

***Effect of Lemon Balm (*Melissa Officinalis L.*) on
Fatty Liver Induced by Oxytetracycline in
Albino Rats***

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Abstract

With growing burden of liver dysfunction, the use of natural plant products is increasing due to its powerful antioxidant properties, negligible side effects and economical merit. The aim of this work was to assesses the effect of lemon balm leaves powder given at two levels (10 and 20 g/kg/ diet/ day) on oxytetracycline induced fatty liver in rats. A total of 32 rats weighing 120-130 g were randomly distributed into four groups of eight rats per group. Injected intraperitoneally of oxytetracycline (120 mg/kg body weight/day) for three days produced hepatic damage as manifested by a significant increase in serum hepatic markers namely aspartate transaminase (AST), alanine transaminase (ALT), gamma glutamyl transferase (GGT) and lactate dehydrogenase (LDH), also increased hepatic lipid peroxidation (MAD). The administration of lemon balm (10 and 20 g/kg diet/ day) weekend the oxytetracycline induced hepatotoxicity by the significant decreased levels of serum AST, ALT, GGT, LDH, glucose, TG, TC, LDL-C, urea, creatininie and MDA. It also and significant increase serum total protein, albumin, globulin, HDL-C in lemon balm treated rats compared with untreated

fatty liver group. Additionally it increase SOD and total antioxidant capacity in lemon balm treated groups at the dose of (10 g/kg) compared with untreated fatty liver rats. Thus, lemon balm treatment had remarkable effects on liver marker enzymes level and lipid peroxidation in rats. It can be concluded that lemon balm leaves phenolic compounds has potential protection effect against hepatocellular damage and fatty liver.

Introduction

The liver is the most important organ of the body, contributing about 2% of the total body weight on the average human. It is linked with most of the physiological processes and serves vital function in human body (***Dey et al. 2013***). The term of Fatty liver, or steatosis, is used to describe the accumulation of triglyceride within the cytoplasm of hepatocytes and linked to obesity, insulin resistance and type 2 diabetes (***Ratziu et al. 2010***) and refers to fat accumulation in the liver exceeding 5%–10% by weight (***Szczepaniak et al. 2005***). When hepatosteatosis is present in the absence of excessive alcohol consumption, it is termed non-alcoholic fatty liver disease (NAFLD) (***Ratziu et al. 2010 & Marchesini et al. 2001***), which is considered to be the hepatic manifestation related to the metabolic syndrome (***Shulman and Mangelsdorf, 2005***). Fatty liver disease comprises a wide spectrum of hepatic damage, from simple steatosis alone, to inflammatory changes found in nonalcoholic steatohepatitis (NASH) and advanced fibrosis and cirrhosis of the liver. The prevalence of fatty liver disease has apparently increased in proportion to the increasing incidence of obesity in different ages (***Sathya et al. 2002 & Clark, 2006***). Presently, there is no effective drug available that can stimulate liver function or regeneration of liver cell in spite of their

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adverse effect. Therefore it is necessary to find out some alternative natural medication for liver damage (**Mishra et al. 2014**).

Over the last few years the importance of medicinal plant based substances have increased greatly all over the world for management and treatment of various diseases (**Nigam and Nambiar, 2015**). Interestingly, herbal medicine has become more and more accepted and their usage is prevalent. Legal regulations and food organizations concerning herbal products are still lacking evidence to substantiate their effective usage in liver diseases (**Rajaratnam et al. 2014**). Medical plants being important sources of natural antioxidants, their importance for use as nutritional supplements or food additives have already been established (**Kaur and Kapoor, 2000**). The search for safe and effective naturally occurring antioxidants is now focused on edible plants especially herbs (**Miliauskas et al. 2004**).

Lemon balm (*Melissa officinalis*) is one of these known herbs from Lamiaceae family and mainly grows and cultivated worldwide for its edible properties, that has been used since a very long time ago for treatment and protection of many illnesses such as gastrointestinal disorders, headaches, migraine, toothache, neurological diseases, rheumatoid, hypertension, relief of menstrual cramps and fever caused by cold (**Wichtl, 2004; Jun et al. 2012 & Ondrejovic et al. 2012**). This herb has been used extensively in traditional medicine and the history of it goes back to more than 2,000 years ago. The plant has been used in a variety of ways from reducing the heart rate, antivirus, antibacterial, antiinflammatory, anti-cancer, sedative, antioxidant, antispasmodic to a neurotherapeutic agent, peripheral analgesic, as well as a binding

agent to cholinergic receptors (**Naghibi et al. 2005; Ghayoor et al. 2010 ; Yosofi et al. 2011 & Zarei et al. 2015**). Today lemon balm is commonly used in food industries (**Birdane et al. 2007**), due to their properties as antioxidant agents (**Rostami et al 2010**). The most important components in the plant are known to be phenolic compounds such as caffeic acid, rosmarinic acid, metrillic acid, cholinergic acid, and flavonoids like luteolin7-oxide-glucoside, apigenin and monoterpene derivatives such as beta-caryophyllene, germacrene, oleanolic, volatile oil, and tannins (**Rasmussen et al. 2011**). Furthermore a study by **Adelifar et al. (2016)** reported that supplementation of *Melissa officinalis* to athletes can increase total antioxidant capacity and prevent the enhancement of Malondialdehyd level.

Fatty liver can be induced by certain drugs or toxins as oxytetracycline. Oxytetracycline is a type of antibiotic called a tetracycline. It is commonly used antibiotic for the treatment of Anthrax, Cholera, Chlamydia, Lyme disease, Relapsing Fever, Typhus, Malaria, Tularaemia, Syphilis, Plaque, Respiratory infection, Rickettsiae, Mycoplasma, Acne and Streptococcal infection . High doses of oxytetracycline is generally considered as toxic, they produce a fairly large number of opposite effects, some of which can be life threatening. Several evidences shows that oxytetracycline makes severe microvesicular steatosis of the liver in patients and it has been reported that excessive dose of oxytetracycline produce hepatic damage (**Jayanthi and Subash, 2010**). The present study was undertaken to investigate, the possible hepatoprotective and antioxidant effects of lemon balm leaves against changes induced by oxytetracycline toxicity in albino wistar rats.

Material and Methods

Plant material: Lemon balm (*Melissa officinalis* L.) leaves were obtained from the International Herbals Company, Cairo, Egypt.

Chemicals: Oxytetracycline was obtained from Sigma Company for Pharmaceutical Industries Cairo, Egypt. Other chemicals and reagents used for the experiments were of analytical grade obtained from El- Gomhoria Company.

Animal Experimental: Thirty-two (32) male albino rats of Wistar strain with average weight of 120-130 g were obtained from Laboratory of Animal Colony, Helwan, Egypt. The animals were housed in plastic cages with metallic stainless covers maintained in controlled temperature. The animals were fed on basal diet which were formulated according to **NRC (1995)** and were kept for 1 week before the commencement of the study for adaptation. Diets were presented to rats in special non-scattering feeding cups to avoid loss of food and contamination. Water was provided *ad libitum* via a narrow mouth bottle with a metallic tube tightly fixed at its mouth by a piece of rubber tube. Animals were subjected to a 12 hours light and 12 hours dark schedule.

Determination of phenolic compounds: Phenolic compounds were determined by HPLC according to the method of **Goupy et al., (1999)**, in Food Technology Research Institute Agric. Rec. Cent., Egypt.

Experimental Design: The experiment was performed in the Animal House in of the Institute of phthalmology, Giza. The rats were

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randomly distributed into four groups at 8 animals per group and treated as follow:

Group I served as normal control group, and was fed on the basal diet and *ad libitum*

Group II served as untreated fatty liver group. The rats injected intraperitoneally with oxytetracycline (120 mg/kg) for 3 days for fatty liver induction (**Nicola et al. 1996**).

Group III injected intraperitoneally with oxytetracycline (120mg/kg body weight) for the first 3 days then followed by administration of lemon balm powder at dose of 10g/kg daily for next 30 days.

Group IV injected intraperitoneally with oxytetracycline (120mg/kg body weight) for the first 3 days then followed by administration of lemon balm powder at dose of 20g/kg daily for next 30 days.

Daily food intake and body weight gain were calculated weekly. Food efficiency ratio (FER) was determined according to the method of (**Chapman et al. 1959**). At the end of the experimental period, animals were anesthetized under light ether anesthesia and then sacrificed. Blood samples were collected and kept for 30 minutes without disturbance then centrifuged at a rate of 5000 revolutions per minute (rpm) for 15–20 minutes to separate serum, which collected into sterilized tubes and stored at -20 °C.

Biochemical analysis

Serum glucose: Level of serum glucose was carried out according to enzymatic colorimetric method described by **Tietz (1986)**.

Determination of liver enzymes: Aspartate amino transferase (AST) and alanine amino transferase (ALT) were determined by the method of **Breuer (1996)**. Serum γ -glutamyl transferase (GGT) was performed by kinetic method according to **Persijn et al. (1976)**.

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Lactate dehydrogenase (LDH) was assayed by the method of **Wrebleski and La Due (1975)**. Serum total protein and albumin levels were determined according to the method of **Doumas et al. (1975) and Dumas et al. (1997)**. The globulin value for each sample was obtained by subtracting the albumin value from the corresponding total protein value. The A/G ratio for each sample was obtained by dividing the albumin level to globulin level.

Determination of serum lipids: Total lipids were assayed by the method of **Kaplan (1984)**. Serum triglycerides (TG) were determined according to the method of **Fossati and Prencie (1982)**. Serum total cholesterol (TC) was performed according to **Henry et al. (1974)**. Serum high density lipoproteins cholesterol (HDL-cholesterol) was assayed according to **Burstein (1970)**. The concentration of low density lipoproteins cholesterol (LDL-cholesterol) in serum was estimated by the equation used by **Friedewald et al. (1972)** as follow:

LDL- cholesterol (mg/dl) = Total cholesterol - HDL cholesterol - (TG/5).

Determination of serum urea and creatinine: Measurement of serum urea was done according to the method of **Patton and Crouch (1977)**. Serum creatinine was evaluated according to the method of **Jaffe (1980)**.

Determination of serum antioxidant parameters: Superoxide dismutase (SOD) activity, total antioxidants capacity (TAC), and malondialdehyde (MDA) were determined according to **Nishikimi et al. (1972); Cao et al. (1993) and Ohkawa et al. (1979)**, respectively.

Data analysis: All data were expressed as mean \pm standard deviation. Data were statistically analyzed using computerized SPSS (Statistic Program Sigmastat, Statistical Soft-Ware, SAS Institute, Cary, NC). Effects of different treatments were analyzed by one way ANOVA (Analysis of variance) test using Duncan's multiple range test and $p < 0.05$ was used to indicate significance between different groups (*Snedecor and Cochran, 1967*).

Results

HPLC chromatography analysis of phenolic compounds of lemon balm leaves

In this study, the HPLC chromatography was used to determine the phenolic compounds in lemon balm leaves extracts. The HPLC results indicated the presence of L-Ascorbic acid, gallic acid, curcumin, pyrogallol, lithospermic acid and rosmarinic acid, (The most abundant phenolic compound in lemon balm leaves were L-ascorbic acid, gallic acid and curcumin comprising 52.49 mg/100g of phenolic compound (Tables 1). The HPLC chromatogram shows the presence of considerable amount of phenolic compounds in the leaves lemon balm of extract.

Effect of Lemon balm on nutritional parameters in rats with fatty livers

After a 30 day consumption of lemon balm leaves at two doses (10 and 20 g/kg), the body weight (Table 2) was significantly increased of lemon balm treated groups as compared with fatty liver (untreated) group. The level of body weight in treated group received 20g/kg of lemon balm leaves was lower when compared with normal control and also with treated group that received 10g/kg of lemon balm. Likewise the levels of feed intake and values feed efficiency

ratio were significantly higher better in treated groups with lemon balm leaves as compared with untreated fatty liver group.

Effect of Lemon balm on hepatic marker enzymes and serum glucose in rats with fatty livers

In this study, the liver marker enzymes (ALT, AST, GGT and LDH) significantly increased in fatty liver group (untreated) as compared with normal as well as treated groups with lemon balm at the two doses (10 and 20 g). The increased levels of AST and ALT in untreated fatty liver group were (128.23, 95.66 U/ml). Likewise, the increased level of GGT and LDH were (22.38 lu/ L and 433 U/L) at ($P < 0.05$) respectively. The peptidase enzyme GGT levels increment was (49.93 IU/ L).

Data also showed high significant increase in serum glucose level in fatty liver (untreated) group when compared with control group (Table 3). Treatment of rats with lemon balm for 30 days after induction of fatty liver with oxytetracycline caused significant ($P < 0.05$) decrease when compared with untreated fatty liver group.

Effect of Lemon balm on serum total protein, albumin, globulin and A/G ratio in rats with fatty livers

There was a significant ($P < 0.05$) increase in the level of serum total protein in lemon balm treated groups when compared with the untreated fatty liver group. The results reported in Table 4 also showed that groups treated with lemon balm leaves at the two doses of 10 and 20g/kg had significantly increased ($P < 0.05$) levels of serum albumin when compared with the fatty liver (untreated) group. Likewise the rats treated with lemon balm showed significant increase in the serum globulin ($P < 0.05$) compared with untreated

fatty liver group. While A/G ratio showed significant change in 10 g/kg lemon balm treated group that produced value similarly to normal control group in comparison with untreated fatty liver group.

Effect of Lemon balm on lipid profile in rats with fatty livers

As presented in Table 5, rats in the fatty liver (untreated) group exhibited increased total lipids, TG, TC and LDL-C levels compared to normal control ($P < 0.05$). The serum levels of HDL-C tended to decline in the fatty liver group (untreated), but the difference was not statistically significant. After treatment with lemon balm at the two doses of 10 and 20g/kg, TG, TC and LDL-C levels decreased compared to the untreated fatty liver group ($P < 0.05$).

Effect of Lemon balm on serum urea and creatinine in rats with fatty livers

Data in Table 6 showed that the untreated fatty liver group showed highly significant ($P < 0.05$) increase in serum urea and creatinine compared with the control group. However rats which treated with lemon balm at two doses till the end of the experiment showed amelioration on the effect of oxytetracycline on serum urea and creatinine levels.

Effect of Lemon balm on SOD, total antioxidant capacity and MDA levels in rats with fatty livers

As shown in Table 7, injection of oxytetracycline caused an elevation of hepatic MDA, but a decline of total antioxidant and SOD levels compared to normal control group. The elevated MDA level was reduced by 47% and the total antioxidant and SOD levels increased by 29 and 23% in lemon balm group that treated with 10g/kg. Similarly, MDA decreased by 53% and total antioxidant and SOD increased by 41 and 30% in lemon balm group that treated with

20g/kg. Compared to fatty liver (untreated) group, the group that treated with lemon balm at dose of 20g/kg was more effective in elevating the content of hepatic SOD (119 vs 154.73 U/mL) at ($P < 0.05$).

Discussion

Medical plants being important sources of natural antioxidants, search for safe and effective naturally occurring antioxidants is now focused on edible plants especially herbs (**Miliauskas et al. 2004 and Helal et al. 2012**). Lemon balm (*Melissa officinalis L*) plant is one of the most known and oldest herbaceous aromatic plants, which have been used in different forms. Most of its therapeutic effects were ascribed to a variety of active components in lemon balm leaves which make therapeutic properties possible (**Zarei et al. 2015**).

When liver gets damaged after oxytetracycline induced fatty liver, it leads to leakage of cellular enzymes into plasma (**Ozougwu et al. 2014**). The increased levels of serum enzymes such as ALT, AST, and LDH observed in fatty liver group (untreated) compared to the normal rats, could be due to hepatocellular damage because these enzymes are normally located in the cytoplasm and released into the circulation after cellular damage (**Hassan and El-Gendy, 2003**). Furthermore, elevated serum levels of AST, ALT and LDH are indicative of poor hepatic function in untreated fatty liver rats (**Moss and Handeson, 1999**). On the other hand, the significant decrease in the serum levels of the ALT, AST, GGT and LDH in lemon balm administered animals might be due to decreased leakage from the liver cells. This suggests that the leaves of lemon balm were able to repair the probable hepatic injury and restore the

cellular permeability; thus reducing the toxic effect of oxytetracycline on the liver cells. It seems that, the effect of lemon balm on reducing liver enzymes is known to be due to its powerful antioxidant properties. This plant contains phenolic compounds, which are among the most important antioxidant agents (**Zarei et al. 2014**). Serum total protein, albumin and globulin decreased in untreated fatty liver group, while A/G was increased. This decrease could be due to hepatic dysfunction and decreased protein synthesis. Also it may be related to the damage of vital biological processes or to changes in permeability of liver, kidney and other tissue cells leading to leakage of protein via the kidney (**Helal et al. 2012**).

Oxytetracycline induced hyperglycemia in fatty liver rats and treating with lemon balm leaves with 10 and 20 g turned glucose levels back to normal values. The improvement in glycemic status may be due to essential oil of lemon balm that has anti diabetic properties and improves glucose tolerance and adjusts the expression of the genes involved in hepatic gluconeogenesis (**Chung et al. 2010**). As well as oxytetracycline caused kidney dysfunction which appeared through the high increase in serum urea and creatinine levels, while after treatment with lemon balm leaves, renal function indicators referred back to normal values, which related to the presence of effective and bioactive antioxidants with especial ability to inhibit the production of free radicals, that has given a unique feature to this plant. These results are in agreement with those of **Namjoo et al. (2013)** who showed that serum activity of urea and creatinine levels decreased significantly after treating with lemon balm extract.

In the present study, the ameliorative effects of lemon balm on lipid profile are in agreement with **Bolkent et al. (2005)** who

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indicated that, lemon balm improved lipid profile of hypercholesterolemic rats by reducing serum lipid concentrations and lipid peroxidation in the liver of rats. Furthermore, **Jun et al. (2012)** who reported that, lemon balm extract produced significant decrease in serum triglycerides levels and the extract exhibit a significant lipid reducing activity and protect tissues from lipid peroxidation. Additionally **Changizi-Ashtiyani et al. (2013)** reported that the hypolipidemic properties of lemon balm were related to the antioxidant properties.

Lipidperoxidation is considered as one of the fundamental mechanism of cellular damage, caused by free radicals. Free radical reacts with lipid causing peroxidation, resulting in the release of product such as malanodialdehyde. Lipidperoxidation is among these and it is a process, which is formed by means of the oxidation of polyunsaturated fatty acids, thus MDA is one of the final products of lipidperoxidation (**Ramesh and Dhanaraj, 2016**). An increase in lipid-peroxides produce serious damage to cell membranes and inhibition of several important enzymes, reducing cellular function and cell death. The level of lipidperoxidation of untreated fatty liver group was significantly higher in the serum (10.34 mmol/L) as compared with normal control group. But in treated groups with lemon balm leaves the level of lipidperoxidation were significantly ($P < 0.05$) lower (5.48, 4.83 mmol/L) as compared with fatty liver group (untreated). This results in agreement with those of **Zarei et al. (2015)** who stated that lemon balm can inhibit the production of chemical active species in their early stages or later and that may block lipid peroxidation through various processes.

Administration of lemon balm showed significant hepatoprotective activity at 10g/kg and 20g/kg, which were comparable to the standard control group. The hepatoprotective effects were more pronounced with the lower dose of 10g/kg of lemon balm. The increased serum levels of ALT and AST levels in oxytetracycline treated animals might be due to the leakage of enzymes into the serum. Furthermore the results revealed that the GGT increment in experimental period was high like other values. These results are in agreement with those obtained by **(Ramesh and Dhanaraj, 2016)** indicated that, the high level of GGT is an indicator to the liver damage which induced by chemicals substances. The increased level of AST, ALT and LDH were indicative of cellular leakage and loss of functional integrity of liver cell membrane **(Drotman and Lowhorn, 1978)**. Also the elevation in total serum protein that, observed in oxytetracycline hepatotoxic rats suggested abnormal conjugation of total protein by the liver due to generalized hepatocellular damage **(El-Sherbiny et al. 2003)**. Total serum protein decreased in oxytetracycline hepatotoxic rats after treatment with lemon balm leaves. The possible mechanism of action of administration lemon balm leaves may be through their antioxidative effects, which related to phenolic compound in plant leaves. This is because lemon balm has active ingredients that are capable of free radical scavenging in living system **(Dastmalchi et al. 2008; Rostami et al. 2010 & Zarei et al. 2015)**. These results were supported with levels of SOD and total antioxidant capacity, which has significantly ($P < 0.05$) decreased in untreated fatty liver group as compared with normal group. While after treatment with lemon balm the value of SOD significantly increased than untreated fatty liver group. The higher value was presented in 10g lemon balm treated rats. These results are agreement with the finding of **Adelifar et al. (2016)** who stated that administration of lemon balm to athletes

increase their total antioxidant capacity and enhanced Malondialdehyd level.

Conclusion

Based on the above results, it may be concluded that lemon balm might has a hepatoprotection effect against oxytetracycline induced fatty liver in experimental animals. Lemon balm leaves have demonstrated hepatoprotective activity based on reducing AST, ALT, GGT, LDH, glucose, TG, TC, LDL-C, urea, creatinine and MDA levels, while there was increase in total protein, albumin, globulin and HDL-C levels in groups treated with lemon balm leaves at two doses (10 and 20 g/kg) in compared with untreated fatty liver group . As well as increase in antioxidant parameters such as SOD and total antioxidant capacity in lemon balm treated groups compared with untreated fatty liver rats. These encouraging results may have future clinical importance because of the increased use of natural herbs worldwide and particularly in Egypt.

Table 1: The concentration of phenolic compound in lemon balm leaves

Phenolic compounds	Mass (mg/100g)
Gallic acid	26.51
Maltol	1.48
Salicylic acid	1.62
Vanillic acid	1.35
P-Coumaric acid	1.82
Curcumin	11.54
L-Ascorbic acid	24.43
P-Hydroxycinnamic	1.28
Pyrogallol	2.74
Benzo-a-pyrene	0.87
Acetylsalicylic acid	1.15
Rosmerinic acid	2.58
Lithospermic acid	2.61

Table 2: Effect of Lemon balm administration on nutritional parameters in rats with fatty livers

Parameters \ Groups	Normal control	Fatty liver (Untreated)	Fatty liver + LBL (10g/kg)	Fatty liver + LBL (20g/kg)
Body weight gain (g)	113.76±8.11 ^a	66.59±6.11 ^b	105.77±9.17 ^a	102.13±9.13 ^a
Food intake (g/day)	15.94±2.20 ^a	13.58±2.03 ^b	15.85±2.32 ^a	15.16±2.21 ^a
Food efficiency ratio	0.255±0.03 ^a	0.175±0.02 ^b	0.257±0.04 ^a	0.246±0.03 ^a

Values are expressed as mean ± SD, n=8, Means with a common superscript (a, b, c) within a row are significantly different (P<0.05); LBL: Lemon Balm Leaves

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Table 3: Effect of Lemon balm administration on serum liver enzymes and serum glucose in rats with fatty livers

Groups Parameters	Normal control	Fatty liver (Untreated)	Fatty liver + LBL (10g/kg)	Fatty liver + LBL (20g/kg)
AST(U/ml)	94.78±1.12 ^d	128.23±1.38 ^a	96.89±1.16 ^c	107.49±1.22 ^b
ALT(U/ml)	49.14±1.74 ^d	95.66±1.58 ^a	50.90±1.72 ^c	55.76±1.65 ^b
GGT(U/L)	10.24±0.43 ^d	22.38±0.83 ^a	11.16±0.77 ^c	13.87±0.22 ^b
LDH(U/L)	189±2.95 ^d	433±3.48 ^a	197±2.89 ^c	201±2.77 ^b
Glucose(mg/dl)	72.63±1.48 ^c	96.0±1.22 ^a	73.4±1.36 ^c	79.94±1.22 ^b

Values are expressed as mean ± SD, n=8, Means with a common superscript (a, b, c) within a row are significantly different (P<0.05), AST: Aspirate amino transferase, ALT: Alanine amino transferase, GGT: Gamma glutamyl transferse , LDH : Lactate dehydrogenase ; LBL: Lemon Balm Leaves

Table 4: Effect of Lemon balm administration on serum total protein, albumin, globulin and A/G ratio in rats with fatty livers

Groups Parameters	Normal control	Fatty liver (Untreated)	Fatty liver + LBL (10g/kg)	Fatty liver + LBL (20g/kg)
Total Protein(g/dl)	7.59±0.08 ^a	5.87±0.09 ^d	7.35±0.11 ^b	6.14±0.22 ^c
Albumin (A)(g/dl)	4.43±1.74 ^a	3.73±0.08 ^d	4.44±0.09 ^b	4.19±1.54 ^c
Globulin (G) (g/dl)	3.16±0.08 ^a	1.90±0.08 ^d	3.15±0.07 ^b	3.02±0.09 ^c
A/G ratio	1.42±0.07 ^c	2.18±0.01 ^a	1.46±0.06 ^b	2.09±0.03 ^a

Values are expressed as mean ± SD, n=8, Means with a common superscript (a, b, c) within a row are significantly different (P<0.05), , LBL: Lemon Balm Leaves

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Table 5: Effect of Lemon balm administration on serum total lipids, Triglycerides, cholesterol, LDL-c and HDL-c in rats with fatty livers

Groups Parameters	Normal control	Fatty liver (Untreated)	Fatty liver + LBL (10g/kg)	Fatty liver + LBL (20g/kg)
Total Lipids (mg/dl)	309.11±1.6 ^d	411.42±2.1 ^a	314.07±1.7 ^c	323.22±1.8 ^b
TG (mg/dl)	42.14±1.9 ^c	90.31±1.4 ^a	43.87±1.8b ^c	45.57±1.7 ^b
TC (mg/dl)	95.80±1.5 ^c	104.34±1.5 ^a	95.40±3.1 ^c	99.18±2.1 ^b
LDL-c (mg/dl)	40.89±2.88 ^c	48.02±1.4 ^a	41.60±1.4 ^c	46.56±1.4 ^b
HDL-c (mg/dl)	46.79±1.6 ^a	38.42±1.2 ^c	46.08±1.6 ^a	40.10±1.8 ^b

Values are expressed as mean ± SD, n=8, Means with a common superscript (a, b, c) within a row are significantly different (P<0.05), TC: Total cholesterol, TG: Triglycerides, HDL: High density lipoprotein cholesterol, LDL: Low density Lipoprotein cholesterol; LBL: Lemon Balm Leaves.

Table 6: Effect of Lemon balm administration on serum urea and creatinine in rats with fatty livers

Groups Parameters	Normal control	Fatty liver (Untreated)	Fatty liver + LBL (10g/kg)	Fatty liver + LBL (20g/kg)
Urea (mg/dl)	37.12± 2.6 ^c	186.54± 8.15 ^a	40 .72± 1.9 ^{bc}	44.21± 1.7 ^b
Creatinine (mg/dl)	0.71± 0.02 ^c	2.04± 0.01 ^a	0.79± 0.08 ^c	1.93± 0.06 ^b

Values are expressed as mean ± SD, n=8, Means with a common superscript (a, b, c) within a row are significantly different (P<0.05), LBL: Lemon Balm Leaves

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Table 7: Effect of lemon balm administration on serum antioxidant parameters in rats with fatty livers.

Parameters \ Groups	Normal control	Fatty liver (Untreated)	Fatty liver + LBL (10g/kg)	Fatty liver + LBL (20g/kg)
SOD U/mL	179.70±9.95 ^a	119.00±7.00 ^d	146.37±8.55 ^c	154.73±9.07 ^b
Total antioxidants mmol/L	2.35±0.22 ^a	1.37±0.15 ^d	1.77±0.15 ^c	1.94±0.06 ^b
MDA mmol/L	4.52±0.33 ^c	10.34±1.09 ^a	5.48±0.26 ^b	4.83±0.21 ^{b c}

Values are expressed as mean ± SD, n=8, Means with a common superscript (a, b, c..) within a row are significantly different (P<0.05), SOD: Superoxide dismutase, MDA: Malondialdehyde ; LBL: Lemon Balm Leaves

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تأثير بلسم الليمون (عشبة المليسا) على الأوكسى تتراسيكلين المسبب للكبد الدهنى فى فئران الالبينو

على مناحى نزال الشمري

قسم الاقتصاد المنزلي – كلية التربية الاساسية – الهيئة العامة للتعليم التطبيقي والتدريب - الكويت

الملخص العربي

مع زيادة المشكلات الناتجة عن اختلال وظائف الكبد ، يعتبر استخدام المنتجات النباتية الطبيعية فى زيادة مستمرة، ويرجع ذلك الى الخصائص القوية لمضادات الاكسدة ، الاثار الجانبية التى لا تذكر وانخفاض تكلفتها.

يهدف هذا البحث الى دراسة تأثير بلسم الليمون بنسبة (10 و 20 جم / كجم الوجبة/ يوميا) وذلك على فئران التجارب المصابة بالكبد الدهنى المحدث باستخدام الاوكسى تتراسيكلين. تم تقسيم 32 من الفئران ذات اوزان 120-130 جم الى اربعة مجموعات. تم احداث الضرر للكبد بالمعاملة بالاوكسى تتراسيكلين (120 ملجم / كجم من الوزن) بالحقن بالغشاء البروتينى وذلك لمدة ثلاثة ايام وذلك كما اتضح من خلال الزيادة المعنوية فى مؤشرات وظائف الكبد التى شملت الاسبرتات ترانسفيريز ، الالانين ترانسفيريز ، جاما جلوتاميل ترانسفيريز واللاكتات دى هيدروجينيز وكذلك زيادة مستوى المالنوالدهيد. ادى تناول بلسم الليمون بنسبة ((10 و 20 جم / كجم / الوجبة/ يوميا)) عن طريق الفم لى تقليل تأثير الاوكسى تتراسيكلين المحدث لتسمم الكبد وذلك من خلال الانخفاض الملحوظ فى السيرم لمستويات مؤشرات وظائف الكبد ، الجلوكوز ، الجلوسريدات الكلية ، الكوليسترول الكلى ، الكوليسترول منخفض الكثافة ، اليوريا ، الكيرياتينين والمالنوالدهيد والزيادة الملحوظة فى سيرم البروتين الكلى ، الاليومين ، الجلوبيولين والكوليسترول مرتفع الكثافة وذلك فى المجموعات المعالجة باستخدام بلسم الليمون بالمقارنة بمجموعة الكبد الدهنى الغير معالجة. وكذلك لوحظ زيادة فى انزيم السوبراوكسيدديسموتيز وقدرة مضادات الاكسدة الكلية

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فى المجموعات المعالجة ببلسم الليمون وخاصة جرعة (10 جم/ كجم) بالمقارنة بمجموعة الكبد الدهنى الغير معالجة.
توصى الدراسة الى أهمية استخدام بلسم الليمون الذى كان له تأثيرات ملحوظة على مستوى انزيمات الكبد والمالونالدهيد فى الفئران. وكما اتضح ان المعالجة بأوراق بلسم الليمون للمجموعات ادى لحماية الكبد من الضرر الناجم عن الاوكسى تتراسيكلين.