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The Hazard Effects of Monosodium Glutamate (MSG) on Kidney of Rats and the Role of Propolis as a natural antioxidant

A thesis submitted
For (Ph.D.) Degree in Zoology
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Dedicated
To
My Lovely Wife
My Father and Mother
My Daughters Login and Leen
My Brothers and Sisters
For their continuous
care and support

بسم الله الرحمن الرحيم

واوحى ربك إلى النحلِ ان اتخِذِي مِن
الجِبالِ بيوتا ومِن الشجرِ ومِما يعرِشون
﴿ ٦٨ ﴾ ثم كلِي مِن كل الثمراتِ فاسلكِي
سبل ربكِ ذللا يخرج مِن بطونِها شراب
مختلِف الوانه فِيهِ شِفاء لِلناس إن فِي
ذلك لاية لِقومٍ يتفكرون ﴿ ٦٩ ﴾

صدق الله العظيم

من سورة النحل (الايتين ٦٨ ٦٩)

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A common example of one of the thousands of chemicals used in our new high-tech foods is the **Monosodium glutamate (MSG)**. MSG is the sodium salt of the non-essential amino acid glutamic acid, one of the most abundant amino acid found in nature. Glutamate is thus found in a wide variety of foods, and in its free form has been shown to have a flavour enhancing effect.

Propolis is a resinous hive product collected by honeybees from many plant sources. Historically it has been used for various purposes, especially as a medicine. Flavonoids and phenolics are the major complementary compounds of propolis. Flavonoids are thought to be responsible for many of its biological and pharmacological activities including anticancer, anti-inflammatory and antioxidant effects.

Several studies have dealt with the use of different substances especially antioxidants to overcome MSG toxicity. Yet nearly none have used Propolis thus initiating the goal of the current investigation.

The present study aimed to investigate the protective and therapeutic effect of propolis against MSG toxic effects on some biological aspects of kidney rat.

Accordingly, ٥٠ male albino rats weighing ٧٥-٩٥ g. were used to study the histological and some histochemical changes including mucopolysaccharides and total proteins in kidney tissues. In addition, biochemical analysis of kidney function parameters were studied, including urea, creatinine, Na^{+}, K^{+} activities, lipid profile

(cholesterol., TG, HDL, LDL and VLDL), total proteins, albumin in the blood sera, MDA, GSH and electrophoresis in kidney tissue. The rats were divided into five groups each containing ١٠ rats (normal controls, propolis, MSG, protective and therapeutic group). Rats received MSG orally in a dose ١g/kg. b. w. for ٨ weeks (MSG group), while propolis was induced orally in a daily dose of ٢٠٠ mg/kg. b. w. alone (Propolis group), before MSG (protective) or after MSG (therapeutic) for the same period. All groups of animals were sacrificed at ٤ and ٨ weeks.

The results of the present study in MSG group revealed increase in mean body weight, absolute and relative kidney weight. Histopathological studies displayed deleterious alterations in kidney tissues where MSG causes inflammatory reactions, loss of characteristic normal configuration, intertubular haemorrahage, degenerative changes, vacuolization, and necrosis in the kidney tissues. Histochemical studies revealed a decrease in carbohydrate and total protein content in kidney tissue. A significant increase in urea, creatinine, Na^+, cholesterol, TG, HDL, LDL, VLDL and MDA activities and decrease in K^+, total proteins, albumin and GSH was recorded. In electrophoretic study, there was an increase in fractions ١ and ٢ and a decrease in fractions ٣, ٤ and ٥. Propolis extract in the protective group showed significant preservation in histopathological and histochemical configuration and significant improvement in the activity of all biochemical parameters. Propolis extract in the curative group was found to be less effective in restoring MSG induced histopathological and histochemical alterations and less effective in restoring MSG induced biochemical and electrophoretic alteration.

Key Words: Kidney, Monosodium glutamate, Propolis, Histology, Histochemistry, Biochemistry, Oxidative stress, Electrophoresis.

٤-HDA	٤-hydroxyalkenals
γ-GT	Gamma glutamyle transferase
ACP	Acid phosphatase
Al	aluminum
ALAT	Alanine aminotransferase
$AlCl_3$	Aluminium chloride
ASAT	Aspartate aminotransferase
ALP	Alkaline phosphatase
APAP	acetaminophen
APE	Aqueous propolis extract
BH	Bee honey
BUN	Blood urea nitrogen
CAPE	Caffeic acid phenethyl ester
CAT	Catalase
CCl_4	Carbon tetrachloride
CHOL	Cholesterol
DCT	Distal convoluted tubules
DPPH	١،١-diphenyl-٢-picrylhydrazyl
EAC	Ehrlich ascites carcinoma
EEP	Ethanolic extract of propolis
F	Fluoride
GPx	glutathione peroxidase
GR	Glutathione reductase
GSH	Glutathione
GSSG	oxidized glutathione
GST	Glutathion-S-transferase
HEDTA	*N*-(٢-hydroxy ethyl ethylene diamine triacetic acid)
HDL	High density lipoprotein
H&E	Haematoxylin and eosin stain