شبكة المعلومات الجامعية

بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأفلام قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأفلام بعيدا عن الغبار
في درجة حرارة من ١٥-٢٥ مئوية ورطوبة نسبية من ٢٠-٤٠%

**To be Kept away from Dust in Dry Cool place of
15-25- c and relative humidity 20-40%**

بعض الوثائق
الأصلية تالفة

بالرسالة صفحات لم

ترد بالاصل

EFFECT OF FOOD ADDITIVE (MONOSODIUM GLUTAMATE) ADMINISTRATION ON SOME ORGANS OF MALE ALBINO RATS

(Histology and Histochemistry)

THESIS

Submitted to the Faculty of Science, University of El-Minia; for the Fulfillments of the Master's Degree of Science in Zoology

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بسم اللہ الرحمن الرحیم

DEDICATION

To my parents,

Wife,

And Children,

(Ahmed and Abdullah)

I- INTRODUCTION AND REVIEW OF LITERATURE

Food additives are any substance that can be added to foods and becomes a part of the food and / or affects the characteristics of the food. Some additives have nutritional purposes, as in case of iodized salt, vitamin and iron-enriched flour. Other intentional additives serve coloring, flavoring, thickening, emulsifying, sweetening or preserving purposes. Unintentional additives are essentially contaminants or adulterants, in particular, radioactive additives and residues of pesticide, fumigants, hormones, and antibiotics that have been added to animal feeds or injected into the animal to stimulate growth or to prevent or treat disease (Last, 1986).

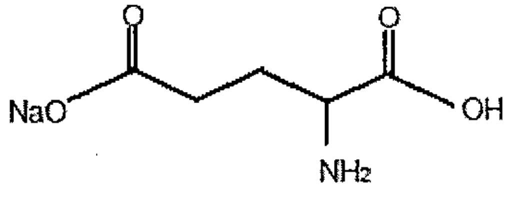
Monosodium glutamate (MSG) as a flavor enhancer:

Food chemists have claimed that MSG increases flavor intensity and palatability of foods (Hegenbart, 1994). In the food industry, MSG is often called "flavor enhancer" which is a substance that is frequently defined to have no flavor of their own at the normal usage level, but yet intensify the flavor of foods (Maga, 1983). MSG dissociates into two ions, sodium and glutamate. The discovery of glutamate receptors on taste buds indicates that there is a separate taste reception mechanism for glutamate on the tongue (Chaudhari *et al.*, 2000).

When glutamate and nucleotides coexist, a very strong synergistic effect occurs, and even a small amount of glutamate added to a food containing nucleotide causes Umami (a Japanese term often used to describe the taste of MSG and related hydrolysates from corn, tapioca etc. Prior to the development of the fermentation process, MSG was produced by hydrolysis of natural proteins, such as wheat gluten and defatted soybean flakes (Yamaguchi and Ninomiya, 1998).

Physical and chemical properties of MSG:

MSG (MW: 187.13) is commonly marketed as a white crystalline powder and is readily soluble in water but sparingly soluble in ethanol. MSG is not hygroscopic and is considered quite stable in that it does not change in appearance or quality during prolonged storage at room temperature. MSG does not decompose during normal food processing or cooking but in acidic conditions (pH 2.2-2.4) and at high temperatures, it is partially dehydrated and converted into 5-pyrrolidone-2-carboxylate (Yamaguchi and Ninomiya, 1998). The chemical structure of MSG is shown in Figure below.



Occurrence of glutamate in food:

Glutamate is naturally present in many foods. Yamaguchi and Ninomiya (1998) listed the naturally occurring glutamate in various foods in the following table.

Table 1: Naturally 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	1200
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	200
Corn	1765	130
Carrots	218	33
Spinach	289	39
Tomatoes	238	140
Potato	280	180

Source: Yamaguchi and Ninomiya 1998

The expected daily intake was therefore estimated to be 16 mg/kg. b. wt. / day between 6-12 years, 9.2 mg/kg b. wt./d between 18-44 years and 8.2 mg/kg b. wt./d beyond 45 years (WHO, 1988).

Occurrence of glutamate in human:

L-glutamate is the most abundant amino acid in proteins. The daily turnover of glutamic acid in man has been estimated to be approximately 5000 mg. The average amount of free glutamate in the normal adult is as follows: 600 mg in the muscles, 2250 mg in the brain, 680 mg in the kidneys and 670 mg in the liver, human milk contains 11.5 to 30.6 mg/100 gm b. wt. versus 4 mg/100 gm b. wt. in cow's milk. The total glutamate content (both free and protein-bound) in human milk is approximately 230 mg/100 gm b. wt. Human plasma contains 4.4 to 8.8 mg/L of free glutamate and approximately 90 to 180 mg/L of protein-bound glutamate. Human urine contains 2.1 to 3.9 µg of free glutamate/ mg of creatinine and 200 µg of protein- bound glutamate/mg of creatinine and (Peters *et al.*, 1969).

In addition, Battaglia (2000) studied glutamate shuttling in the fetus. The placenta (much like the intestines in adults) utilizes glutamate as an important source of energy. Indeed, the placenta is said to account for 60% of the total fetal glutamate disposal rate. Also, the fetal liver has been identified as the key provider of glutamate, although the placenta is fully capable of utilizing maternal-derived glutamate as well.

Estimated intake of MSG:

Data from the United Kingdom indicates an average intake of 590 mg/day, with extreme users (97.5th percentile consumers) consuming 2330 mg/day (Rhodes *et al.,* 1991). In a highly seasoned restaurant meal, however, intakes as high as 5000 mg or more may be possible (Yang *et al.*, 1997).

Metabolism of glutamate:

Glutamate performs a myriad of essential roles in intermediary metabolism and is present in large amounts in the organs and tissues of the body. The daily turnover of glutamate in the adult human has been estimated as 4800 mg (Munro, 1979). Some of the important metabolic roles of glutamate include:

- **A substrate for protein synthesis**, as one of the most abundant amino acids present in nature, comprising between 10 – 40% by weight of most proteins, L-glutamic acid is an essential substrate for protein synthesis. Glutamic acid possesses physical and chemical characteristics which make it a principal contributor to the secondary structure of proteins, namely the α-helices (Young and Ajami, 2000).
- **A transamination partner with α-ketoglutarate,** L-glutamate is synthesized from ammonia and α-ketoglutarate (an intermediate of the citric acid cycle) in a reaction catalyzed by L-glutamate dehydrogenase. This reaction is of fundamental importance in the biosynthesis of all amino acids, since glutamate is the amino group donor in the biosynthesis of other amino acids through transamination reactions (Lehninger, 1982).
- **A precursor of glutamine**, glutamine is formed from glutamate by the action of glutamine synthetase. This is also an important central reaction in amino acid metabolism since it is the main pathway for converting free ammonia into glutamine for transport in the blood. Glutamate and glutamine are thus key links between carbon and nitrogen metabolism in general and between the carbon metabolism of carbohydrate and protein in particular (Reeds *et al.*, 2000).

- **An important neurotransmitter**, glutamate is the major excitatory transmitter within the brain, mediating fast the synaptic transmission and is active in perhaps one third of central nervous system synapses (Watkins and Evans, 1981).
- **An important energy source for some tissues,** intestinal tissues (mucosa) are responsible for significant metabolism of dietary glutamate, where it serves as a significant energy yielding substrate (Young and Ajami, 2000). Currently, it is well established that the intestines and the placentas consume large quantities of glutamate for energy generation. This phenomenon may explain why glutamate concentrations in plasma and blood rise relatively modestly after large MSG or glutamate doses have been ingested by adults (Tsai and Huang, 2000), and why fetal plasma and blood glutamate concentrations do not rise in response to marked elevations in maternal plasma and blood glutamate concentrations (Stegink *et al.*, 1975).

Glutamine is considered as a fuel in the intestinal absorptive cells and leads to the production of various metabolites including glutamate, ammonia, alanine, aspartate, ornithine, citrulline, praline, glutathione and N-acetyl-glutamate (Portteous, 1980; Uchiyama *et al.*, 1981; Blachier *et al.*, 1991; Watford, 1994; Dugan *et al.*, 1995; Murphy *et al.*, 1996 and Reeds *et al.*, 1997).