CODEN (USA): IAJPBB ISSN: 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

http://doi.org/10.5281/zenodo.377017

Available online at: http://www.iajps.com *Research Article*

HEPATO-PROTECTIVE EFFECT OF AQUEOUS LEAF-EXTRACT OF *TALINUM TRIANGULARE* IN MONOSODIUM GLUTAMATE (MSG) INDUCED HEPATIC DAMAGE IN ALBINO RATS

Aja P. M[1], Udeh S.M.C[2], Opajobi A. O[3], Uzuegbu U. E[3], Alum E. U[1], Edwin N[1]. And Ugwu Okechukwu P.C[1]

[1.] Department of Biochemistry, Faculty of Sciences, Ebonyi State University Abakaliki, Nigeria.
[2]Department of Biochemistry, University of Nigeria Nsukka, Enugu State, Nigeria.
[3]Department of Medical Biochemistry, Faculty of Basic Medical Sciences, Delta State University, Abraka, Delta State, Nigeria.

Received: 28 December 2016 **Accepted:** 28 January 2017 **Published:** 28 February 2017

Abstract:
Hepato-protective effect of aqueous leaf-extract of Talinum triangulare on monosodium glutamate (MSG) induced hepatic damage in albino rats. Liver damage was induced via oral intubation with MSG in two test groups; one group was not treated while the other group was treated with aqueous leaf-extract of Talinum triangulare at 100,200 and 400 mg/kg body weight of rats twice for 1 week respectively. One group was not induced and received distilled water only. The Liver enzymes activities were determined from plasma transaminase activities of the rats. Twenty eight albino rats were grouped into A, B and C. Group B and C were further subdivided into B_1, B_2, B_3, C_1, C_2 and C_3 respectively. Each group contained four rats. MSG was administered in all the B and C sub-groups except group A (Positive control). Group B_1-B_3 (negative control) were not administered aqueous leaf-extract of Talinum triangulare while groups C_1-C_3 were administered aqueous leaf-extract of Talinum triangulare and MSG orally twice daily for 1 week at varying doses of 100, 200 and 400mg/kg body weight. The liver enzymes levels were determined using spectrophotometric method. The result showed a significant ($P<0.05$) increase in the levels of ALT, AST and ALP in a dose dependent manner in albino rats administered MSG solution without treatment. The result revealed that there were significant ($P<0.05$) reductions in AST, ALT and ALP levels in rats treated with aqueous leaf-extract of Talinum triangulare in a dose dependent manner in group C. The study revealed that MSG has potential to increase liver enzymes and the administration of Talinum triangulare (water leaf) extract together with MSG to albino rats may be responsible for the decreased level of liver enzymes.

Key words: *Talinum triangulare, MSG, Aqueous leaf-extract, Hepato-protective effect and transaminase activities and ALP Activity.*

Corresponding Author:
Aja P. M,
Department of Biochemistry,
Faculty of Sciences,
Ebonyi State University Abakaliki,
Nigeria.

QR code

Please cite this article in press as Aja P.M et al, ***Hepato-Protective Effect of Aqueous Leaf-Extract of Talinum Triangulare in Monosodium Glutamate (MSG) Induced Hepatic Damage in Albino Rats****, Indo Am. J. P. Sci, 2017; 4(02).*

INTRODUCTION:

Monosodium glutamate (MSG), the sodium salt of amino acid glutamate, is a food additive, popularly used as "flavour enhancer" foods. It is sold as a fine white crystalline substance, similar in appearance to table salt (NaCl) and sugar, and used to enhance the natural flavour of certain foods (for example meat, vegetables and soups), without adding significant flavour of its own [1]. Trade name of monosodium glutamate includes Ajinomoto, vetsin and Tasting powder [2]. It was once made predominately from wheat gluten, but is now made mostly from the fermentation of carbohydrates with a nitrogen source, using bacteria or yeast species from genera such as *Brevibacterium Arthrobacter, microbacterium, micrococcus and Corynebacterium* [3] .

MSG was originally made in the Orient from seaweed but in modern Japan, it is made from bean protein. In the United States of America, it is made from cereal protein, glutein obtain from wheat and from sugar beets [4]. MSG has been used medically to treat hepatic coma[5]. However, unfavorable effects have been reported following its consumption. Such effect include headache, infra orbital pressure, Chinese resultant syndrome and increase activity of ALT (alanine aminotransferase) as found in acute hepatic disease [4].

The liver is the second largest organ in the human body after the lungs and it is one of the five vital organs. The liver conducts several hundreds of function every second; it metabolizes nutrients and substance, helps with food digestion and cleans the blood. It also stores many vitamins and minerals [6]. The liver contains numerous enzymes, some of which are also present in the serum in very low concentrations. These enzymes have not been reported to have any known function in the serum other than to provide information of the hepatic state and disorders [7]. Egbuonu *et al*. (2009) [8] and Ayalogu *et al.*(2001)[7] reported that elevated serum Aspartate aminotransferase , alanine aminotranferase and alkaline phosphatase levels are indicators of liver injuries/diseases. The apparent of presumed mechanisms responsible for the elevation of the activities of these enzymes includes an increase in their rate of release from the tissues and organs where they perform specific duties increase in the amount available for release, and decrease in the rate of disposition [7]. These mechanisms tend to increase the level of activities of the enzymes in the serum [7].

For the past 30 years, the use of MSG has been controversial. Its safety has been doubted because of reports of adverse reaction in people who have eaten food that contain MSG (FDA, 1996). Many researches on the role of glutamate in the nervous system have also raised questions on the chemical safety of MSG [9].

Talinum triangulare (water leaf) is an herbaceous, perennial, coalescent and glabrous plant widely grown in tropical regions as a leaf vegetable [10]. It is consumed as a vegetable and constituent of a sauce in Nigeria. In Nigeria, it is widely distributed and consumed as a leafy vegetable in the Southern ecological zones. Its leaves are used as softener of other vegetable species in vegetable soup [11]. However, despite that the leaves are used as a natural softener of other vegetable species during vegetable soup preparation [11]. Despite that the hepato-toxic effect of MSG has been established. The manufacturer of the products still packaged it in different forms as food enhancer. No information has been published on the role of some local vegetables in preventing the hepato-toxic effect of MSG. In order to ascertain the medicinal and protective values of the vegetable species and thereby stimulate interest in its utilization beyond the traditional localities, this study was designed to evaluate the hepato-protective effect of aqueous leaf-extract of *Talinum triangulare* (water leaf) in MSG induced liver damage in albino rats.

MATERIALS AND METHODS:

Materials

Equipment and Instrument:

The equipment and instruments used were of analytical standards.

Chemicals and Reagents: The chemicals and reagents used were of analytical grades

Collection of Plant Materials

Fresh leaves of *Talinum triangulare* (water leaf) were collected from Akpunuoke Amagu Ishiagu, Ivo local government area of Ebonyi State between the month of August and September, 2015. The plant sample was identified by a taxonomist, Prof. S. S. Onyekwelu of the Department of Applied Biology, Ebonyi State University, Abakaliki, Nigeria. A voucher specimen was deposited at the herbarium in the Department of Applied Biology, Ebonyi State University, Abakaliki, Nigeria, for reference purposes.

Preparation of Stock Solution of Monosodium Glutamate (MSG)

Ten grams of monosodium glutamate (MSG) was measured using electrical weighing balance and was dissolved in a beaker containing 100 ml of distilled water and preserved in a refrigerator.

Experimental Animals

Twenty eight Wister male albino rats weighing between 80–120g (4-6-weeks old) were obtained from the animal house of the faculty of Veterinary Medicine University of Nigeria, Nsukka. They were acclimatized for seven days in stainless steel cages under good laboratory conditions. They were fed with commercial poultry growers mash feed (Vital feed®, Jos, Nigeria). Clean water was provided daily and access was free. The animals were weighed using triple beam weighing balance. Handling, management and use of animals for the experiment were as such that allowed minimal stress. Faculty of Science, Ebonyi State University, Abakaliki Animal Ethical Committee approved the animal study.

Experimental Design

The animals were divided in to seven(7) groups of 4 rats each (A, B_1, B_2, B_3, C_1, C_2 and C_3). The albino rats were then subjected to the following treatment for 7 days.

Group A which served as the control were fed with distilled water and animal feed for seven days twice daily.

Group B_1 received 100mg/kg body weight of MSG twice daily through oral intubation for seven days.

Group B_2 received 200mg/kg body weight of MSG twice daily through oral intubation for seven days.

Group B_3 received 400mg/kg body weight of MSG twice daily through oral intubation for seven days.

Group C_1 received 100 mg/kg body weight of aqueous leaf-extract of *Talinuim triangulare* and100mg/kg body weight of MSG twice daily via oral intubation for seven days.

Group C_2 received 200 mg/kg body weight of aqueous leaf-extract of *Talinuim triangulare* 200mg/kg body weight of MSG twice daily via oral intubation for seven days.

Groups C_3 received 400 mg/kg body weight of aqueous leaf-extract of *Talinuim triangulare* and 400mg/kg body weight of MSG twice daily via oral intubation for seven days.

Blood Collection and Preparation

After the end of seven days, the animals were starved and were sacrificed the next day. Their blood samples were collected individually with sterile capillary tube into properly labeled specimen bottle by ocular puncture technique. The blood samples thus collected were allowed to clot and then centrifuge 3000rpm (revolution per minute) for 10minutes. After centrifugation, the serum was then separated from the whole blood and used for assay of serum aspartate aminotransferase activity (AST), alanine aminotransferase (ALT) and serum alkaline phosphatase (ALP). **Determination of Liver Enzymes and Alkaline phosphatase**

Aspartate aminotransferase (AST), Alanine aminotransferase (ALT), and Alkaline phosphatase (ALP) were determined by method described by Carl and Edward, 1999 and Reitman and Frankle, 1957[12,13].

Data Analysis

Results were expressed as mean standard deviation. The one-way analysis of variance (ANOVA) was used to analyze the data followed by post-hoc tests. The results are considered significant at $P<0.05$.

RESULT:

Results of liver enzymes in Albino rats administered Monosodium glutamate (MSG0 and Aqueous Leaf-Extract of *Talinum triangulare*

The result showed a significant (P<0.05) increase in the levels of ALT, AST and ALP in a dose dependent manner in albino rats administered MSG solution without treatment (Figure 1-3). The result revealed that there were significant (P<0.05) reductions in AST, ALT and ALP levels in rats treated with aqueous leaf-extract of *Talinum triangulare* in a dose dependent manner (Figure 1-3).

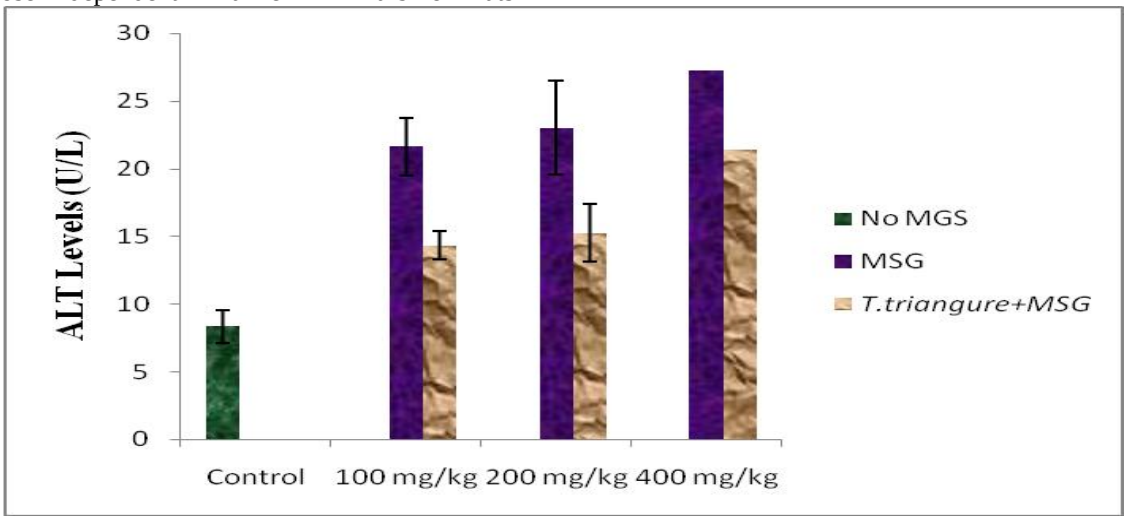

Fig 1: ALT Level in Albino rats Admistered MSG and Aqueous Leaf-Extract of *Talinum triangulare*

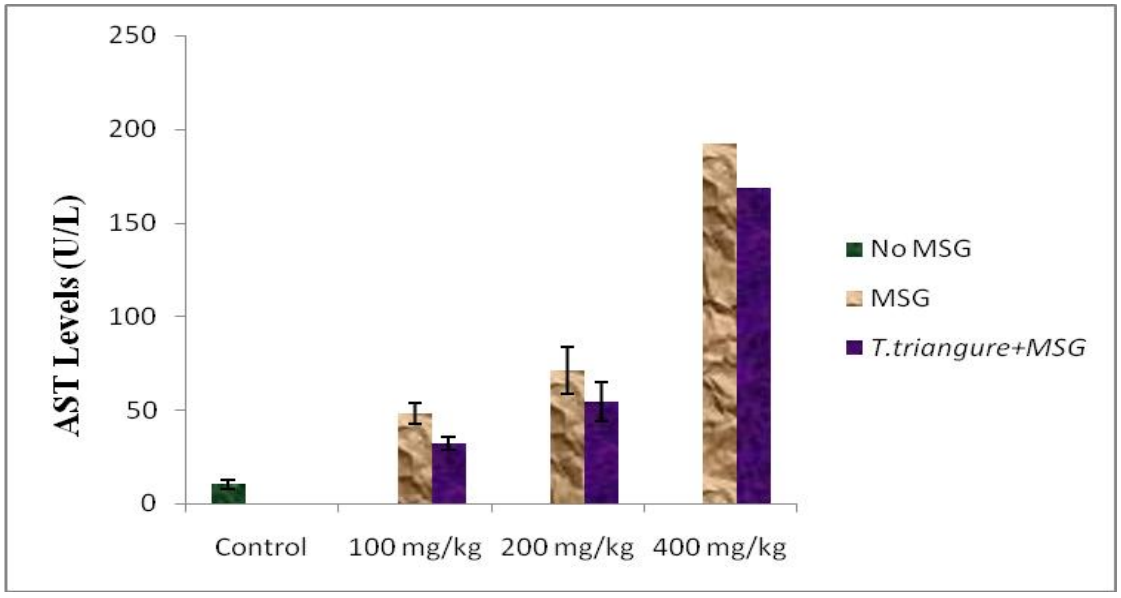

Fig 2: AST Level in Albino rats Admistered MSG and Aqueous Leaf-Extract of *Talinum triangulare*

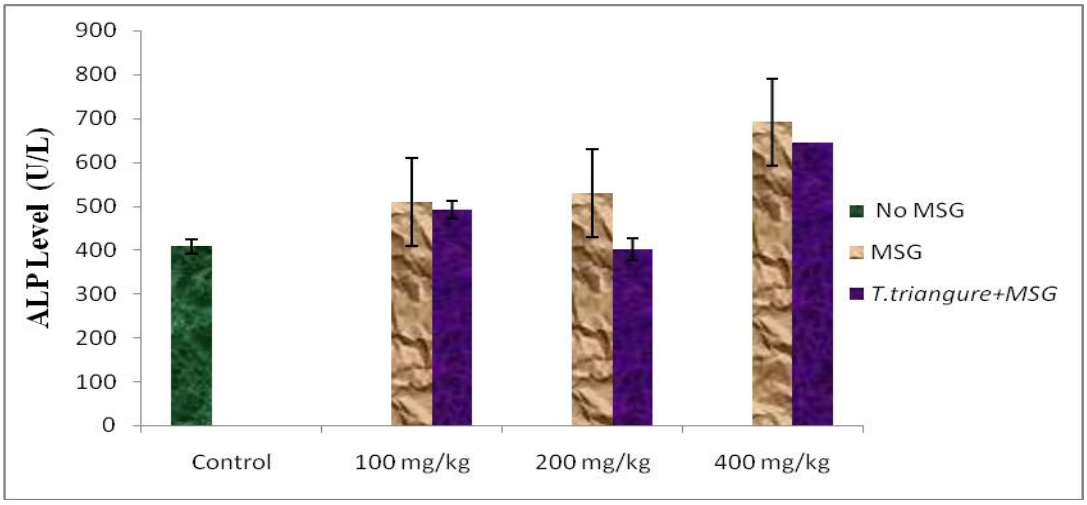

Fig 3: ALP Level in Albino rats Admistered MSG and Aqueous Leaf-Extract of *Talinum triangulare*

Weight of Albino rats during seven days of Administration.

The result showed a significant ($P<0.05$) increase in the weight of the rats in the groups administered compared to the control as shown in figure 4.

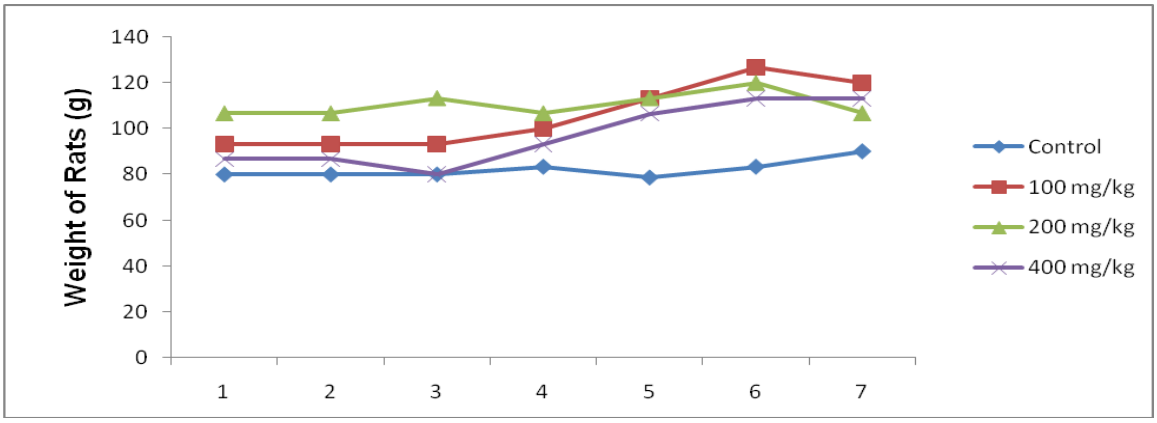

Fig 4: Weight of Rats during Seven Days of Administration

DISCUSSION:

Monosodium glut*a*mate (MSG) is one of the most common food additives which is widely used as a popular flavour enhancer in a variety of foods prepared at homes, in restaurants and by food processors in today's world [31,32]. The result revealed that MSG to be hepato-toxic by raised levels of AST, ALT and ALP (Figure 1-3). The result also showed that the administration of MSG and Aqueous Leaf-Extract of *Talinum triangulare* were able to reduced raised levels of the liver enzymes (Figure 1-3). Bian (2003) [14] had reported increase level of AST in rat treated with MSG. In addition, the observed increase in serum AST level in rats administered with MSG may be indicative of myocardial infarction as reported by Rodwell and Kennelly (2003) [15]. The observation agrees with the previous reports of Farombi and Onyeoma (2006) and Onyeoma *et al.*, (2006)[16,17] that the activity of serum AST increased in male rats that were fed MSG.

In particular, damage to the brain may occur since MSG could spike blood plasma levels of glutamate, which is an excitotoxin [18,19,20].

High level of excitotoxins have been shown in animals studies to cause damage to areas of the brain unprotected by the blood-brain barrier leading to a variety of chronic diseases [21,22]. Therefore, such damage to brain may lead to the observed increase in the serum AST activity with MSG treatment. Thus, the result may imply that the oral intake of MSG at low dose may be destructive to the liver and other organs with high metabolic activity which may have adverse health implication, hence has to be used with caution.

The result also revealed an increase in ALT level in albino rats administered MSG (Figure 2). The ALT enzyme is a sensitive marker of liver damage [23]. The result agrees with the report of Farombi and Onyeoma (2006) and Onyeoma *et al.,* (2006) [16,17] that the activity of serum ALT increased in male rats that were fed MSG in the liver. The result showed an increase in ALP level at 400mg/kg body weight of MSG (figure3). Egbuonu et *al.* (2009) [8] reported an increased in ALP, AST and ALT activities in albino rats treated with MSG. This increase in ALP level may indicate possible presence of adverse effect of high dose of MSG intake on the pathologies of bone since increased serum ALP activity has been associated with bone disease (Bush, 1991) [24]. This finding however, agrees with previous report of Elefteriou *et al.,* (2003)[25] that MSG treatment caused hypogonadism, a condition inducing bone loss in mice.

The observed reduction in liver enzymes levels in albino rats administered with water leaf extract and MGS may be attributed to high level of flavonoids and other antioxidants phytochemicals in *Talinum triangulare* leaf. Aja *et al.* (2010)[11] reported the high level of flavonoids in *Talinum triangulare* leaf in both dry and wet samples. Offor *et al*. and Aja *et al.* (2015)[28,29] also reported the presence antioxidant phytochemicals in various concentrations in *Terminalia catappa* leaf, *Cajanus cajan* leaf and seed respectively. Nwali *et al*.(2013)[27] showed that *Bryophylum pinnatum* leaf contained low levels of phytochemicals. Aja *et al.* (2015)[26] also reported that *Cajanus cajan* leaf and seed are very rich in phytochemicals. Aja *et al.* (2015) also had reported the rich phytochemical contents of *Dissotis rotundifolia* leaf and root.

CONCLUSION:

The study revealed that MSG has potential to increase liver enzymes and the administration of *Talinum triangulare* (water leaf) extract together with MSG to albino rats may be responsible for the decreased level of liver enzymes.

REFERENCES:

1.Uwakwe, A. A. and Muonanu, M. O. Effect of monosodium glutamate on human serum alanine aminotransferase. *Nigerian Journal of Biochemistry and Molecular Biology* 2003;**18**(1):19-20.

2.Beyreuther, K., Biesalski, H. K. and Fernstrom, J. D. Monosodium glutamate-an update. *European Journal of Clinic Nutrition*, 2007;**61**(3):304-313.

3.Willians, A. N. and Woessner, K. M. Monosodium glutamate allergy: menace or myth. *Clinical and Experimental Allergy,2009;* **39**:640-646.

4.Uwakwe and Muonanu, in normal adults ingesting aspartame andmonosodium L-glutamate as part of a soup/beverage meal Metabolism,2003; 36(11): 1073-1079.

5.Gwinn, R. P., Norton, P. B. And Goatz, P. N. (1971). Monosodium Glutamate. Encyclopaedia Britannica, Inc. 15th edition, 8 : 265 – 266.

6.Collision, K. S., Maqbool, Z. and Saleh, S. M. Effect of dietary monosodium glutamate on trans fat-induced non-alcoholic fatty liver disease. *Journal of Lipid Research* ,2009;**50**(8):1521-1537.

7.Ayalogu, O. E., Igbo, N. M. and Dede, E. B. Biochemical changes in serum and liver of albino rats exposed to petroleum samples (gasoline, kerosine and crude petroleum). *Journal of Applied Science and Environmental Management,2001;* **5**(1):97-100.

8.Egbuonu, A. C. C., Obidoa, O., Ezeokonkwo, C. A., Ezeanyika, L. U. S. and Ejikeme, P.

M. Hepatotoxic effects of low dose oral administration of monosodium glutamate in male albino rats, *African Journal of Biotechnology, 2009;8 (13): 3031-3035.*

9.Blaylock, R. L. (1994). *Excitotoxin*: The taste that kills. *Santafe*, National Medical Health Press.

10.Adewunmi, A. O. and Sofowora, E. A. (1980). Preliminary Screening of some Plant

Extract for Mulluscidal Activity, Planta Medical, 39: 57-82.

11.Aja, P.M., A.N.C. Okaka, P.N. Onu, U.A. Ibiam and A.J. Uraku. Phytochemical Composition of *Talinum triangulare* (Water Leaf) Leaves. 2010;Pakistan *Journal of Nutrition*, 9(6): 527-530.
12.Carl, A. A. and Edward, R. A. (1999).Tietz Textbook of Clinical Chemistry.3rd edition, W. B. Saunders Company, Philidelphia, 651-684.
13.Rietman, S. and Frankel, S.A.Calorimetric Method of serum glutamic oxaloacetate transaminase and Glutamic pyruvate transaminase.1957; *American journal of clinical pathology* **28**(7): 56-67.
15.Rodwell, V. W. and Kennelly, P. J. (2003). Enzymes: mechanism of action in:Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. edition. Harper's Illustrated Biochemistry 26th Edition Lange Medical Books/McGraw-Hill, New York 7: 57.
16.Farombi, E. O. and Onyeoma, O. O. Monosodium Glutamate Induced Oxidative damage and Genotoxicity in Rat: Modulatory Role of Vitamin C, Vitamin E and Quercetin. 2006;*Journal Human Experimental Toxicology*, **25**:251-259.
17.Onyeoma, O. O., Farombi, E. O., Emerole, G. O. and Onyeoma, G. O. Effect of vitamin E on monosodium glutamate induced hepatotoxicity and oxidative stress in rats. *Indian Journal of Biochemical and Biophysics,2006;* **43**:20-24.
18.Stegink, L. D., Filer Jr, L. J., and Baker, G. L.. Plasma glutamate concentrations in adult subjects ingesting monosodium L-glutamate in consomme. *American Journal of Clinical Nutrition, 1985;*42: 220-225.
19.Stegink, L. D., Filer Jr, L. J. and Baker, G. L. (1987). Plasma amino acid concentrations.
20.Himwhich WA, Peterson IM (1954). Ingested sodium glutamate and plasma levels of glutamic acid. Journal of Applied Physiology, 7 (2): 196-199.
21.Meldrum, B. (1993). Amino acids as dietary excitotoxins: a contribution to understanding of neurodegenerative disorders. Brain research. Brain research reviews 18 (3): 293-314.
22.Nemeroff, C. (1980). Monosodium glutamate-induced neurotoxicity: Review of the literature and call for further research. Nutrition &Behavior edited by Sanford A. Miller (U.S. Food & Drug Administration): p. 177-211.
23.Al-Mamary, M., Al-Habori, M., Al-Aghbari, A. M. and Baker, M. M. (2002). Investigation into the toxicological effects of Catha edulis leaves: a short-term study in animals. Phytoether Res. 16: 127-132.
24.Bush BM (1991). Interpretation of laboratory results for small animal clinicians. Blackwel Scientific Publications. Oxford.
25.Elefteriou, F., Takeda, S., Liu, X., Armstrong, D. and Gerard, K (2003). Monosodium glutamate-sensitive hypothalamic neurons contribute to the control of bone mass. Endocrine, 144 (9): 3842-3847.
26.Aja, P.M., Alum, E.U., Ezeani, N. N., Nwali, B. U and Edwin, N.(2015). Comparative Phytochemical Composition of *Cajanus cajan* Leaf and Seed, *International Journal of Microbiological Research* 6 (1): 42-46.
27.Aja, P. M., Nwachukwu, N., Ibiam, U. A., Igwenyi, I. O., Offor, C. E and Orji, U. O. Chemical Constituents of *Moringa oleifera* Leaves and Seeds from Abakaliki, Nigeria,2014; *American Journal of Phytomedicine and Clinical Therapeutics* 2(3):310-321.
28.Nwali, B. U., Okaka, A. N. C., Ibiam, U. A., and Aja, P. M. Phytochemical Composition of *Bryophyllum pinnatum* Leaves,2012; *International Journal of Advanced Biological Research* (IJABR), *Volume 2(3):1-3*
29.Offor, C. E., Ugwu, Okechukwu, P. C., Aja,,P. M. and Igwenyi, I. O. Proximate and Phytochemical Analyses of *Terminalia catappa* Leaves, *European Journal of Applied Sciences*, 2015;7 (1): 09-11.
30.Aja, P. M., Alum, E. U., Ezeani, N. N., Nwali, B. U. and Edwin, N. Comparative Phytochemical Composition of *Cajanus cajan* Leaf and Seed, *International Journal of Microbiological Research,2015;* 6 (1): 42-46.
31.Federation of American Society for Experimental Biology (FASEB) (1996). Safety of amino acid used as supplements/enhancement. Life Science **19**:223-288.
32.Food and Drug Administration (FDA) (1996). Monosodium glutamate. Food and Drug Administration *Background*, 91-97.