

REVIEW ON CHINESE SALT; MONOSODIUM GLUTAMATE

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ABSTRACT

Monosodium Glutamate may be a sodium salt of a non-essential aminoalkanoic acid, L- amino acid, which is widely utilized in the food industry. flavourer (MSG) is widely used as a food additives which reinforces the flavour of food and is additionally commonly referred to as a flavouring enhancer in food processing which provides Umami taste that intensifies the meaty, savory flavor of food as present glutamate like meat soups. In this paper, we review on animal and human studies during which MSG shows toxic effects on cantral systema nervosum, adipose tissues, liver, reproductive organs and health system and also we discuss about their implications for human MSG intake. Globally, commercial MSG's consumption is extremely markable increasing in Asia and therefore the European Economic Community classify it as a food additives permitted in certain foods. flavoring (MSG) plays a crucial role in essence of brain functions which incorporates formation and stabilization of synapses, memory, learning, and cellular metabolism. it's safety was evaluated by the International organizations (EFSA, FDA) as a secure and also the limits were founded and their studies concerns about it's side effects like obesity, asthma, migrain, headache etc. ruddles, Curmuma, Green tea, Ginkyo biloba and a few vitamins are the most natural products for protective against MSG toxicity by different mechanisms. This review provides a short and general information about MSG with updates in research.

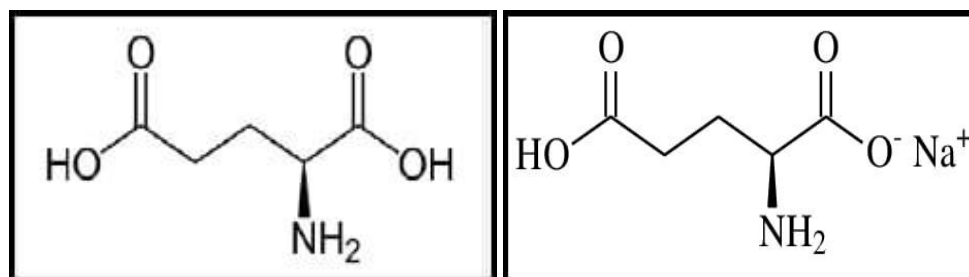
**KEYWORDS:** Food additives, obesity, Monosodium Glutamate, flavouring enhancer, Umami taste, migrain, cellular metabolism etc.

❖ INTRODUCTION

Now a days food, additives aren't a new term anymore. Everyday a huge amount of food is needed to meet requirement of the world hunger, which is increasing day by day rapidly out of control. Food additives have an important role in handling this challenge.

Monosodium Glutamate (MSG) is one in all the world's most extensively used food additives & it's ingested as a

component of various processed foods species. Monosodium glutamate (MCG) is a sodium salt of glutamic acid. It is generally a white powder. Water ionizes it into free Sodium particles and glutamic corrosive, which is a natural compound having five carbon molecules. - It has a carboxylic (- COOH) bunch and an amino (- NH<sub>2</sub>) bunch connected to an "Alpha" carbon molecule (a carbon particle which is joined straightforwardly to the - COOH bunch).



Structure of Glutamate. Structure of Monosodium Glutamate

Monosodium Glutamate (MSG) was found within the nineteenth century in Japan yet it's widely utilized in chines, Japanese and Thai cooking.

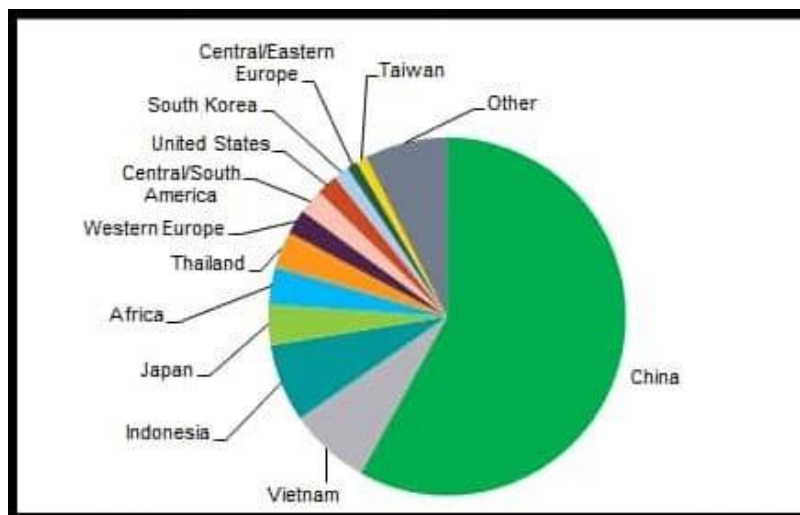
The flavouring is most generally used everywhere the globe as a flavour enhancer in various foods and spices. The chemical formula of MCG is C<sub>3</sub>H<sub>8</sub>N NaO<sub>4</sub> and its

molecular mass is about 169.11 g/mol. MSG has the identical basic structure of organic compound glutamate, with an amino (-NH<sub>2</sub>) and carboxylate ion is placed rather than the carboxylic group (-COO). The difference within the MSG & Glutamate structure is that one atom of the carboxylic chain has been replaced with Sodium atom, hence, the name of the compound is seasoner (MSG).

glutamate sodium Hydrolyzed vegetable protein, Pottasium glutamate, soyabean and yeast extract. It is made from molasses by fermentation of monosodium glutamate being the sodium salt glutamate being the sodium of glutamic acid. → MSG is commonly used in cooking as a flavor enhancer with an Umami tastes which enhance of intensities the meaty, savory flavor of food.

MSG was first prepared and discovered in 1908 by Japanes biochemist kikune Ikeda, the idea came from the Ikeda's desire to inhance the aroma of the sarvry taste of kombu, which is an edible seaweed used as a base for many Japanese Soups, ramen & (Asian soups). Monosodium glutamate is generally found in stock (bouillon) cubes, soups, ramen, gravy, stews, condiments, savory, snacks etc. Glutamic acids and its salt's are found under the other following names such as calcium caseinate E62(according to European regulation).

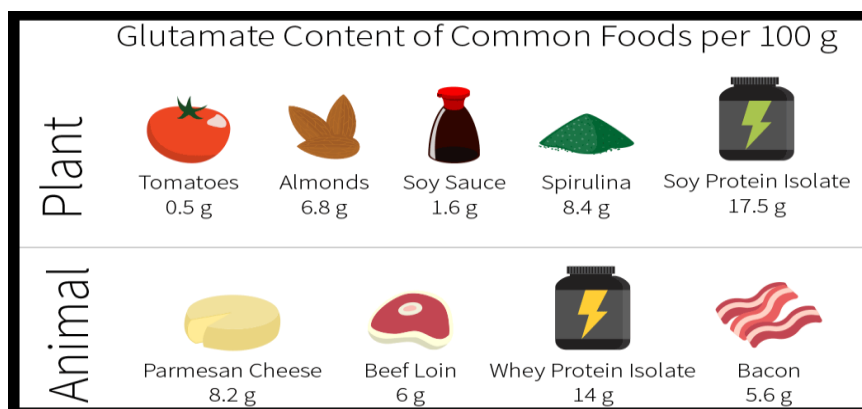
The day by day admission of glutamate relies upon a specific areas and nations. The normal admission of MSG was assessed to be 0.3-1.0 g/day in created nations. As the normal admission of MSG in UK was 0.58 g/day, 10 g/day in Germany, while it has been as of late revealed that in other European nations, the normal day by day admission of MSG is close around 1.0 g/day. Japan is higher with an admission of MSG around 1.1-1.6 g/day and 1.6-2.3g/day in South Kurea.



World Consumption of Monosodium Glutamate - 2018

Although the Food and Drug Administration (FDA) Reported or stated that MSG is a safe substance but several studies in animals has been indicated the negative effects after chronic consumptions of MSG.

The adverse effects of MSG has been shows in different organs which includes as thymus, brain, pancrease, liver, kidney & testis and also it is linked with several diseases such as obesity hypertension, headaches, asthma, neurotoxicity and detrimental effects on the reproductive organs.



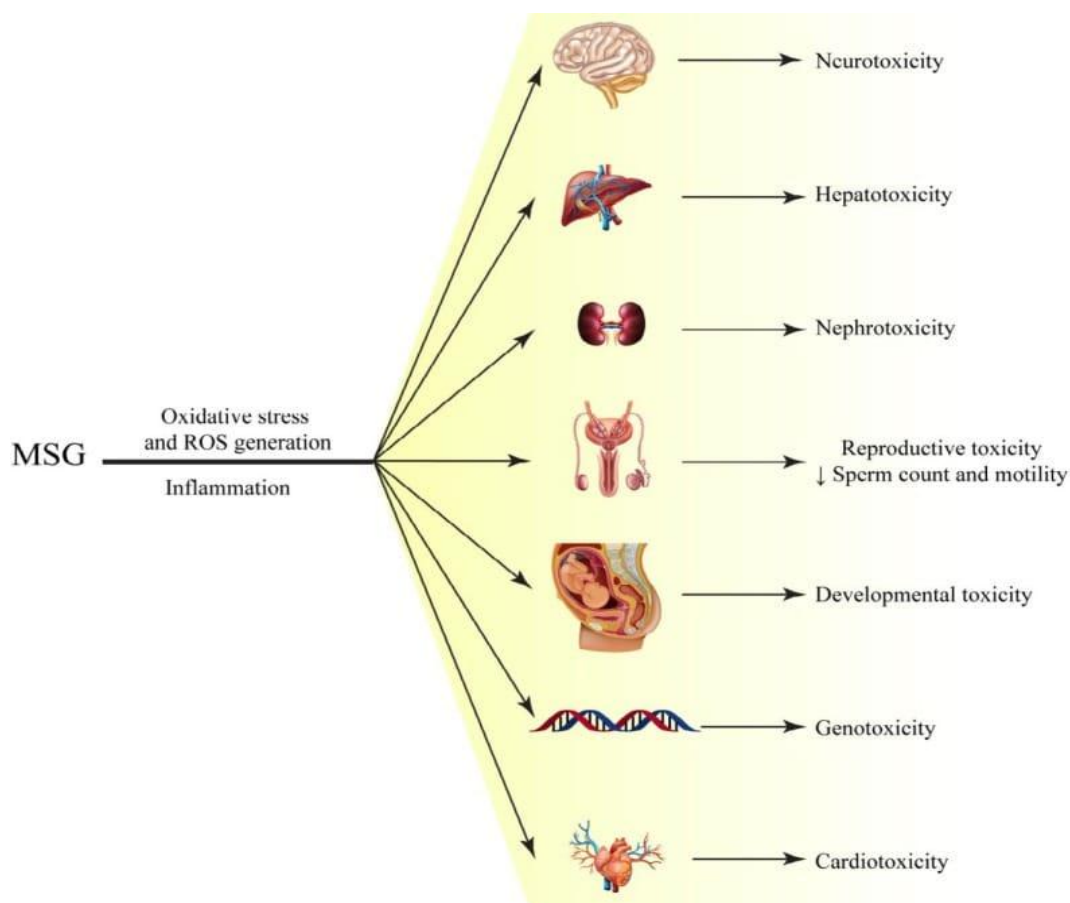
Glutamate content in Common Foods

### ❖ History / Discovery of MSG

Glutamic acid was discovered in 1866 by the German Chemist Karl Heinrich Ritthausen. He treated wheat gluten with Sulfuric acid. Then, at that point, Kikunae Ikeda from Tokyo Imperial University was disconnected the glutamic corrosive as a taste substance in 1908 from the ocean growth kombu by watery extraction and crystallization and this taste is called as Umami (Pleasant exquisite taste). He concentrated on the different taste properties of glutamate salts, calcium, potassium, magnesium, and ammonium glutamate. Ikeda noticed that all these salts detected Umami and metallic taste due to the presence of other minerals. Among of them,

Sodium glutamate was the most soluble, most palatable and the easiest to crystallize, so Ikeda was named his product as "Monosodium Glutamate". Monosodium Glutamate is generally found in stock (bouillon) cubes, soups, gravy, stews, savory snacks, etc.

Then the Suzuki brothers begin commercial production of MSG in 1909 which is named as a Ajinomoto ("essence of taste"). Figure 1. is a schematic representation of different organs which may be affected by MSG toxicity. In this review, the protective effects of medicinal plants & natural products. against the MSG induced toxicities are discussed.



**Figure 1:** Is a schematic representation of different organs which may be affected by MSG toxicities.

### ❖ Chemistry of MSG

MSG was first extracted from the seaweed *Laminaria Japonica* and identified by the Japanese chemist Kikunae Ikeda in 1908. It is a sodium salt of nonessential amino acid known as L-glutamic acid.

- Molecular formula -  $C_5H_8NO_4Na$
- Molecular weight/mass - 169.11 g/mol.
- ★ (Anhydrous) Monohydrate :- 187.12 g/mol.
- IUPAC Name :- Sodium-2-aminopentane diate
- Melting point :-  $232^\circ C$
- Boiling point :- decomposes
- PH :- Going from 6.7 to 7.
- Taste :- Umami (savory, meaty taste),
- shape :- Crystalline Solid
- odour :- odorless

- Use :- Flavour enhancer.

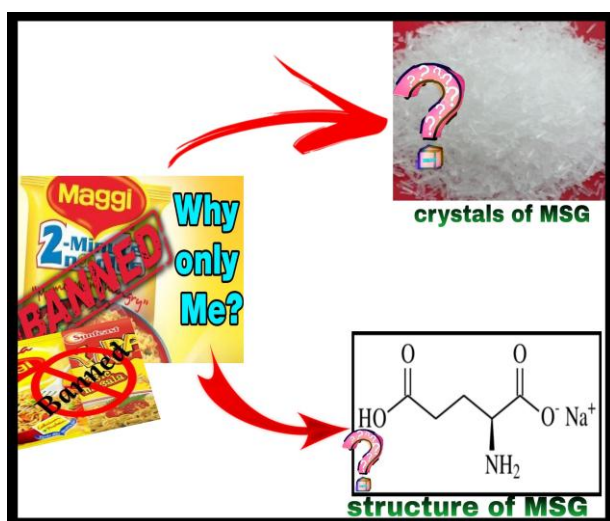
In solid MSG /the glutamate ions exists in its zwitterion form -  $O(C=O)CH(NH_3^+)(CH_2)_2(C=O)O^-$ . MSG is most soluble in water & sparingly soluble in alcohol & also soluble in oil or organic solvents. MSG contains 78% of glutamic acid, 22% Sodium salt & water. The major reason of using such additive is that MSG having a higher & more rapid dissolution rate against the glutamic acid.

### ❖ Maggi Contravarsy

Originally "Maggi" brand started with humble beginnings in the late 19th Century in Switzerland and was named after its developer "Julius Maggi" and who later

launched Maggi ready- to- use soups in 1886. And in 1947, Maggi was included into the Nestle Company and has dominated more than 60% of Nestle in India known as Nestle India Limited (NIL) launched the Maggi noodles marketed of worth 1100 cr. Maggi noodles incorporates seasoning parcels named as a "Tastemaker" which is planned to disintegrate in water during cooking.

On March 26, 2014 that Sharda K.Verma. a junior Analyst and also who was the incharge of the lab at Baba Raghav Das Medical College, campus Gorakhpur where he and his team of five members discovered that the traces of MSG in Maggi. Although their reports came on several occasions indicating the presence of MSG in different commercial food items. But the real shock was came in April 2015 with the final reports of referral food laboratory Kolkata.



May 2015, likewise the FDA delegate from the Barabanki, a locale of Uttar Pradesh India, expressed that examples of the items Maggi (Brief Noodles) had bizarrely lead to unnecessary degrees of Monosodium Glutamate (MSG). The packets stated "No added MSG", however, MSG naturally occurs in hydrolyzed peanut protein, onion powder and wheat flour. Also the Food Safety and Standards Authority of India (FSSAI) insisted that the powder itself should be tested and their reports clearly illustrated that the presence of Monosodium Glutamate in Maggi leads to the toxicity and which was found to be 17.2 ppm well over the permissible limits of 2.5 ppm. They observed the total 13 samples which was tested by the Delhi authorities and 10 of them had leads to content surpassing the limits. These bundles that started by the examination from Uttar Pradesh which has lead to 17.2 ppm. On 6 June 2015, the Focal Legislature of India prohibited the cross country deals of Maggi Noodles for an endless period. And also due to the fear for Maggi toxicity was almost instantaneously banned in the states of Delhi, Gujarat, Uttarakhand, Assam, Jammu and Kashmir.

Then, at that point, Settle scrutinized the unwavering quality of labs utilized and results from the testing outside of India, revealed that Maggi noodles were protected. Then, at that point, the court oversaw testing to be done at the three explicit research centers in (Punjab, Hyderabad and Jaipur) where Maggi was viewed as protected. And Bombay High Court also agreed that the test results which is performed in earlier laboratories were reliable.

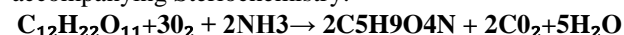
On 26 June 2015 - During the press meeting, the Pastor for Wellbeing and Family Government assistance of Karnataka, U.T. Khader expressed that Maggi food varieties would not be prohibited and furthermore on 13 August 2015, the cross country restriction on Maggi food varieties were struck somewhere around the Bombay High Court.

#### ❖ Company Response

Corporate issues Service of India forced a ₹ 640 centers (₹ 6.4 Billion) fine on Settle India for the presence of MSG and prompts harmfulness past as far as possible.

#### ❖ Production of MSG

The first biotechnological creation of Glutamic Acid was found in 1950 with E. Coli in tiny amounts however later that it was found that enormous amounts of Glutamic Acid can be created by different microscopic organisms which was subsequently named as carynebacterium glutamicum (c.glutamicum), From carb as per the accompanying Stereochemistry.



The worldwide yearly creation of MSG surpasses 3 million metric tons. The money related worth per kilogram of MSG shifts somewhere in the range of US\$7.30 and US\$1.8 relying upon the producer and nature of the product. The chinese have utilized as added substances certain seqweed to improve the kind of nourishment for exactly long term. In 1908, the flavor upgrading specialist was recognized as Glutamic corrosive which is otherwise called Monosodium glutamate. Monosodium glutamate has been fabricated and delivered by following three strategies.

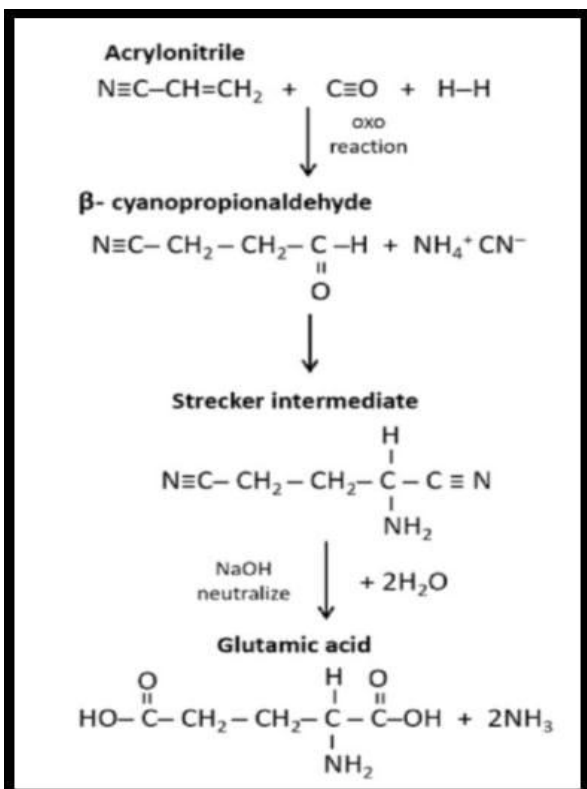
- (a) By hydrolysis of vegetable protein using hydrochloric acid (HCl) 1909-1962.
- (b) By direct chemical synthesis 1962-1973.
- (c) By bacterial Fermentation (current method)

#### A. By Protein Synthesis

In this method the hydrolysis of vegetable proteins with hydrochloric acid (HCl) to disrupt the peptide bonds. Generally Wheat gluten which contains more than 30g of glutamate and glutamine in 100g of protein was originally used for hydrolysis of protein.

#### B. By direct chemical synthesis

The polyacrylic Fiber industry was began Japan during the mid-1950 & Acrylonitrile was adopted as a base material to synthesize monosodium glutamate.



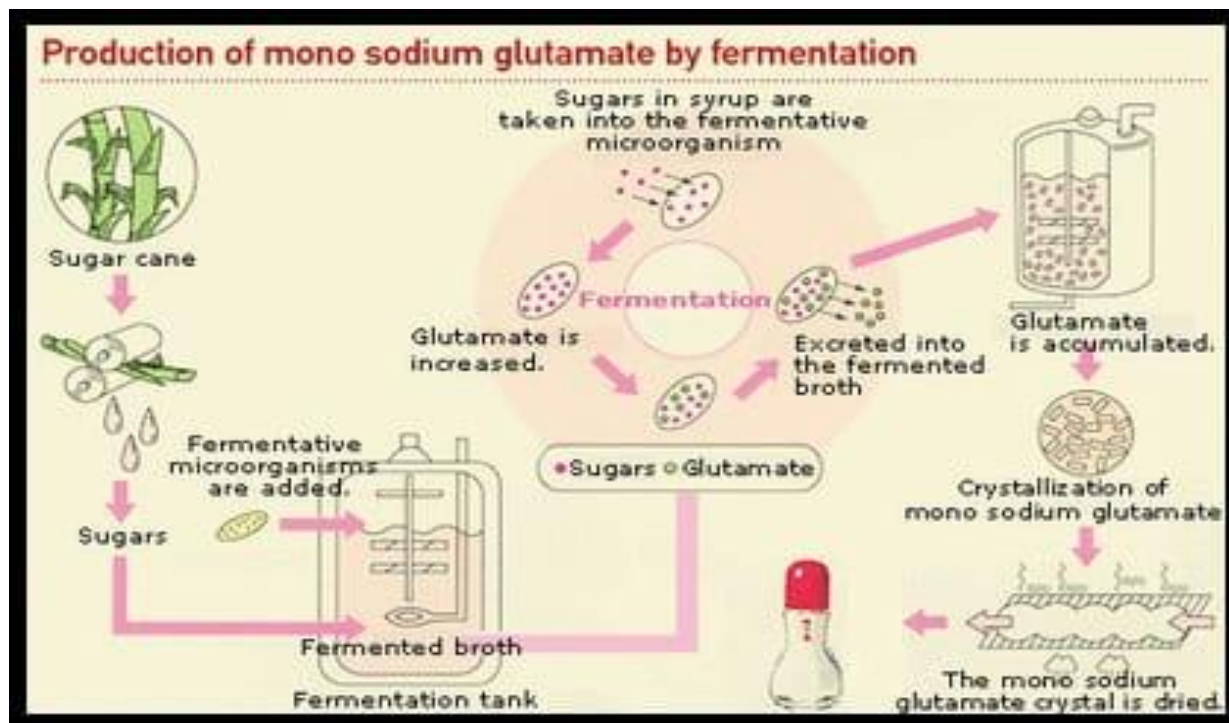
Chemical Synthesis of Glutamic Acid from Acrylonitrile.

**C. Bacterial fermentation**

On currently(2016) the monosodium glutamate is produced world wide by bacteria fermentation in which the bacteria are grown aerobically in a liquid nutrient medium. The bacteria release the glutamic acid as a by product of metabolism.

About 1.9 million tons of Monosodium glutamate are produced worldwide per year by bacterial fermentation by using bacteria corynebacterium glutamicum & it's related species. The bacteria are biotin auxotrophs and biotin (vitamin B2) is used as cofactor. Then the corynebacterium species cultured with ammonia, ammonia salts and carbohydrates from sugar beets, sugarcane and molasees which excrete amino acid into the culture broth from which the L-glutamate is isolated. Then the glutamic acid is separated from the fermentation broth medium by filtration, acidification, concentration and crystallization and it converts to it's sodium salt.

The company Kyowa Hakko Kogyo developed the industrial fermentation to produce L- glutamate. The conversion from sugars to glutamate yields and it continues help to improve the industrial production of MSG.



Fermentation Process

❖ **Toxicity of Monosodium Glutamate**

1) **Oxidative Stress**

The system of activity of monosodium glutamate instigated harm to various organs like liver, mind, testis, and kidney, is identified with the acceptance of oxidative pressure. Oxidative stress is a situation when

intracellular levels of reactive oxygen species ( ROS ) are enhanced, which leads to the disruption of cellular metabolism and damage to the lipids, carbohydrates, proteins and nucleic acids. Oxidative stress is generally associated with many human disorders like diabetes, cardiovascular disease, atherosclerosis, inflammatory

bowel disease, osteoporosis and carcinogenesis. The organization of MSG to creatures prompted expanded thymocytes apoptosis through the oxidative pressure.

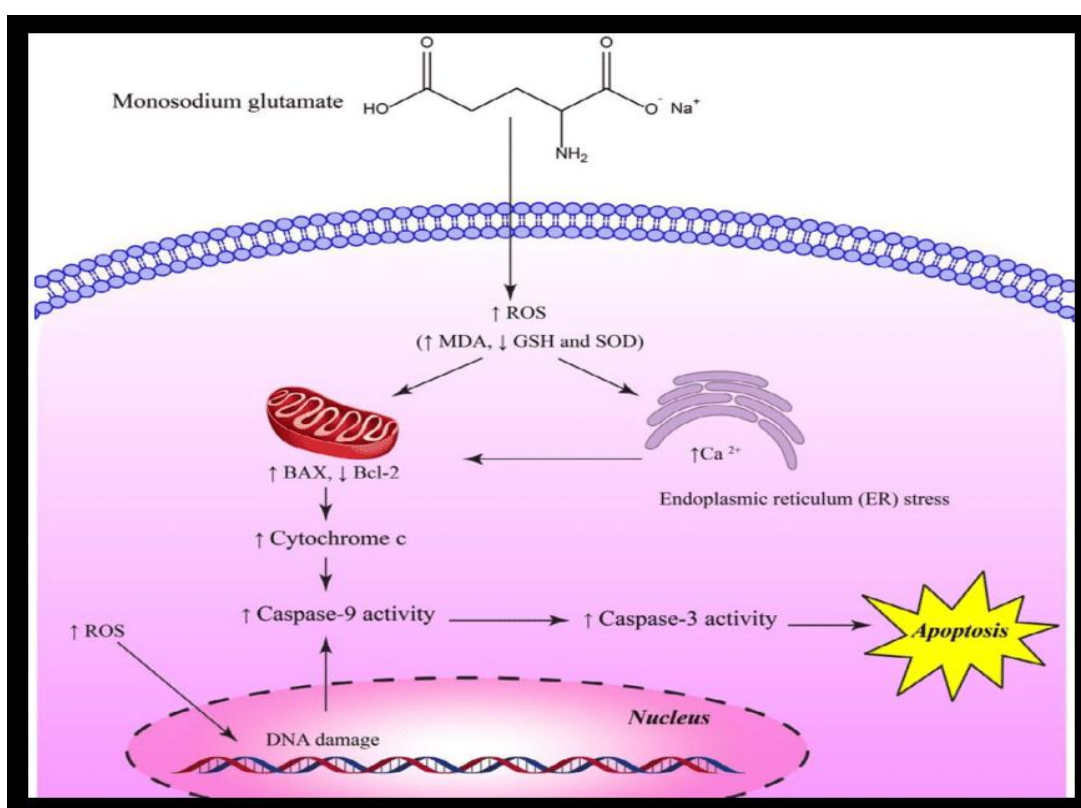
Organization of MSG at dosages multiple mg/g of body weight for grown-up male mice supported oxidative pressure in erythrocytes by expanding lipid peroxidation.(LPO, as a marker of oxidative pressure.). MSG also induced hepatotoxicity through the oxidative stress evidenced by increased lipid peroxidation, reduced antioxidants enzymes and fibrosis.

**2) Neurotoxicity**

MSG causes neurotoxicity through the expanding LPO, oxidative pressure and resulting apoptosis and cholinergic brokenness. In spite of the fact that it is neurotoxic, and producer's are utilizing glutamic

corrosive since it is modest and don't have any desire to public to realize that.

It's neurotoxicity is generally associated with the over activation of excitatory amino acid receptors which causes enhanced the intracellular calcium that triggers a cascade of enzymatic activities which results in cell death. MSG organization annihilates neurons of the nerve center in rodents which causes numerous metabolic irregularities. It is likewise observed that MSG could be related with other neurodegenerative sicknesses, for example, amyotrophic sidelong sclerosis, Alzheimer's and Parkinsons illness. In different investigations, when presented to MSG causes hindrance of memory in rodents related to the restraint of Na, K-ATPase movement in the hippocampus of rodents.



**Monosodium glutamate (MSG)-induced cell death.** As shown in figure, MSG can activate intrinsic apoptosis pathway, leading to cell death.

**3) Nervous System**

Glutamate is the excitatory synapse in the mammalian focal sensory system (CNS), which assume a significant part in both physiological and obsessive cycles ( Mattson 2008). MSG shows consequences for Brain and sensory system when MSG is added to various food materials so as it invigorate the nerve sensation inside the oral depression. When MSG ingested along with food material, then it is absorbed within the intestine into blood vesicles.

MSG stimulates the Glutamate receptors which in humans includes three ionotropic receptors- NMDA ( N-

Methyl D- Aspartate receptors); AMPA ( Alpha- amino-3- hydroxyl- 5-Methyl-4-isoxazolepropionic acid receptors.) and Kinate. These receptors are distributed throughout the nervous system, amygdala, hippocampus, etc.so their activation may affects the entire nervous system.Normally brain and nervous system remains protected from MSG effects through the blood brain barrier (BBB), but MSG may can cross this “BBB” during the period of hypoglycemia or allergy, where it behaves as an excitatory neurotransmitter which causing neural necrosis.

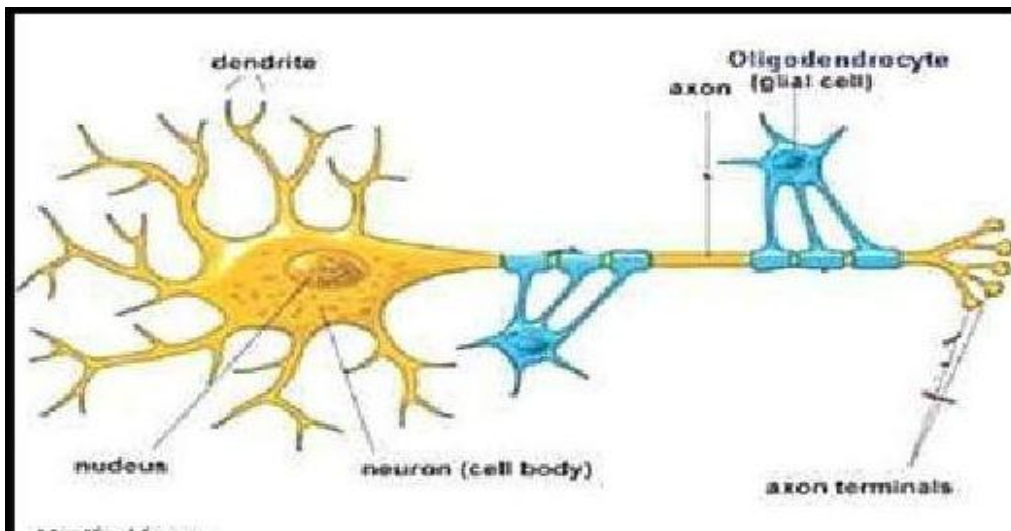


Figure shows MSG kills Oligodendrocytes & impairs Myelin formation.

Level of glutamate within the brain CSF may kill the Oligodendrocytes which are responsible for biosynthesis of the myelin sheath over the neurons so, their death will lead to impaired neuronal cell signalling and multiple sclerosis, especially in case of children's (Gonzalez-Burgos et al. 2001).

### 3) Chinese Restaurant Syndrome

The Chinese Restaurant Syndrome (CRS) was interestingly portrayed over 40 years prior. This syndrome associated with the consumption of the westernised version of Chinese food, of symptoms having their onset about 20 minutes after starting the meal.

**Chinese Restaurant Syndrome: The adverse effects of MSG**

**Mild adverse reactions:**

- Burning sensation in the neck, forearms and chest
- Facial pressure or tightness
- Headache
- Nausea
- Palpitation
- Chest pain
- Drowsiness and weakness
- Bronchospasm or difficulty in breathing in asthmatics

**Serious/life-threatening reactions:**

- Anaphylaxis
- Seizures
- Dysrhythmias
- Hypovolemic shock
- Fainting spells with marked fall in blood pressure and constricted throat

### The various symptoms which is characterized as

The side effects of flushing, unsteadiness, syncope and facial strain were portrayed later (Geha et al. 2000). Monosodium Glutamate was broadly accepted to be related with CRS, but many surveys of significant examinations which have suggested that the investigations related MSG with CRS don't have the vigorous trial plan, which results were conflicting and the recurrence of reactions to MSG admission was insufficient to bring the proof that MSG is the trigger to CRS (Zautcke et al. 1986, Freeman 2006). CRS is by and large happen in individuals who are delicate to MSG.

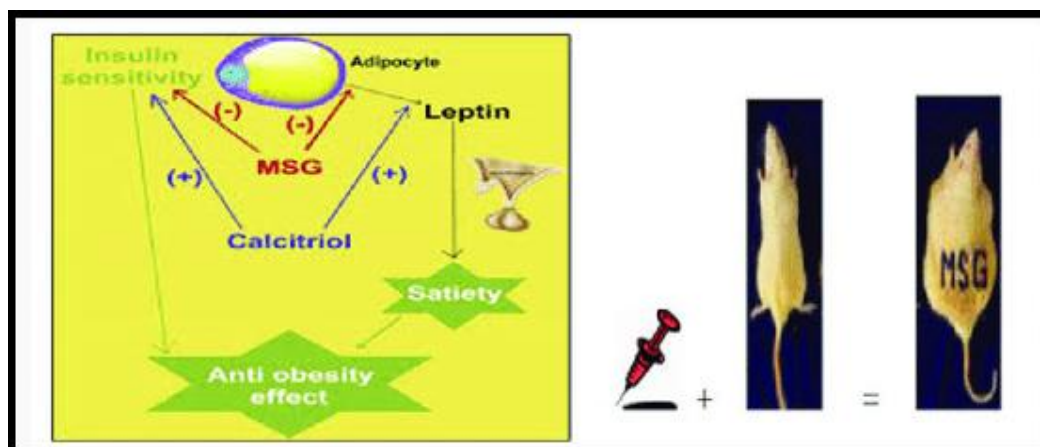
The issue stays dubious, since MSG is indistinguishable from Glutamate (amino corrosive) which is normally

contained in numerous food varieties, and it is ingested and used by body in same way then again 'if "Disorder" is to be portrayed as indications ascribed to explicit food fixings and the restrictions of the condition should be determined' (Kerr et al. 1979). Thus the particular symptoms or damaging effects have been associated with ingesting MSG such as related to the Alzheimer's and Parkinson's diseases. This was excused by an agreement meeting lead by Nobel Preis laureate Professor Dr. Konrad Beyreuther in light of the fact that MSG ingested through food which can not cross the Blood - Brain Barrier in sound people.

#### 4) Obesity

Information from various creature studies had demonstrated that Monosodium Glutamate played out a powerful job of prompting stoutness in mice and this trial was led (752 solid chinese) to discover the connection between MSG admission and corpulence in people. It was viewed as decidedly related with expanded weight

file (BMI). Thusly MSG clients had supposedly expanded body weight as contrasted and non-clients. The neonatal organization of MSG furnishes a model of heftiness with disabled glucose resilience and insulin opposition prompted worries about corpulence in people creatures utilizing MSG in food.



**Figure: Induction of Weight Gain by MSG.**

The expected connection among MSG and weight incorporates the MSG consequences for energy balance by expanding the agreeability of food and by upsetting the hypothalamic flagging course of leptin activity. MSG had also reported that to increase the mRNA expression of interleukin 6, tumor necrosis factor alpha, resistin and leptin in visceral adipose tissues. Monosodium Glutamate (MSG) causes reduction in the secretion of growth hormones which leads to stunted growth and irreversibility in obesity.

#### 5) Reproductive System

Information from creature studies, the impacts of MSG on the regenerative framework are restricted uniquely to creature studies. In male Swiss Albino mice, the subcutaneous association of MSG at an element extent of two mg/g during the perinatal period at the second, fourth, 6th, eighth, and tenth extended lengths of life which cause grow the quantity of pachytene period of fundamental spermatocytes at the 75th day of life appeared differently in respect to controls. The twofold piece (4 mg/g) of MSG oversaw all the while to newborn child rodents which achieves reduced heap of pituitary organ and balls and lower the testosterone level in 4 months old genuinely mature male rats. (Miskowlalc *et al.* 1993).

Progesterone is a female sex chemical which assume a focal part in ovulation, pregnancy, implantation and guideline of uterine capacities. MSG shows hurtful ramifications for the testis by causing a basic oligozoospermia and addition the odd sperm morphology in a part subordinate plan in male Wister rodents. It has been associated with male desolateness by causing testicular release, degeneration and change of sperm cell people and morphology.

#### 6) Hepatotoxicity

The hepatocytes have metabolic capacities which manages the exceptionally fundamental cycles like a detoxification, deamination, transamination and evacuation of smelling salts as urea and biosynthesis and release of non-essential amino acids and plasma proteins with an exception of immuno gamma globulins, gluconeogenesis, storage of glycogen and conversion of carbohydrates and proteins to lipid, synthesis of lipoproteins and fatty acids as well as storage of vitamins A, Da and B.<sup>[12]</sup>

An experiment was conducted on mice to check the liver inflammation which is caused by MSG and results in all mice developed non-alcoholic fatty liver disease and non-alcoholic liver inflammation with fat accumulation causes steatohepatitis. Thus on experiment condition of 12 - month old mice with steatohepatitis was similar with human steatohepatitis so, it was difficult to differentiate between these two conditions. Nikanishi and it's co-workers recommended that pulling out of MSG from natural pecking order and reevaluation of it's wellbeing profile. Hence the utilization of this substance as a flavor enhancer throughout the time which has been accounted for to be hepatotoxic.

Several functions and enzymes tests have been formulated to explore hepatic status such as alanine aminotransferase (ACT) and aspartate aminotransferase.

#### ❖ CONCLUSION

Monosodium glutamate (MSG) is one of the world's widely utilized food added substances which improves the kind of food. As a flavor enhancer, MSG builds the sapidity of food. Individuals do have an exceptionally



superior presentation towards the taste given by MSG ordinarily known as umami taste. The expansion in monetarily MSG use has raised the worry of the two researchers and buyers about its safety. Therefore, because of a need of full understanding with regards to MSG, it is important to give more consideration in concentrating on it, more examinations are needed to evaluate causal connections to disease. MSG harmful impacts on focal sensory system, fat tissue, hepatic tissue and regenerative organs were displayed in various creature studies, but the strategy for organization and the pre-owned portions in the majority of them were not tantamount with human MSG intake. Animal studies in which MSG was regulated perorally in dosages like normal human admission or admission of outrageous clients showed that MSG prompted aggravations in digestion with the increment in more boundaries including insulin, unsaturated fats and fatty oils in serum, MSG expanded the outflow of a few qualities ensnared in adipocytes separation, it impacted the liver capacity bringing about height of transaminases levels and bile amalgamation, it additionally prompted oxidative pressure in liver and to the neurotic changes in ovaries and fallopian tube. Chinese eatery condition and asthma were not ended up being related with MSG consumption. Nutrient C, nutrient E, quercetin and diltiazem effectsly affected msg actuated poisonous change. Thus, moreover, escalated research is needed to investigate MSG related sub-atomic and metabolic systems. Benefits in the advancement of examination techniques and specialized supplies ought to be taken advantage of to acquire higher exactness result.

#### There are about 12 common foods which we should have to avoid them

- 1) **Monosodium Glutamate:-** MSG is utilized to improve the kind of many handled food varieties. Certain individuals might have a touchy to MSG, however it's safe for the vast majority when utilized with some restraint.
- 2) **Artificial Food Coloring:-** Artificial Food Coloring might elevate hyperactivity in delicate to kids' and can cause hypersensitive responses. Red 3 has additionally been displayed to build the danger of thyroid growths in creature studies.
- 3) **Sodium Nitrite:-** Sodium Nitrite is a typical fixing in handled meats that can be changed over into an unsafe compound called as nitrosamine. A higher admission of nitrites and handled meats might be connected to a higher danger of a few kinds of disease.
- 4) **Guar Gum:-** Guar Gum is a long-tie starch used to thicken and tie food sources. It has been related with better stomach related wellbeing, lower levels of glucose and cholesterol, just as expanded sensations of totality.
- 5) **Fructose Corn:-** High-fructose corn syrup is related with weight gain, diabetes and aggravation. It's likewise high in void calories and contributes only calories to our eating regimen.
- 6) **Artificial Sweeteners:-** Artificial Sweeteners might assist with advancing the weight reduction and glucose control. Specific sorts might cause gentle secondary effects like migraines, however they are by and large viewed as protected with some restraint.
- 7) **Carrageenan:-** Test-cylinder and creature investigations have discovered that carrageenan might cause high glucose and could cause digestive ulcers and developments.
- 8) **Sodium Benzoate:-** Sodium Benzoate might be related with expanded hyperactivity. Whenever joined with nutrient C, it might likewise frame benzene, a compound that might be related with malignant growth advancement.
- 9) **Trans Fat:-** Eating trans fats has been related with many adverse consequences on wellbeing, including aggravation, coronary illness and diabetes.
- 10) **Xanthan Gum:-** Xanthan Gum might assist with decreasing the degrees of glucose and cholesterol. In enormous sums, it might cause stomach related issues like gas and delicate stools.
- 11) **Artificial Flavoring:-** Some creature investigations have discovered that counterfeit enhancing might be poisonous to bone marrow cells. More examination is expected to assess the impacts in people.
- 12) **Yeast Extract:-** Yeast separate is high in sodium and contains glutamate, which may triggers manifestations in certain individuals. However in light of the fact that main limited quantities of yeast remove are added to food varieties, it's probably not going to creates some issues for the vast majority.

#### ❖ REFERENCES

1. Zealand, F.S. Monosodium Glutamate, a Safety Assessment. Technical Report Series No. 20 FSANZ; 2003. [Google Scholar]
2. truthinlabeling. History of Invention and Use of MSG. n.d. <http://www.truthinlabeling.org/IVhistoryOfUse.html> (accessed April 17, 2016). [Google Scholar]
3. Skurray, G.R.; Pucar, N. L-G-Lutamic Acid Content of Fresh and Processed Foods. *Food Chemistry*, 1988; 27: 177–180. [Crossref], [Web of Science ®], [Google Scholar]
4. The Glutamate Association. What Foods are Glutamate Rich? 2016. [http://www.msgfacts.com/nutrition/what\\_foods\\_are\\_glutamate-rich.aspx](http://www.msgfacts.com/nutrition/what_foods_are_glutamate-rich.aspx) (accessed November 13, 2016). [Google Scholar]
5. iHS. Monosodium Glutamate (MSG). 2015. Chemical economics handbook: <https://www.ihs.com/products/monosodium-glutamate-chemical-economics-handbook.html> (accessed April 17, 2016). [Google Scholar]
6. Staples, P. Advantage & Disadvantage of Monosodium Glutamate. n.d. eHow: [http://www.ehow.com/info\\_8492575\\_advantage-disadvantage-monosodium-glutamate.html](http://www.ehow.com/info_8492575_advantage-disadvantage-monosodium-glutamate.html) (accessed April 17, 2016). [Google Scholar]

7. Windmueller, H.G.; Spaeth, A.E. Intestinal Metabolism of Glutamine and Glutamate from the Lumen as Compared to Glutamine from Blood. *Archives of Biochemistry and Biophysics*, 1975; 171: 662–672. [Crossref], [PubMed], [Web of Science ®], [Google Scholar]
8. Windmueller, H.G.; Spaeth, A.E. Respiratory Fuels and Nitrogen Metabolism in Vivo in Small Intestine of Fed Rats. Quantitative Importance of Glutamine, Glutamate, and Aspartate. *Journal of Biological Chemistry*, 1980; 255: 107–112. [Google Scholar]
9. Kanai, Y.; Hediger, M.A. The Glutamate and Neutral Amino Acid Transporter Family: Physiological and Pharmacological Implications. *European Journal of Pharmacology*, 2003; 479: 237–247. [Crossref], [PubMed], [Web of Science ®], [Google Scholar]
10. Fan, M.Z.; Matthews, J.C.; Etienne, N.M.; Stoll, B.; Lackeyram, D.; Burrin, D.G. Expression of Apical Membrane L-Glutamate Transporters in Neonatal Porcine Epithelial Cells along the Small Intestinal Crypt-Villus Axis. *American Journal of Physiology. Gastrointestinal and Liver Physiology*, 2004; 287: 385–398. [Crossref], [PubMed], [Web of Science ®], [Google Scholar]
11. Ataseven N, Yuzbasioglu D, Keskin AC, & Unal F. Genotoxicity of monosodium glutamate. *Food and Chemical Toxicology*, 2016; 91: 8–18. doi:10.1016/j.fct.2016.02.021 [PubMed] [CrossRef] [Google Scholar]
12. Baad-Hansen L, Cairns B, Ernberg M, & Svensson P. Effect of systemic monosodium glutamate (MSG) on headache and pericranial muscle sensitivity. *Cephalalgia*, 2009; 30(1): 68–76. doi:10.1111/j.1468-2982.2009.01881.x [PubMed] [CrossRef] [Google Scholar]
13. Baky NA, Mohamed AM, & Faddah LM. Protective effect of N-acetyl cysteine and/or pro vitamin A against monosodium glutamate-induced cardiopathy in rats. *Journal of Pharmacology and Toxicology*, 2009; 4(5): 178–193. [Google Scholar]
14. Barraji L, Murphy M, Tran N, & Petersen B. Chemistry, manufacturing and exposure assessments to support generally recognized as safe (GRAS) determinations. *Regulatory Toxicology and Pharmacology*, 2016; 79(2): S99–S104. doi:10.1016/j.yrtph.2016.07.003 [PubMed] [CrossRef] [Google Scholar]
15. Battezzati A, Brillon DJ, & Matthews DE. Oxidation of glutamic acid by the splanchnic bed in humans. *American Journal of Physiology*, 1995; 269(2Pt1): E269–276. doi:10.1152/ajpendo.1995.269.2.E269 [PubMed] [CrossRef] [Google Scholar]
16. Bawaskar HS, Bawaskar PH, & Bawaskar PH. Chinese restaurant syndrome. *Indian Journal of Critical Care Medicine*, 2017; 21(1): 49–50. doi:10.4103/0972-5229.198327 [PMC free article] [PubMed] [CrossRef] [Google Scholar]
17. Belluardo N, Mudo G, & Bindoni M. Effects of early destruction of the mouse arcuate nucleus by monosodium glutamate on age-dependent natural killer activity. *Brain Research*, 1990; 534(1–2): 225–233. [PubMed] [Google Scholar]
18. Bertrand G, Puech R, Loubatieres-Mariani MM, & Bockaert J. Glutamate stimulates insulin secretion and improves glucose tolerance in rats. *American Journal of Physiology*, 1995; 269(3Pt1): E551–556. doi:10.1152/ajpendo.1995.269.3.E551 [PubMed] [CrossRef] [Google Scholar]
19. Bertrand G, Ravier M, Puech R, Loubatieres Mariani MM, & Bockaert J. Effects of glutamate on glucose tolerance and insulin secretion in a rat model of type II diabetes. *Diabetologia*, 1997; 40: 514–514. [Google Scholar]
20. Beyerle J, Frei E, Stiborova M, Habermann N, & Ulrich CM. Biotransformation of xenobiotics in the human colon and rectum and its association with colorectal cancer. *Drug Metabolism Reviews*, 2015; 47(2): 199–221. doi:10.3109/03602532.2014.996649 [PubMed] [CrossRef] [Google Scholar].
21. Kurihara K. Glutamate: from discovery as a food flavor to role as a basic taste (umami). *Am J Clin Nutri*, 2009; 90: 719S-22S.
22. Loliger J. Function and importance of glutamate for savory foods. *J Nutri*, 2000; 130: 915-20.
23. S. Basic properties of umami and effects on humans. *Physiol Behavior*, 1991; 49: 833-41.
24. Halpern BP. Glutamate and the flavor of food. *J Nutri*, 2000; 130: 910S-4S.
25. Sano C. History of glutamate production. *Am J Clin Nutri.*, 2009; 90: 728-32.
26. Yamaguch S. Technical committee, umami manufacturers association of Japan. What is umami?. *Food Reviews Int.*, 1998; 14: 123-38.
27. Accent flavor enhancer. Accent flavor com. B&G Foods, Inc. Retrieved, August 11, 2014.
28. Institute of Food Technologists. Expert panel on food safety and nutrition. Monosodium Glutamate. *Food Technol*, 1987; 41: 143-5.
29. Schiffman SS. Intensification of sensory properties of foods for the elderly. *J Nutri*, 2000; 130: 927S-930S.
30. Mojet J et al. Taste perception with age: generic or specific losses in threshold sensitivity to the five basic tastes. *Chem Senses*, 2001; 26: 845-60.
31. Bellisle F et al. Monosodium glutamate affects mealtime food selection in diabetic patients. *Appetite*, 2003; 26: 267-76.
32. Onyema OO et al. Effect of vitamin E on monosodium glutamate induced hepatotoxicity and oxidative stress in rats. *Ind J Biochem Biophys*, 2006; 43: 20-4.
33. Farombi EO, Onyema OO. Monosodium glutamate induced oxidative damage and genotoxicity in rat: Modulatory role of vitamin C, vitamin E and quercetin. *Human Experi Toxicol*, 2006; 25: 251-9.
34. Diniz YS et al. Toxicity of hyper caloric diet and monosodium glutamate: Oxidative stress and

- metabolic shifting in hepatic tissue. Food Chem Toxicol, 2004; 42: 319-25.
35. Singh P et al. Prolonged glutamate excitotoxicity effects on mitochondrial antioxidants and antioxidant enzymes. Mol Cell Biochem, 2003; 243: 139-45.