Effect of Vitamin E on Monosodium glutamate in some biochemical and Immunity parameters in Rats

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**A B S T R A C T:**

The purpose of this study was to investigate the role of vitamin E in reducing the effect of monosodium glutamate in some biochemical and immunological variables in adult male rats for 28 days. The results showed a significant decrease in (P <0.05) in the efficacy of all enzymes measured for vitamin E groups compared with groups of animals that were dosage with monosodium glutamate alone. This study showed a significant decrease in the values of creatinine and urea when added vitamin E with MSG compared with the groups of animals added the monosodium glutamate alone. The results of the study showed a significant increase in in immunoglobulin IgM and IgA for groups treated with vitamin E and MSG compared with the values of the groups of animals that were dosage with monosodium glutamate alone.

KEY WORDS: Monosodium glutamate, Vit. E, biochemical and immunity parameters

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1. INTRODUCTION:

Monosodium glutamate (MSG) is the sodium salt of glutamic acid (Eweka, 2007). Previous studies have shown MSG causes oxidative stress and damage in the brain, kidneys, and liver (Shivasharan \textit{et al}, 2013). Monosodium glutamate (MSG) is one of the most widely used taste enhancer enhancer in food industry in the world (Attia \textit{et al}, 2016). Hamza and AL-Harbi (2014) found that supplementation of selenium or vitamin E could ameliorate testicular toxicity caused by MSG consumption and reduced the oxidative stress on testis tissues. The Food and Drug Administration (FDA) of the United States reports that MSG is safe and that it should be maintained on the “Generally Recognized as Safe” (GRAS) list of foods (FDA, 1995). MSG has a toxic effect on the testis by causing a significant oligozoospermia and increase abnormal sperm morphology in a dose dependent fashion in male Wistar rats (Onakewhor \textit{et al}, 1998). It has been implicated in male infertility by causing testicular hemorrhage, degeneration and alteration of sperm cell population and morphology (Oforofuo \textit{et al}, 1997). It affects liver and kidney functions parameters causing an increase in serum ALT, AST, ALP, total protein, Albumin, Globulin, total cholesterol and TG levels (AbdelReheim \textit{et al}., 2014), urea and creatinine levels (Tawfik and Al-Badr, 2012). It is necessary to find methods that can prevent or even minimize the deleterious effect and health hazards of MSG (Attia \textit{et al}, 2016). The preventive effect of vitamin E on cypermethrin or endotoxin induced oxidative stress in rat tissues is suggestive of its antioxidant activity (Atessahin \textit{et al}., 2005). Farombli, 2006 has shown that dietary antioxidants such as Vitamin C and Vitamin E has a modulator effects on MSG induced serum urea oxidative damage in the liver and kidney of rats. The variation in the level of urea and creatinine
are markers of renal dysfunction. The preventive effect of vitamin E on cypermethrin or endotoxin-induced oxidative stress in rat tissues is suggestive of its antioxidant activity (Avanzo et al., 2001). It has also shown protective effect against nephrotoxicity (Burtis and Ashwood, 1999. The antioxidant vitamins C and E and the polyphenolic compound quercetin have been shown to be effective against MSG induced damage in rat livers, kidneys, and brains (Farombli and Onyema, 2006). Therefore, the increased activities of ALT, AST and ALP in the serum of MSG treated animals might have resulted from the liver injury caused by the MSG induced oxidative stress (Ateya et al., 2016). Vit. E significantly reduced the oxidative stress and hepatic toxicity induced by MSG (Onyema et al., 2006).

Materials and methods

Animals

Adult albino rats of both sex with average weight of 120 - 140 g were obtained from college of veterinary medicine, Tikrit University. Animals divided to six groups: G1: Control, G2: MSG 1 g, G3: MSG 3 g, G4: MSG 1 g and vit. E 200 mg, G5: MSG 3 g and vit. E 200 mg. The animals were housed in cages under standard hygienic conditions and were fed with rat chow and water. In order to optimize treatment doses, all animals were fasted for 10 h prior to treatment administration.

Chemicals

MSG was purchased from BDH laboratory (UK), vitamin E were obtained from Sigma Aldrich Chemicals Co. (USA).

Blood samples collection

At the end of treatment period the animals were sacrificed 24 hr. Blood samples were withdrawn and collected in glass tubes. Serum was separated by centrifugation at 3000 rpm for 10 min and stored at freezing bending biochemical analysis.

Biochemical Assays

Determination of liver enzymes:

ALT, AST and ALP enzymes which was measured by used the Kit analysis from ROCHE Company with the Reflotron system (Tietz, 2005).

Determination of Urea and Creatinine:

Urea and Creatinine which was measured with the spectrophotometer at 580 and 490 nm by used Kit analysis from BIOLABO Company (France) (Tietz, 1999) (Tietz, 2005).

Estimation of Immunity:

Immunoglobuline of IgM and IgA was estimation by (Aggarwal et al., 1994).

Statistical Analysis

Results obtained from the experiment were analyzed using analysis of variance (SAS, 2001), while comparisons were made using the Dunnet’s test at P < 0.05 level of significance (Duncan, 1955).

Results and discussion

Table 1 show activities of ALT, AST and ALP enzymes that were measured in serum samples. Significant (p < 0.05) increases in all enzymes ALT, AST and ALP was observed in the MSG treated rats compared to control group with increase concentration of MSG, (86.50, 98.50) (137, 147.5) (133, 144.5) respectively. Vit. E when added with MSG make to reduced in all concentration of all enzymes at (76.0, 87.5) (131.5, 141.5) (121.0, 136.0) compared with MSG when added only. That may be resulted from hepatotoxicity and liver damage, as the more severe the liver damages the higher the release of the liver enzymes (El-Khayat et al., 2009). Since these additives cause damage of liver cells and cellular degeneration or destruction in the liver as the hepatic cell membrane is damaged, varieties of enzymes normally located in the cytosol are released into the blood stream (Etim et al., 2006). Therefore, When the added Vitamin E with MSG make Significant decrease in all enzyme concentration compared with MSG was added only. This increase could also be explained by free radical production which reacts with polyunsaturated fatty acids of cell membrane leading to impairment of mitochondrial and plasma membranes resulting in enzyme leakage (Poli et al., 1990). The result seemingly agrees with the reports of (Farombli and Onyema, 2006 : Onyema et al, 2006) that the activity of serum enzymes increased in male rats that were fed MSG probably due to the finding that MSG induced oxidative stress in the liver. An increase in the activities of these enzymes indicates an effect due to the doses. Administration of Vit. E resulted a significant reduction in the serum level of ALT, AST and ALP enzyme at both MSG doses. The use of Vit. E found to be more effective in improving in the serum level enzyme.

The activities of the serum enzyme markers of hepato-cellular injury enzyme increased significantly by MSG administration at concentration of 1.6 mg/g body weight. Vitamin E when administrated with MSG reduced the activity of enzyme (Tietz, 1986). Therefore, the
increased activity of enzyme in the sera of MSG treated animals might have resulted from the liver injury caused by the MSG-induced oxidative stress. A similar trend was observed in the study of Onyema et al., 2006 when adding Vitamin E with MSG.

**Table 1: Role of vit. E to reduce effect of monosodium glutamate in some enzymes parameters in male rats.**

| Treatment   | Concentration | ALP     | AST     | ALT     |
|-------------|---------------|---------|---------|---------|
| Control     |               | 50.00d  | 100.00d | 96.00d  |
| MSG         | 1 g /kg       | 86.50b  | 137.00b | 133.00b |
|             | 3 g/kg        | 98.50a  | 147.50a | 144.50a |
| Vitamin E + | 1 g /kg +     | 76.00c  | 131.50c | 121.00c |
| MSG         | 200 mg /kg    |         |         |         |
|             | 3 g/kg + 200 mg /kg | 87.50b  | 141.50b | 136.00b |

The results in table 2 show to the significant increase in level of urea and creatinine when added MSG in both concentration (54.0 , 62.52) (1.55 , 1.99) mg/dl compared with control group (47.0 , 0.74) mg/dl. Vit. E made reduce of concentration of urea and creatinine when added with MSG ( 50.5 , 56.5 ) ( 1.10 , 1.64 ) compared with MSG added only.

**Table 2: Role of vit. E to reduce effect of monosodium glutamate in some biochemical parameters in male rats.**

| Treatment   | Concentration | Urea mg/dl | Creatinine mg/dl |
|-------------|---------------|------------|------------------|
| Control     |               | 47.00d     | 0.74d            |
| MSG         | 1 g /kg       | 54.00b     | 1.55b            |
|             | 3 g/kg        | 62.52a     | 1.99a            |
| Vitamin E + | 1 g /kg + 200 mg /kg | 50.50d     | 1.10c            |
| MSG         | 3 g/kg + 200 mg /kg | 56.50b     | 1.64b            |
These results were accepted with (Anwar and Mohammed, 2010 : Eman et al, 2017) they showed to significant increase in Urea and Creatinine when dosage MSG to rats. High levels of urea and creatinine in blood serum considered indicator on the low renal nomination ( Lieske et al, 2005). The significant increase in Urea and creatinine content of the serum following the administration of MSG may be attributed to compromise of the renal functional capacity. MSG might have either interfered with creatinine metabolism leading to increased synthesis or the tissues might have compromised all or part of its functional capacity of tubular excretion (Vinodini et al, 2010). Exposure to MSG may cause an adverse effect on the renal function which might be due to oxidative stress induced by MSG on the renal tissue. Addition of Vit. E resulted in a significant improvement in the serum levels of biochemical parameters in kidneys. Farombli, 2006 has shown that dietary antioxidants such as Vitamin C and Vitamin E has a modulator effects on MSG induced serum urea oxidative damage in the liver and kidney of rats. The variation in the level of urea and creatinine are markers of renal dysfunction.

Table 3: Role of vit. E to reduce effect of monosodium glutamate on some Immunity parameters in male rats.

| Treatment       | Concentration | IgM   | IgA   |
|-----------------|---------------|-------|-------|
| Control         |               | 66.20a| 86.50a|
| MSG             | 1 g /kg       | 43.70c| 63.60d|
|                 | 3 g/kg        | 30.60d| 38.20e|
| Vitamin E + MSG | 1 g /kg +     | 55.60b| 70.00c|
|                 | 200 mg /kg    |       |       |
|                 | 3 g/kg +      | 42.90c| 50.75b|
|                 | 200 mg /kg    |       |       |

Table 3 show to significant increase in immunoglobuline levels IgM and IgA when added Vit. E with MSG in both concentration 1, 3 g / kg body weight (55.60, 42.90) (70.0, 50.75) respectively compared with animals groups MSG added alone (43.70, 30.60) (63.60, 38.20). These results was agree with Sadia, (2012) found reduce in activity of immunoglobuline compared with animal control group when added Vit. E. Vit. E made to increase of immunity system in the body through the increase of immune cells thus increase in objects immune (Tokura et al, 1999).

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