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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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First and foremost grateful thanks to "ALLAH" the most beneficent and merciful.

To Prof. Dr. Madiha Abdel Moneim Ashry, Professor of Histochemistry, Zoology Department Girls' College, Ain Shams University, I would like to express my sincere thanks and deepest gratitude for suggesting the topic of research, her professional reading and revision of this thesis, for suggesting the problem of this study, for her great efforts in planning the practical work and interpretation of pathological findings. I greatly appreciate her meticulous guidance, emotional support and valuable time she sacrificed to me. I will never be able to express my feeling toward her with simple word.

Words are not enough to reply Dr. HALA FAHMY ABD-ELLAH Assistant Prof. of Histology and Cytology, Department of Zoology, Girls' College, Ain Shams University, for the critical reading and revision of all the details of the manuscript. Her scientific merit, deep experience and constant support leading to completion of this thesis were most beneficiary.

Also, I want to thanks Dr. Walaa Ahmed Moustafa El-Nahrawy Assistant Prof. of Zoology, Department of Zoology, Girls' College, Ain Shams University, for her kind help through the physiological work.

I would like to extend my deepest appreciation to all the staff members of Department of Zoology, Girls' College, Ain Shams University.

Finally, I would like to express my deep thanks to my husband and my family for their continuous encouragement during my life.

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 ٧٥-٩٥ 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, ١٠ rats each, and treated as follows: ١) rats received distilled water (controls group); ٢) rats received ٢٠٠ mg propolis/kg b. w. for ٨ weeks (Propolis group); ٣) rats received ١ g MSG /kg. b. w. for ٨ weeks (MSG group); ٤) rats received ٢٠٠ mg propolis /kg. b. w. for ٨ weeks +١ g MSG/kg b. w. during the last ٤ weeks (protective group); ٥) rats received ١ g MSG/kg. b. w. for ٨ weeks+٢٠٠ mg propolis/kg b. w. during the last ٤ 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 ١, ٢, ٥ and fraction ٦ and increase in fractions ٣ and ٤. 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.

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	Ethanolic extract of propolis
FDA	Food and Drug Administration
FR	Free radical
G٦PH	Glucose-٦-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	Malondialdhyde
(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

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