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Monosodium Glutamate (MSG) Hepatotoxicity in Rats and the Possible Ameliorative Effects of a Natural Antioxidant (Propolis)

**A Thesis submitted
For (Ph.D.) Degree in zoology**

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Food additives are chemical substances added intentionally to food stuffs to preserve, color, sweeten and flavor food. Monosodium glutamate (MSG) is used as a flavor enhancer and is found in most soups, salad dressing and processed meat. The use of MSG in food is growing. Irrational fear had increased in the last few years due to the adverse reactions and toxicity of MSG and there is growing concern that excitotoxins such as MSG play a critical role in the development of several hepatic disorders. Propolis, a resinous wax-like beehive product is collected by honey bees from plant exudates and the chemical properties of propolis are not only beneficial to bees but have general pharmacological value as a natural mixture. The present study aimed to investigate the protective and curative effects of propolis against MSG on the rat liver. Fifty male albino rats weighting 100-150 g. were used to study the biochemical analysis of liver function parameters, including ALAT, ASAT, ALP activities, total proteins, albumin in the blood sera, MDA, GSH and electrophoresis in liver tissue. Besides, studying the histological alterations and histochemical changes including total proteins and carbohydrates in liver tissues. The experimental animals were divided into five groups, 10 rats each, and treated as follows: 1) rats received distilled water (controls group); 2) rats received 200 mg propolis/kg b. w. for 4 weeks (Propolis group); 3) rats received 1 g MSG /kg. b. w. for 4 weeks (MSG group); 4) rats received 200 mg propolis /kg. b. w. for 4 weeks +1 g MSG/kg b. w. during the last 2 weeks (protective group); 5) rats received 1 g MSG/kg. b. w. for 4 weeks+200 mg propolis/kg b. w. during the last 2 weeks (therapeutic group). Rats were received their respective doses daily by oral gavage.

The results of the present study in MSG group reveal that the mean body weight, absolute and relative liver weight was increased and a highly significant increase in ASAT, ALAT, ALP and MDA activities and decrease in total proteins, albumin and GSH. In electrophoresis study, there was decrease in fractions λ , μ , ν and fraction τ and increase in fractions ρ and ξ . The Histopathological studies displayed deleterious alterations in the liver tissues where MSG caused distortion or disorganization of hepatic architecture with inflammatory reaction and leucocytic infiltration in the liver tissues together with swollen vacuolar, hyaline degeneration and even atrophy and necrosis of hepatocytes. Congestion, dilatation, damage of blood vessels and haemorrhage were met with. The portal tract showed increased fibrosis, thick walled fibrotic portal vein and inflammatory cell infiltration. Histochemical studies revealed that MSG alone decreased polysaccharides and total proteins in the liver tissue. In the protective group, propolis extract in this group showed considerable protection in the activity of ASAT, ALAT, ALP, total protein, albumin, MDA, GSH and the mean body weight, absolute and relative liver weight, electrophoresis. Histopathological and histochemical alterations were also protected. On the contrary, propolis extract in the therapeutic group showed mild improvement to the changes induced by MSG.

In conclusion, the results confirm the hepatotoxic effect of MSG in addition to the hepatoprotective effect of propolis. In contrast, using propolis as a therapeutic agent was only of limited value in reversing the biochemical, histopathological and histochemical alteration.

Key Words: Liver, Monosodium glutamate, Propolis, Biochemical, Oxidative stress, Electrophoresis, Histological, Histochemical.



LIST OF ABBREVIATIONS	I
LIST OF TABLES	III
LIST OF FIGURES	IV
INTRODUCTION	١
AIM OF THE WORK	٥
REVIEW OF LITERATURE	٦
A- Monosodium glutamate (MSG):	٦
١- Effect of monosodium glutamate (MSG) on biochemical parameters:	٨
٢- Effect of monosodium glutamate (MSG) on liver protein fractions by electrophoresis:	١٥
٣- Effect of monosodium glutamate (MSG) on histology and histochemistry of liver:	١٧
B- Propolis:	٢٢
١- Effect of propolis on biochemical parameters:	٢٣
٢- Effect of propolis on liver protein fractions by electrophoresis:	٣٣
٣- Effect of propolis on histology and histochemistry of liver:	٣٤

MATERIAL AND METHODS	۳۹
MATERIAL	۳۹
A- Experimental Animals:	۳۹
B- Experimental Chemicals and Antioxidant:	۴۰
۱- Monosodium glutamate (MSG):	۴۰
۲- Natural antioxidant (Propolis):	۴۰
METHODS	۴۱
A- Chemical and Antioxidant Preparation and Administration:	۴۱
۱- Preparation of monosodium glutamate:	۴۱
۲- Preparation of Propolis:	۴۱
B- Experimental design:	۴۱
C- Preparation of serum samples:	۴۲
D- Preparation of tissue samples:	۴۳
E- Determination of Body Weight, Liver Weight and Relative Liver Weight:	۴۳
۱- Body weight:	۴۳
۲- Relative liver weight:	۴۴
F- Biochemical Methods:	۴۴
a- Liver function tests:	۴۴
۱- Determination of serum alanine aminotransferase (ALAT):	۴۴

ʒ- Determination of serum aspartate amino transferase (ASAT):	٤٦
ʒ- Determination of serum alkaline phosphatase (ALP):	٤٦
b- Protein profile tests:	٤٨
١- Determination of serum total protein levels:	٤٨
٢- Determination of serum albumin levels: .	٤٩
c- Liver Tissue (Oxidative stress parameters) Methods:	٥٠
١- Determination of Glutathione (GSH): ..	٥٠
٢- Determination of lipid peroxidation malondialdehyde (MDA):	٥٢
G- Liver protein electrophoresis:	٥٤
H- Histopathological and Histochemical Studies:	٥٧
١- Histopathological examination:	٥٧
Harris's haematoxylin and eosin stain	٥٧
٢- Histochemical examination:	٥٩
Mercuric Bromophenol Blue	٥٩
Periodic acid-Schiff (PAS)	٦٠
I- Statistical Analysis:	٦٣

RESULTS	٦٤
A- Determination of body weight, absolute and relative liver weight:	٦٤
١- Body weight:	٦٤
٢- Liver weight:	٦٤
٣- Relative liver weight:	٦٥
B- Biochemical Studies	٧٠
a- Liver function tests	٧٠
١- Serum alanine aminotransferase (ALAT) (U/L) level:	٧٠
٢- Serum aspartate amino transferase (ASAT) (U/L) level:	٧٠
٣- Serum alkaline phosphatase (ALP) (U/L) level:	٧١
b- Protein profile tests	٧٦
١- Serum total protein (T. P.) (g/dl) level: ...	٧٦
٢- Serum albumin (g/dl) level:	٧٦
c- Liver tissue (Oxidative stress tests):	٨١
١- Tissue Glutathione (GSH) (µg/g protein) level:	٨١
٢- Tissue lipid peroxidation malondialdehyde (MDA) (mM/١٠٠g) level:	٨١

C- Liver protein electrophoresis:	٨٦
D- Histopathological studies	٩٥
E- Histochemical studies	١٣٧
a- Total proteins content:	١٣٧
b- General carbohydrates content:	١٦١
DISCUSSION	١٨٥
General concept:	١٨٥
A- Body weight, absolute and relative liver weight changes:	١٨٧
B- Biochemical studies:	١٩٠
C- Liver protein electrophoresis changes:	٢٠٥
D- Histopathological studies:	٢٠٨
E- Histochemical studies:	٢٢٢
SUMMARY AND CONCLUSION	٢٣١
Summary	٢٣١
Conclusions	٢٣٧
REFERENCES	٢٣٩
ARABIC SUMMARY	



ALAT	Alanine aminotransferase
ALP	Alkaline phosphatase
APE	Aqueous propolis extract
ASAT	Aspartate aminotransferase
Bs	Blood sinusoids
CAT	Catalase
Cv	Central vein
Dn	Double nuclei
Ec	Endothelial cells
EEP	Ethanollic extract of propolis
FDA	Food and Drug Administration
FR	Free radical
G ⁶ P ^H	Glucose- ⁶ -phosphatase
GGT	γ glutamyl transferase
GPX	Glutathione peroxidase
GR	Glutathione reductase
GSH	Glutathione
GSTs	Glutathione-S-transferase
H	Hepatocytes
H&E	Haematoxylin and eosin stain
HL	Hepatic lobules

HK	Hexokinase
K	Karyolysis
Kc	Kupffer cells
LDH	lactate dehydrogenase
LPO	lipid peroxidation
MDA	Malondialdehyde
(MNPCes)	micronucleated polychromatic erythrocytes
MSG	Monosodium glutamate
N	Nucleus
NADPH	Nicotine amide dinucleated phosphate
NO	nitric oxide
P	Pyknosis
PAGE	polycrylamide gel electrophoresis
PAS	Periodic Acid Schiff
Pt	Portal tract
RP	Red propolis
SGOT	Serum glutamic-oxaloacetic transaminases
SGPT	Serum glutamic-pyruvic transaminases
Sn	Single nuclei
SOD	superoxide dismutase
TAP	Total acid phosphatase
TBARS	Thiobarbituric acid-reactive substances



Table No.	Table Title	page
١	The protective and therapeutic role of propolis on body weight, absolute and relative liver weight (g) in control and experimental groups.....	٦٦
٢	The protective and therapeutic role of propolis on ALAT, ASAT and ALP (U/L) levels in control and experimental groups.....	٧٢
٣	The protective and therapeutic role of propolis on total protein (g/dl) and albumin (g/dl) levels in control and experimental groups.....	٧٨
٤	The protective and therapeutic role of propolis on liver tissue MDA (mM/١٠٠g protein) and GSH (μg/g protein) levels in control and experimental groups.....	٨٣
٥	Protein fractions of liver tissue (g/١٠٠g protein) in control group.....	٨٨
٦	Protein fractions of liver tissue (g/١٠٠g protein) in propolis group.....	٨٩
٧	Protein fractions of liver tissue (g/١٠٠g protein) in MSG group.....	٩٠
٨	Protein fractions of liver tissue (g/١٠٠g protein) in protective group.....	٩١
٩	Protein fractions of liver tissue (g/١٠٠g protein) in therapeutic group.....	٩٢
١٠	The protective and therapeutic role of propolis on protein fractions of liver extract (g/ ١٠٠g protein) in control and experimental groups.....	٩٣



Figure No.	Figure Title	Page
1	Chemical structure of MSG	40
2	The protective and therapeutic role of propolis on body weight (g) in control and experimental groups.	67
3	The protective and therapeutic role of propolis on liver weight (g) in control and experimental groups.	68
4	The protective and therapeutic role of propolis on relative liver weight (%) in control and experimental groups.	69
5	The protective and therapeutic role of propolis on ALAT (U/L) in control and experimental groups.	73
6	The protective and therapeutic role of propolis on ASAT (U/L) in control and experimental groups.	74
7	The protective and therapeutic role of propolis on ALP (U/L) in control and experimental groups.	75
8	The protective and therapeutic role of propolis on total protein (g/dl) in control and experimental groups.	79
9	The protective and therapeutic role of propolis on albumin (g/dl) in control and experimental groups.	80
10	The protective and therapeutic role of propolis on liver tissue GSH ($\mu\text{g/g}$ protein) in control and experimental groups.	84