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Study of the Possible Protective Role of Ascorbic Acid and α-Tocopherol on the Hepatotoxicity Induced by Monosodium Glutamate in Adult Albino Rat

Thesis

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دراسه الدور الوقائى المحتمل لحمض الاسكوربيك والالفا توكوفيرول علي التسمم الكبدي الناتج عن جلوتامات الصوديوم الاحاديه في الجرذ الابيض البالغ

رسالة مقدمه

توطئة للحصول على درجة الماجستير فى علم التشريح

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سورة البقرة الآية: ٣٢

الملخص العربى

معظم الاشياء التي تضاف للطعام تكون اما لحفظه او لتحسين طعمه ومن هذه الاشياء جلوتامات الصوديوم الاحادية.

وبالرغم من ان مادة جلوتامات الصوديوم الاحادية تحسن من طعم الوجبات الغذائية وبذلك تحفز مركز الشهية وتزيد من وزن الجسم فان امان استخدام جلوتامات الصوديوم الاحادية محل جدل واسع. فقد وجد انها تسبب تضخم بالكبد وارتفاع في الالبيومين بالدم وانخفاض في الجلوبيولين بالدم.

ان مضادات الاكسده ومن بينها حمض الاسكوربك والالفا توكوفيرول قد ثبت انها تاخذ جزىئات الاوكسجين وبالتالي فانها تمنع اكسدة بعض المركبات مثل البروتينات والدهون والحمض النووي مما يقلل من تدميرهم.

ويعتبرالهدف من هذه الدراسة هو تقييم الدور الوقائى المحتمل لحمض الاسكوربك والالفاتوكوفيرول علي التسمم الكبدي الناتج عن جلوتامات الصوديوم الاحادية.

وفي هذه الدراسة تم استخدام اربع وعشرون جرذ من الجرذان البيضاءالبالغة، متوسط وزنَ الجرذ200 جراما تقريبا، وتم تقسيمهم عشوائيا إلي اربع مجموعات متساوية و هى كالتالى:

المجموعة الأولي:- (المجموعة الضابطة) تغذت الجرذان علي الوجبه العادية لمدة اربعة عشر يوما.

المجموعة الثانية :- تغذت الجرذان علي وجبة بها جلوتامات الصوديوم الاحادية لمدة اربعة عشر يوما.

المجموعة الثالثة:- تغذت الجرذان علي وجبة تحتوي علي جلوتامات الصوديوم الاحادية بالتزامن مع حمض الاسكوربيك لمدة اربعة عشر يوما.

المجموعة الرابعة:- تغذت الجرذان علي وجبة تحتوي علي جلوتامات - الصوديوم الاحادية بالتزامن مع الالفا توكوفيرول لمدة اربعة عشر يوما.

وفي اليوم الخامس عشر، تم ذبحهم و أخذت عينات من الكبد جهزت لعمل الدراسات الهستولوجية وصبغت لتفحص بالميكروسكوب الضوئى .

وفى نهاية البحث تم استنتاج أن حمض الاسكوربك اسيد والألفا توكوفيرول لهم تأثير وقائى على السمية الناتجة من مادة جلوتامات الصوديوم الأحادية على كبد الجرذ الأبيض البالغ.

Introduction

Most food additives act either as preservatives, or enhancers of palatability. One of such these food additives is Monosodium glutamate (MSG).

Although MSG improves the palatability of meals; thus influencing the appetite center positively with the resultant increase in body weight **(Rogers and Blundell, 1990**; **Iwase *et al.*, 1998 and Gobatto *et al.*, 2002)**, the safety of MSG usage has generated much controversy. **Berry *et al.* (1974)** found that it caused an enlargement of the liver, an increase of serum albumin, and a decrease of serum globulin. Moreover, **Miskowiak *et al.*, (1999) and Diniz *et al.*, (2004)** found that the injection of rats with MSG resulted in a decrease in the number of graafian follicles and led to a decrease in the thickness of endometrium.

Antioxidants have been reported to play a significant role in the protection against lipid peroxidation **(Steenvoorden and Henegouwen, 1999).** Among which, ascorbic acid and Alpha-tocopherol were reported to

scavenge reactive oxygen species and may, thereby, prevent oxidative damage to the important macromolecules, such as DNA, proteins and lipids **(Konopacka, 2004).**

Since ascorbic acid and Alpha-tocopherol together with MSG may be present in human diet, it is therefore logic enough or even important to examine the possible effect of their interaction, in order to establish weather ascorbic acid and Alpha-tocopherol would exacerbate or ameliorate the adverse effects of MSG.

Aim of the Work

This work will be carried out to evaluate the possible protective role of ascorbic acid and Alpha-tocopherol on the hepatotoxic effect of MSG.

I. Rat Liver Anatomy

In rats, the liver mass represents approximately 5% of the total body weight, while in adult human it represents 2.5%. In rats weighing between 250 and 300 g, the liver mean weight was 13.6 g and the liver transverse diameter measured from 7.5 to 8 cm. The superior–inferior diameter measured from 3.8 to4.2 cm, while the anterior–posterior diameter ranged from 2.2 to 2.5 cm **(Casting *et al.*, 1980).**

Surfaces:

The rat liver has basically three surfaces: superior, inferior and posterior. A sharp, well-defined margin divides the inferior from the superior surface. Different from human liver, the other margins are sharp. Although the rat liver is lobated, it has rather uniform surfaces as lobes lie flat against each other. The only exception to this is the posterior caudate lobe (CL), which is separated from the remainder of the liver by the stomach **(Lorente *et al.*, 1995).**

The superior (parietal) surface comprises a part of the left lateral and medial lobes, and as a whole, is convex and fits under the vault of the diaphragm. It is completely covered by the peritoneum except along the line of attachment of the falciform ligament. The line of attachment of the falciform ligament divides the liver into two parts, termed the right and left lobes. Different from human liver, the rat left and right lobes have approximately the same volume **(Hebel and Stromberg, 1976)**.

The inferior (visceral) surface is uneven, concave and is in relation to the stomach, duodenum, right colic flexure, the superior part of the pancreas, the right kidney and the right suprarenal gland. However, Liver impressions (colic, renal, duodenal and suprarenal) are not as evident as in human. This surface is almost completely invested by the peritoneum. Through the porta (which is also called transverse fissure) go the portal vein, the hepatic artery and nerves, the hepatic duct and lymphatics **(Hebel and Stromberg, 1976)**.

The posterior surface is in direct contact with the diaphragm and is not covered by the peritoneum over some

part of its extent. The rat liver posterior and inferior surfaces do not have the fossae in the shape of the letter H as in humans. Furthermore, the inferior vena cava is completely intrahepatic **(Hebel and Stromberg, 1976)**.

Ligaments:

Similar to the human liver, the rat liver is connected to the undersurface of the diaphragm and to the anterior wall of the abdomen by five ligaments. Four of which (the falciform, the coronary, and the two triangular) are peritoneal folds; whereas the fifth ligament the round ligament, is a fibrous cord derived from the obliterated umbilical vein. The liver is also attached to the lesser curvature of the stomach by the hepatogastric ligament, and to the duodenum by the hepatoduodenal ligament **(Brand *et al.*, 1995)**.

The falciform ligament is a thin peritoneal fold and is attached to the undersurface of the diaphragm and the posterior surface of the right rectus abdominal muscle at the level of the umbilicus. Its free edge contains the round ligament and the paraumbilical veins **(Lorente *et al.*, 1995).**

The coronary ligament consists of an upper and a lower layer. The upper layer is reflected from the upper margin of the bare area of the liver to the undersurface of the diaphragm **(Greene, 1963)**.

There are two triangular ligaments (right and left). The right triangular ligament is situated at the right extremity of the superior right lobe (SRL), and consists of a small fold that passes to the diaphragm being formed by the opposition of the upper and lower layers of the coronary ligament. On the other hand, the left triangular ligament is a fold that connects the posterior part of the upper surface of the left lobe to the diaphragm **(Hebel and Stromberg, 1976)**.

The round ligament (ligamentum teres hepatis) is a fibrous cord resulting from the obliteration of the umbilical vein. It ascends from the umbilicus, in the free margin of the falciform ligament, to the umbilical notch of the liver **(Hebel and Stromberg, 1976)**.

In addition to the aforementioned five ligaments, the caudate process, which is also known as paracaval portion, is attached to the dorsal diaphragm by thin ligaments. The

inferior right liver lobe (RLL) is also attached to the diaphragm and has another ligament to the anterior part of the infrahepatic vena cava **(Lorente *et al.*, 1995).**

Liver lobes:

The rat liver is multilobated as in human **(Zanchet and Monteiro, 2002).** Since the mammalian portal system is the most constant anatomical reference, the rat liver lobes are named after the portal branches that supply them **(Lorente *et al.*, 1995).** The liver lobes are middle lobe, right lateral lobe, left lateral lobe and caudate lobe **(Kongure *et al.*, 1999).**

The middle or median lobe (ML)is the largest, accounting for approximately 38% of the liver weight. It has a trapezoidal shape and is fixed to the diaphragm and abdominal wall by the falciform ligament. It is in continuity with the left lateral lobe (LLL) and is subdivided by a vertical fissure (main fissure or umbilical fissure) into a large right medial lobe (RML)accounting for 2/3 of the volume of the medial lobe and a smaller left medial lobe (LML)representing 1/3 of the volume. The RML has both left and right hepatic vascular components **(Kongure *et al.*, 1999).**