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Effects of monosodium glutamate on some hematological parameters in adult rats

KEYWORDS

Dr. Rashad Fadhil Ghadhban

Dept. of Physiology, pharmacology and chemistry/ college of Veterinary medicine / University of Basra

ABSTRACT This study aimed to investigate the physiological effects of administration monosodium glutamate which use as food additive and flavor enhancer on some hematological parameters in rats blood.

16 normal healthy adult rats weight (120-200) g. The animal divided into two groups, each one consist of 8 animal, the first group (control) administrated orally withe distal water, second group (experiment) administrated orally with food additive monosodium glutamate dose 200 mg /Kg/ day for 30 days

The result show significant increase in the body weight, WBC count, lymphocyte%, RBC count, and significant decrease monocyte %, granulocyte %, mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC).

Introduction

Various environmental chemicals, industrial pollutants and food additives have been implicated as causing harmful effects. Monosodium glutamate (MSG), the sodium salt of amino acid glutamate, is a food additive, popularly used the world over as "flavor enhancer". The safety of MSG's usage has generated much controversy locally and globally ***(Zerasky, 2010).*** As a food additive, monosodium glutamate is described and listed on food labels as a "Flavouring" or "Hydrolysed vegetable protein". Through its stimulation of the Orosensory receptors and improving the palatability of meals, monosodium glutamate influences the appetite positively and induces weight gain ***(Moore, 2003)***. Despite its taste stimulation, and improved appetite enhancement, reports indicate that monosodium glutamate is toxic to humans and experimental animals ***(Biodun and Biodun, 1993)***.

This study aimed to determine the physiological changes on body weight and some blood parameters when administration monosodium glutamate orally to rats.

MATERIAL AND METHODS

In this study used 16 normal healthy adult rats weight (120-200) g. The animal divided into two groups, each one consist of 8 animal, the first group (control) administrated orally withe distal water , second group (experiment) administrated orally with food additive monosodium glutamate dose 200 mg /Kg/ day for 30 days .

Blood collecting

At the end of the experiment 2ml of blood each were collected into heparinized sample bottles and were then analyzed for hematological parameters such as packed cell volume (PCV), hemoglobin concentration (Hb), total red blood cells (RBC) count, mean cell volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), total white blood cell (WBC) count WBC differential percentage were collected from experimental and control animal through scarified the animal by heart puncture directly Ewuola and Egbunike (2008).

Statistical Analysis

All recorded data were analyzed for ANOVA II (Steal and Torrie, 1980) using complete Randomized design (CRD) using computer packaged program (SPSS 2009). Least significant differences (LSD), was calculated to compare the significant differences between means of treatments were ANOVA showed significant differences. This data were expressed as mean ±S.D. (stander Deviation).

RESULT AND DISCUSSION

Table 1 show significant P≤0.05 increase in body weight of treatment group in the 30days in compare with 0 days and also with control group.

TABLE (1) EFFECTS OF ADMINISTRATION OF MONOSODUIM GLUTAMATE (MSG) ON BODY WEIGHT (MEAN±SD)

GROUPS		WEIGHT
CONTROL	0-DAY	198.12±14.37
	30-DAY	197.50±13.88
MSG	0-DAY	201.87±21.20
	30-DAY	283.75±56.61**

**significant p≤0.05

The results are compatible with previous findings obtained by Oluba et al. (2011) after administration of MSG, where treated rats showed significant increase in body weight which led to obesity, as they showed that consumption of MSG increases body weight gain. Kawakita et al., (2005) explained that the potential for MSG-obesity link lies in the alteration of regulatory mechanism that affect fat metabolism.

The results in the table (2) show significant effects to administration of MSG which are significant P≤0.05 increase in total WBC count approximately about ($2.8*10^3$) and lymphocyte percentage about (7.7%) in other hand result show significant P≤0.05 decrease in the percentage of both the monocyte and granulocyte about (1.7%) and (5.98%) respectively in treatment group in period (30 days) in comparing with the (0 day) of treatment and control group

TABLE (2) EFFECTS OF ADMINISTRATION OF MONOSODUIM GLUTAMATE (MSG) ON WBC COUNT (MEAN±SD)

GROUPS		WBC $x10^3/mm^3$	Lymph%	MONO%	GRAN%
CONTROL	0-DAY	6.48 0.33	63.55±2.89	3.41±0.27	33.51±2.96
	30-DAY	7.52±0.92	62.82±2.79	3.41±0.29	33.76±2.77
MSG	0-DAY	6.72±0.39	61.36±1.00	3.55±0.27	34.96±0.95
	30-DAY	9.53±0.68**	69.06±6.05**	1.85±0.50**	28.79±5.80**

**significant p≤0.05

Increase in lymphocyte percentage in the treated animals might be due to the fact that MSG is perceived as a toxic agent in the treated animals or could be a consequence of the interaction between MSG gastrointestinal macrophages.

Macrophages serve as antigen presenting cell, and the antigenic products (polypeptides) to the helper T cells and the B lymphocytes bringing about their activation (Sembuligham, 2005).

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Macrophages also secrete substances called interleukin-1 /- cytokines, which brings about the activation, proliferation and increase in the lymphocyte count (Sembulingham, 2005; Barrett *et al.,* 2010).

The result of this study agree with result of (Ashaolu.,*et al* 2011) who shows MSG administration has a significant effect on the neutrophil and lymphocyte count, indicative of a compromised immune status and poisoning respectively in the treated animals.

Significant effects P≤0.05 of administration of MSG to laboratory rats where the results in table (3) show significant increase in the total red blood cells RBC count about ($0.5*10^6$) and in other hand significant decrease in both mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) about (2.9)Pq (4.69)g/dl respectively in treatment group in period (30 days) in comparing with the (0 day) of treatment and control group while there are no significant effects on each of packed cell volume(PCV), hemoglobin (HB) and mean cell volume (MCV).

TABLE (3) EFFECTS OF ADMINISTRATION OF MONOSODUIM GLUTAMATE (MSG) ON RBC COUNT (MEAN±SD)

GROUPS		RBC $x10^6/mm^3$	PCV %	HB g/dl	MCVfl	MCH pq	MCHC g/dl
CONTROL	0-DAY	6.66 ±0.41	40.87 ±1.17	13.52±0.75	57.91±1.03	19.01±0.64	33.97±1.18
	30-DAY	7.44±0.31	41.42±0.76	13.65±0.79	57.02±1.95	18.22±1.32	31.03±2.04
TREATMENT	0-DAY	7.00±0.15	40.58±0.66	13.95±0.43	58.33±0.44	19.21±0.70	33.31±0.65
	30-DAY	7.59±0.63**	41.18±6.43	13.10±0.91	58.56±0.81	16.31±1.46**	28.61±2.10**

**significant p≤0.05

(Ashaolu.,*et al* 2011) suggests that the effects of MSG on the RBC count probably reduces the life span of red blood cells in the blood which might be as a result of direct toxicity. This might also have been mediated through a deleterious effect on the hemopoietic stem cells in the bone marrow. MSG might cause increased oxidative stress (a function of anaerobic respiration) in the tissues of the animals.

While the decreased MCHC is indicative of macrocytic anemia (Sembulingham, 2005 Thus, macrocytic normochromic anemia (pernicious anemia) was more specifically indicated. This might be due to the atrophy of the gastric mucosa (gastritis) caused by the MSG which is acidic (L form of glutamic acid), resulting in reduced synthesis of the intrinsic factor, and thus poor absorption of vitamin B12 which is the main cause of pernicious anaemia (Sembulingham, 2005).

Likewise there are reports suggesting that MSG could be toxic to erythrocytes and also cause deleterious changes in hematological and biochemical parameters (Ashaolu.,*et al* 2011,Meraiyebu., *et al* 2012).

Conclusion

In this study the result show that the MSG have harmful effects on the body which effects on immune system and also lead to increase in the weight gain and this cause to obesity.

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