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Research article

The effect of monosodium glutamate alone or with lycopene on some physiological and biochemical parameters in adult male rats.

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Abstract

In the current investigation, the antioxidant action of lycopene was examined experimentally through deference en route for its protecting properties in contrast to the effect of monosodium glutamate which prompted oxidative stress happening in rats. Sixty of male rats divided randomly in to six groups (ten in each) were use in my study. G1 represented control, in which administered normal saline. G2 was given MSG (20 mg/kg) for 30 days, by orally administration. The third group received MSG (20 mg/kg, 15days) also orally administration followed with treatment by lycopene (200mg/kg) for another 15 days. G4 administrated in cooperation lycopene (200 mg/kg) for 15 days, also by orally administration followed treatment by MSG(20mg/kg)for another fifteen days. Rats in the fifth group received MSG (20 mg/kg) and lycopene(100mg/kg) also orally administration for thirty days. While the six group the rats received MSG (20 mg/kg) and lycopene (200 mg/kg) also orally administration for thirty days. The animals were mastered the body weight then euthanized after 30 days. The whole blood was collecting in order to determine the hematological levels as well as some of the serum hormone as well as ACTH, Cortisol, TSH,T3 and T4. The data showed that the body weight gain reduce in G4 and G5, while, RBCs parameters most of them showed increase in all co-treated groups, the result of ACTH all treated groups showed a significant increase ($p<0.05$) as compared with the control, cortisol level in all treated group had a significant decrease ($p<0.05$) as compared with the control. While, TSH level had not any significant differences. But, the result of T3 level had showed a significant decrease($p<0.05$) as compared with the control, while, T4 level was an increase only in MSG group. We found that treatment with lycopene reduced some of the harmful effects of MSG in rats and oxidative stress.

Keywords :- Hematology, Lycopene, *Monosodium glutamate*, Msg.

Introduction

Monosodium Glutamate is some of food improver, also it's vended in the almost shops in addition stocks in Nigeria as "Ajinomoto" sold by West African Flavor Company Limited. Certain compulsive conditions like the cancers which consequence as of the body's ordinary reactions to irregular ecological effects. Like the harmful outer effects as pathogenic microbes, nutritional absences, trauma, also genetic factors substitute only or in difficult communication through conservation reasons, source diseases. Large amounts of MSG can reason of a sensation of facial pressure, chest pain, headaches, extreme fluid retention, burning sensation, in addition sweating. The investigations have shown that exposure the body to glutamate in place of a transmitter and there are glutamate- responsive tissues all over encephalopathy related to liver disease (1). Nevertheless, an integrity of MSG treatment, has triggered combative

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using nearby as well as Worldwide (2). Currently, the safe concentration of MSG in foods and its toxicity in the human is still a debatable matter (3). Higher doses of MSG have displayed neurotoxic effect as it destructs neurons in the hypothalamic nuclei through their variations in the hypothalamo-pituitary- adrenal axis in animals (4). Lycopene is a dominant component of red-colored fruits and vegetables, including of 40 carbon atoms connected through unsaturated and conjugated double bonds (5). Lycopene has been defined to have anti-inflammatory, anticancer effects and lycopene consumption has been found to be related with decreases of the frequency of the prostate cancer, breast cancer, and lung cancer (6). Lycopene is present in tomatoes as an acyclic form of ß-carotene, whose eating can evolve high lycopene concentrations in blood which give a protective effect against myocardial infarction and anticancer of the digestive apparatus (7). Lycopene is one and only of an extreme powerful antioxidants also the best chief carotenoid in hominid plasma besides its hypothetical to become one of an active composites held accountable for the fitness profits of the tomato (8). Lycopene is moreover found in other sources such as: Gac fruit(*Momordica cochinchinensis*) tomato products, including tomato juice, ketchup, pizza sauce, watermelon, papaya, pink grapefruit, and pink guava (9). The aim of this study was to investigate if lycopene has the protective effect against MSG hazard on some of the physiological parameters in the adult male rats.

Materials and Methods:

Animal housing and management:

Sixty adult male rats used an average body weight between (350±25) gm. The animals were housed in individual cages measuring (50*50 cm), at the animals house of pharmacy collage, University of Basrah Iraq. All animals were exposed to the similar environment including climate management, feeding and acclimatization on the place for two weeks before treatment. The animals were kept under optimal condition (25±5Cº) and (12/12 hours light/dark cycle) during the study. The rats feed standard pellets and distal water.

Study design :

Frist group (**control**): Rats were given 0.25ml orally normal saline by oral gavage.

Second group(**MSG**) : Rats were given 0.25 ml of monosodium glutamate (20 mg/Kg BW) by oral gavage.

Third group(**G3**): Rats were given 0.25ml of MSG(20mg/kg BW) by gavage orally for 15 days and after that the animals given 0.25ml of Lycopene (200mg/kg BW) by oral gavage for other 15 days.

Fourth group(**G4**): Rats were given orally 0.25ml with Lycopene (200mg/kg BW) by gavage for 15 days and after that the animals were given orally 0.25ml by MSG (20 mg/kg BW) for another 15 days.

Fifth group(**G5**): Rats were given orally 0.25 ml of lycopene (200mg/kg BW) by gavage then after one hour the same animals had been given orally(0.25ml) of MSG (20 mg/kg BW) by gavage for 30 days.

Sixth group(**G6**): Rats were given orally 0.25ml of lycopene(100mg/kg) by gavage daily and after one hour the same animals had been given 0.25ml of MSG (20mg/kg BW) by gavage for 30 days.

The experiment continues for one month after that we measure the following parameters:

Body weight

The present experiment determined for 30 days, the animals were weighing up on zero days (pretreatment) then at the finale of the experiment. Body weight difference after 30 days of treatment was estimated according to the following equation:

Body weight change (g) = Final body weight (g) – Initial body weight (g)

Hematological study

The hematological tests were done in the laboratory of the collage of the pharmacy of Basrah university by using hematology analyzer (count 60 model Genex). The hematological parameters limited by the instrument were (RBCs, Hb, MCV, PCV,

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MCH, MCHC). The procedure done according to (10).

Hormones assay

The Adrenocorticotropic Hormone ACTH and Cortisol Hormone Immunoassay were tested by Enzyme-Linked Immuno-Sorbent Assay (ALPCO, USA). Estimation of serum thyrotropin (TSH) and total Thyroxin (T4) as well as total Triiodothyronine (T3) (Sigma-Aldrich, USA).

Results

Bodyweight

According to the results seen in Table (1), there is non-significant differences in initial body weight in all the treated groups as compared with the control group, while regarding the final body weight there is a significant increased ($p<0.05$) in all treated group compared with control group but less increased in both G4 and G5 compared with other treated. The results of body weight gain showed a significant decrease($p<0.05$) in G4 and G5 as a compared with the control and other treated groups, whereas the other group showed a significant increase ($p<0.05$) as a compared with the control group.

Table (1): Effect of MSG alone or with Lycopene on body weight. (Mean ± SE), n=6

Groups	*Body weight (gm)/month*		
	Initial body weight	**Final body weight**	**Body weight gain**
G 1 Control (normal saline)	327.00±22.95	402.50±14.40 a	75.50±12.82 a
G 2 MSG (20mg/kg)	320.67±21.41	401.83±16.15 a	81.17±11.69 a
G 3 MSG(20mg/kg) to lycopene(200/kg)	323.33±5.54	401.00±4.95 a	77.67±5.99 a
G 4 lycopene(200mg/kg) to MSG(20mg/kg)	335.50±10.98	386.83±15.86 b	51.33±8.21 b
G 50 MSG(20mg/kg) + lycopene(100mg/kg)	328.83±10.44	355.00±8.82 c	26.17±3.79 c
G 6 MSG(20mg/kg)+lycopene(200mg/kg)	337.17±25.98	400.00±25.32 a	62.83±6.77 ab
LSD	NS	13.56	15.67

The diverse small letters denote to significant differences at ($p< 0.05$).

Red Blood cells parameters

The results in table (2), showed a significant increased($p< 0.05$) 0f RBCs count in G3 and G4 as compared with control and other treated groups. It also seen that Hb concentration revealed a significant increased ($p<0.05$) in G3 as compared with control and all other groups, while G2 and G5 appeared a significant decreased($p< 0.05$) compared with control and other treated groups. The same table showed that the PCV percentage, is a significant increase in G3 compared with all treated group. Regarding the (MCV), it showed is a significant decreased ($p<0.05$) in G2 as a compared with the other groups. Furthermore, the results demonstrated a significant decreased ($p<0.05$) of (MCH) in G2 and G4 compared with control and other groups. Finely, the results of MCHC is also showed that there is a significant decreased($p< 0.05$)in all treatment groups as a compared with the control and G3.

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Table (2): Effect of MSG alone or with Lycopene on Red blood cells parameters. (Mean ±SE), n=6

Groups	*Red blood cells parameters*					
	RBCs ($\times 10^6$)	Hb g/dl	PCV %	MCV fL	MCH pg	MCHC g/dl
G 1 Control (normal saline)	5.47±0.47 b	11.10±1.01 bc	35.57±2.93 b	57.66±1.15 ab	20.16±0.48 a	35.40±0.75 a
G 2 MSG (20mg/kg)	4.71±0.53 b	10.53±1.15 c	32.96±3.32 b	52.66±1.15 b	17.06±0.54 c	32.91±0.85 b
G 3 MSG(20mg/kg) lycopene(200/kg)	7.12±0.50 a	13.19±1.07 a	41.16±3.11 a	58.35±1.08 a	20.95±0.51 a	33.40±0.79 a
G 4 lycopene(200mg/kg) MSG(20mg/kg)	6.45±0.58 ab	11.55±1.24 b	35.42±3.59 b	55.07±1.24 b	17.95±0.59 bc	32.62±0.92 b
G 5 MSG(20mg/kg) + lycopene(100mg/kg)	5.34±0.58 b	10.27±1.24 c	31.41±3.59 b	57.74±1.24 ab	18.79±0.59 b	33.13±0.92 b
G 6 MSG(20mg/kg)+lycopene(200mg/kg)	5.67±0.47 ab	11.09±1.01 bc	34.04±2.93 b	59.48±1.02 a	18.60±0.48 b	32.43±0.75 b
LSD	1.58	1.16	4.14	3.00	1.21	2.14

The dissimilar small letters talk about to significant differences at (p< 0.05).

Hormones.

The results in table (3) showed that, there is a significant increased (P<0.05) of adrenocorticotropic hormones level (ACTH) in all treated groups compared with the control. It is also showed that, there is a significant decreased (P<0.05) of cortisol hormone level in all treated groups compared with the control. In addition to that, the same table demonstrated no significant differences of thyroxin stimulating hormone (TSH) level between all groups. While it indicated that there is a significant decreased (P<0.05) of triiodothyronine (T3) in all treated groups compared with the control. Finally, it is also showed that, there is a significant increased (p<0.05) of tetraiodothyronine (T4) in G2 as a compared with the control also other treated groups.

Table (3) The Effect of msg alone or with Lycopene on some of hormones (mean± SE) n=6

Groups	ACTH Pg/ml	Cortisol Ug/dl	TSH mL/L	T_3 Ng/dl	T_4 ug/dl
G 1 Control (normal saline)	4.26±0.80 b	85.99±9.99 a	0.02±0.009	3.15±0.55 a	44.41±5.49 b
G 2 MSG (20mg/kg)	8.95±3.88 a	47.36±10.84 b	0.02±0.008	1.35±0.12 b	56.37±4.95 a
G 3 MSG(20mg/kg) to lycopene(200/kg)	7.03±2.08 a	37.01±4.50 b	0.01±0.009	1.42±0.12 b	42.33±1.52 b
G 4 lycopene(200mg/kg) to MSG(20mg/kg)	7.34±2.27 a	51.42±8.98 b	0.01±0.002	1.67±0.08 b	46.77±3.13 b
G 5 MSG(20mg/kg) + lycopene(100mg/kg)	6.89±2.42 a	38.08±5.25 b	0.01±0.007	1.51±0.08 b	45.82±2.44 b
G 6 MSG(20mg/kg)+lycopene(200mg/kg)	10.88±4.02 a	47.16±10.37 b	0.01±0.001	1.29±0.06 b	44.82±3.31 b
LSD	2.58	12.50	NS	0.50	10.74

The different small letters refer to significant differences at (p< 0.05).

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Discussion

Body weight

The results of the present study showed that the increased in final body weight and weight gain of adult male rats treated with MSG(20mg/kg)for thirty days, do not reach a significant differences compared with control group, which is agreed with (11) and (12) they suggested that MSG has no effect on the body weight. While in other study from Thailand establish that the ordinary consumption of MSG was associated with an increase in prevalence of overweight (13). Also, the results were disagree with results of (14), they set up that effectiveness of MSG as a fatness prompting agents are advanced in hypertensive as compared with normotensive rats. Another study done by (15) discover connection concerning MSG consumption in addition to fatness in 752 healthy Chinese, it was found to become linked by amplified body mass index (BMI), msg consumers were supposedly improved weight as compared per non-users, a result liberated of physical action plus whole energy consumption. The potential relationship between MSG and obesity comprises the MSG effect on energy balance by increasing sweetness of food and by disturbing the hypothalamic signaling cascade of leptin action (16).In the other studies, mice are injected with MSG to become obese. Scientists think MSG led to lesions in the brain and obstructs processing leptin . Leptin is a hormone that pointers to the brain that you have had enough to eat, and it shuts off your appetite and increases your calorie-burning, problems with leptin signaling, called leptin resistance, are influences in obesity(17).While the result of final body weight and weight gain in adult male rats treated with MSG(20mg/kg) and lycopene(100mg/kg)for thirty days, also in adult male rats treated with lycopene(200mg/kg) for fifty days followed by treatment with MSG(20mg/kg) for other fifty days. They showed a significant decrease($p< 0.05$)compared with control. May be because the efficiency of the lycopene in decreasing inflammatory elements in obese in addition to overweight people(18). For instance, lycopene is hydrophobic also there are excessive lipoprotein receptors in obese tissues for it, the packing position for lycopene and other carotenoids is adipose tissues (19). Our result agreement with results of (20) and (21) they revealed the lycopene prevents inflammatory routes in obesity then supports weight loss done concluded the diminution of appearance of cytokines plus chemokines in the adipocytes. Also, the results agreement with (22) they study presented that there is a direct association between increased lycopene plasma levels through reduced adiposity as well as weight defeat in juveniles by overweight or else obese. (23) they showed that lycopene significantly condensed serum levels of the ghrelin and reduced body weight in female rats. Ghrelin for instance a real peptide in cumulative hunger is mostly formed in the stomach also, but in lesser levels in the brain, the hypothalamus, adrenal cortex, pituitary, pancreatic islet cells in addition to other frequent tissues (24).

Blood parameters

The results of RBCs count, Hb and PCV percentage , just group of animals which treated by MSG(20mg/kg) for fifty days followed treated with lycopene(200mg/kg)for another fifty days ,showed a significant increase compared with control and all treated groups but, also within normal range. This result may be due to improved effect of lycopene cause this is the former effect. The result agreed with (25).Moreover, other groups showed no significant differences or decrease .This result may be due to effect of MSG which agreed with(26) but disagreed with results of (27) .Furthermore, the other red blood parameters(RBCs indices) which include MCV,MCH and MCHC, the group of animal which treated only by MSG also showed a significant decrease compared with control. This result agreed with (27) and(25) .But disagreed with (28). But regarding to rest group which co- treated with lycopene,

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showed values near to control. MSG could be toxic to erythrocytes and also cause deleterious changes in hematological parameters but existence of lycopene improved the results.

Hormonal parameters

Various forms of stress disturb a sensitivity of the HPA axis also excite the discharge of corticotropin-releasing factor from the periventricular nucleus in the hypothalamus. A creation also discharge of adrenocorticotropic hormone via pituitary gland concurrently upsurges by means of the rise in the discharge of CRF. ACTH, consecutively, promotes the discharge of glucocorticoids in humans or else corticosterone in animals beginning in the adrenal cortex (29).The results of some of hormones such as ACTH represented in table (3) that showed a significant increase in all treated groups compared with control group. Our result agreed with (30). The co-treatment with lycopene don't change result. This result disagreed with (31). They report that lycopene and beta-carotene, inhibiting cell proliferation and strongly suppress ACTH secretion. The excitatory neurotransmitters and brain animator has correspondingly been disturbed in the chronic prompt of the HPA axis. While an accurate protagonist of these neurotransmitters in stress reaction is indeterminate, around is accumulative preclinical indication the glutamate is an excitatory amino acid, shows an essential starring role in the ruling through the HPA axis (32) While in cortisol hormone which represented in same table (3) that showed a significant decrease in all treated groups compared with control group. Our result agreed with (33). But disagreed with (30). ACTH increases the creation and release of all adrenal steroids, aldosterone, cortisol and adrenal androgens. It is the main modulator of cortisol. As the cortisol level in blood increases, release of ACTH is inhibited directly at the pituitary level. Through this same mechanism, decreasing cortisol levels lead to elevated ACTH levels (34). There are numerous opinions to describe the quite low level of cortisol excluding an obstetrics of negative feedback inhibition otherwise down-regulation of the CRF receptor in the hypothalamus because of the high CRF situation (35). As glutamate causes stress, and the level of plasma cortisol in humans otherwise corticosteroid in rats that were often showing to somatic or emotional stress so lead to rise or decline. Furthermore, also the same table (3) showed there is non-significant differences in TSH in all treated groups compared with control. This result agreement with (36). Since TRH is formed principally in the paraventricular nuclei. our results acquired submit that this hypothalamic nuclei is not damaged by MSG. The cells in certain regions of CNS are more resistant to neurotoxic glutamate than cells of arcuate nucleus (AN). This may be due to different types of receptors, differences in second messenger systems or different levels in ion channel triggering (37). While T3 and T4 which represented in table (3) that showed a significant decrease in all treated groups compared with control group in T3 but in T4 hormone reveal only MSG treatment group showed a significant increase compared with control group. While the other co- treated groups with lycopene give result near the control. Our results disagreed with (36, 38). These variations in T.H. (T3&T4) can be lead to modification in the PTA or may be due to effect of MSG on enzymes which responsible for comfort T4 to T3 especially deiodenase enzyme.

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