table 9: The Mean, standard deviation, and percentages of monosodium glutamate and its relationship to food safety

| Rank | the number | the domain | Mean | standard deviations | Percentage | degree of impact |
|---|---|---|---|---|---|---|
| **2** | **1** | **Food habits associated with monosodium glutamate** | **1,9983** | **0,41138** | **66,6%** | **Medium** |
| **1** | **2** | **Effect of monosodium glutamate on the human body** | **1,4%** | **0,39141** | **%70** | **high** |
| **Total score** | | | **1,6991** | **0,41138** | **84,9%** | **Very high** |

Table (9) shows that the total score was very high. This indicates that the majority of the respondents agreed on the responses of the question paragraphs. The percentage was 84.9 %% while the highest percentage was 70% with an average of (1) , 4%) and the effect of monosodium glutamate on the human body compared with the general arithmetic mean (1,6991).

## Research Results

- The results of the questionnaire analysis show that the consumption of mono sodium glands is higher than that of meat.
- After asking several questions about the effect of monosodium glutamate on human performance, it was found that its consumption often leads to nausea and sometimes stomach pain, headaches and allergies.
- While studies suggest that mono-sodium glutamate increases weight, the findings in the current study suggest that eating products containing mono-sodium glutamate does not affect the weight of their bodies.
- The study also noted that eating products containing monosodium glutamate moderately does not affect the health of pregnant women