Tetrachloromethane (CCl4)-induced liver deterioration in rats with effects of the phytochemical in loquat (Eriobotrya japonica) leaves

Dalia. R. Hassan

ABSTRACT:

The fruit tree Eriobotrya japonica (EJL) performs a variety of essential functions. The current article's target was to establish the hepatoprotective effects of the phenolic and flavonoid constituents in loquat leaves (E. japonica); versus CCl4 in rats. In this study, thirty male albino rats averaging 190±10 g were separated into two main sets: first G (−ve) was fed on a basal diet for 4 weeks and the remainder were injected by CCL4 for induction liver injury twice weekly for 4 weeks, there are all treatment rats divided into 4 sub-groups. Second G was fed a basal diet with CCL4 injection (2 mg /kg) (+ve) control and sets (3,4,5) fed different dried Eriobotrya japonica levels at (50, 100 and 150 g/kg diet). The findings revealed that all indicators have highly significantly increased (malondialdehyde MDA, liver enzymes, lipid parameter) after CCL4 injection, but when added EJL at different levels, all parameters were highly significantly decreased when compared with positive G, and the decreasing level was accompanied with increasing the EJL levels, this due to the phenolic and flavonoids compounds of EJL. The same effects were noticed in histological results. Bread sensory evaluation revealed the good palatability of these leaves, which could be used as ameliorating products for liver injury.

Keywords: EJL – flavonoids – tannin – MDA – liver function.
INTRODUCTION:
Asian trees called loquats (Eriobotrya japonica, EJL) are grown for their fruit. Its leaves have been employed in medicine for humans (Liu et al., 2016). Additionally, loquat leaf is a crucial component of culinary applications, and in China and Japan, it has been the main component of certain wholesome and delectable herbal teas (Hui et al., 2017).

The healthy food and drug sectors may use polysaccharides derived from loquat leaves (LLPs) when the structural characterization of polysaccharides gets more efficient (Agsalda-Garcia et al., 2020; Trang et al., 2020). However, it is yet unclear if a chemical change has an impact on the antioxidant activity of EJL.

The main bioactive substances in E. japonica leaves, according to spectrometry, are tormentic acid, oleanolic acid, ursolic acid, and corosolic acid (Yanwei et al., 2022). A green fruit tree called Eriobotrya japonica is planted in several nations, including Iran, Spain, Turkey, Tunisia, and Egypt (Liu et al., 2016).

Eriobotrya japonica, Tussilago farfara, and Ephedra sinica were among 56 chosen Chinese herbal remedies that Song et al. (2010) studied; the findings suggested that these plants may be excellent sources of naturally occurring antioxidants.

The leaves of E. japonica contain a range of natural substances, including tannins, triterpenes, sesquiterpenes, and flavonoids. Several of these substances have antiviral, anti-inflammatory, anti-hyperglycemic, and antitumor properties (Cha et al., 2011).

The primary bioactive components of loquat leaves are polysaccharides, which account for 3.62–5.29% of the plant’s total weight and have strong antioxidant, anti-tumor, anti-inflammatory, anti-obesity, and antifatigue properties (Wu et al., 2018). Additionally, research shows that the Eriobotrya japonica plant has a variety of essential functions, including the enhancement of liver, lung, renal, and brain cells (Yang et al., 2012).
According to Arjun (2022), the key organ in charge of regulating essential processes like digestion and the major detoxifying of poisons that reach the body is the liver. Because hepatic cytochrome P450 converts CCl$_4$ into very reactive carbon-centered trichloromethyl radicals, it is frequently employed to injure the liver. These radicals cause liver injury by triggering a series of lipid peroxidation events (Aminjan et al., 2019).

The current focus of research is on the pharmacological use of plants and natural components. Determining the hepatoprotective qualities of E. japonica (EJL) leaves and their various fractions towards CCl$_4$-induced rat liver injury was the objective of the current work.

**MATERIALS AND METHODS:**

**Materials:**

After being collected, the leaves were cleaned to get rid of the dirt and tiny feathers that were already on them. Next, leave it in the air (room temperature) for two consecutive days. This helps to dry the leaves before they are ground into an ultrafine powder and packaged.

Formalin with carbon tetrachloride (CCl$_4$) at 100% concentration. was acquired from the Al-Gomhoria - Company.

**Animals:**

Thirty male albinos Sprague Dawley rats weighing 190±10 g each were employed in this experiment. The creatures were bought from the Helwan animal house- in Cairo. For one week of acclimatization, they were kept in cages and given unlimited amounts of food and water.

**Methods:**

**Determination of total phenolic and flavonoids:**

The actual amount of phenol in the sample was measured using the Folin-Ciocalteu micro-method (Saeedeh and Asna, 2007). The approach of using the total flavonoid content as a measurement (Ordon et al., 2006).

**Preparation of toast bread**

Flour blends were baked using the straight–dough method; according to (Chauhan et al. 1992 and Radwan and Elmaadawy
Wheat flour was substituted by three levels of EJL powder (5, 10, and 15 %). The baking formula was composed of a 500 g flour blend, 9 g of compressed baker's yeast, 5 g of NaCl, 13 g of cane sugar, and 10 g of vegetable oil. The dough was fermented for 90 min at 28±1°C and then punched, scaled to 250 g dough pieces, proofed for 90 min at 30°C, 85% relative humidity, and baked at 250°C, for 30 min.

**Sensory evaluation:**
The sensory qualities of toast samples were assessed. Each bread sample was given to ten participants in the form of a half-slice on disposable, odorless, white plates. Samples were graded on a scale of 1 to 10 for taste, texture, fragrance, color, and overall quality. The assessment was completed using methodology according to (Land and Shepherd 1988).

**Design of the experiment:**
A total of 30 male Sprague Dawley albino rats, weighing 180–200 g, were kept in separate cages under standard circumstances and given a week of a baseline diet to help them adjust. The rats were split into two major groups after this week, as follows: The first group (each with six rats) had a basal diet according to Reeves *et al.*, (1993) for four weeks (negative group). Four subgroups were created from the 24 rats in the second major group. Carbon Tetra Chloride (CCl₄) 2 mg/Kg of rat body weight was administered intraperitoneally (IP) into all rats twice weekly (Fang, *et al.*, 2008). Rats in the third through fifth groups were fed a base meal with various EJL concentrations at (5%, 10%, and 15% /kg basal diet instead of corn starch) (Sundaresan and Subramanian 2003). At the conclusion of the experiment, all rats received a mild anesthetic, and blood samples were taken from the retro-orbital arteries. To extract the serum, blood samples were separated for 15 minutes at 3000 rpm after being allowed to clot.

**Biological evaluation**
Weekly measurements Feed intake was taken and was an assessment of the growth rates of the rats in all groups throughout the experiment, and the growth
rates for each group were as follows: Growth is the variation between the current weekly weight (g) and the previous weekly weight (g) (Adeyemi et al., 2015). The relative weight of the liver is determined in the final period as follows: weight liver/ final weight of rat.

Serum biochemically and antioxidant enzymes evaluation:

aspartate aminotransferase and alanine aminotransferase (AST and ALT) as stated by Reitman and Franke (1957), serum alkaline phosphatase (ALP) as reported by Roy (1970), gamma-glutamyl transferase (GGT) according to Fischbach (2004), bilirubin In keeping with (Walter and Gerade 1970), malondialdehyde (MDA) in line with Draper et al., (1993), total cholesterol as stated by Allain et al., (1974), triglycerides consistent with Trinder (1969), High-Density Lipoprotein-cholesterol HDL-c in line with Lopes-Virella et al., (1977), Low-Density Lipoprotein-cholesterol LDL-c and Very Low-Density Lipoprotein- cholesterol VLDL-c consistent with (Friedwald et al., 1972).

Histopathological examination:

A liver organ was dried with high alcohol concentrations after being immersed in a formalin solution (10%). Each group collected five 5-mm thick slices and stained them with Masson Trichrome and eosin and hematoxylin (H&E) (Bancroft and Gamble, 2002).

Statistical Analysis

An examination of variation in one direction was used to establish the statistical significance of standard deviation across groups (ANOVA). In order to determine if mean differences at (P ≤ 0.05) were significant, the Least Significant Difference (LSD) test was used. All data analysis was done using SPSS software (Version 16; SPSS Inc., Chicago., USA) (McCormick and Salcedo 2017).

RESULTS AND DISCUSSION:

The total phenolic, flavonoid, and tannin content of Eriobotrya japonica Leaves (EJL) were (0.175± 0.01, 0.073± 0.01,
Tetrachloromethane (CCl4)-induced liver deterioration in rats with effects of the phytochemical in loquat (Eriobotrya japonica) leaves

Dalia. R. Hassan

6.94±1.11 g/100g), according to data in table 1. These findings were in line with research by Pande and Akoh (2009), who discovered that EJL contains tannins, sesquiterpenes, triterpenes, megastigmene glycosides, and flavonoids including quercetin, epicatechin, and catechin, as well as phenolic acids like p-coumaric, gallic, caffeic, and ellagic acid. The leaves of Eriobotrya japonica had a high tannin concentration, which was consistent with the findings of Nawrot-Hadzika et al. (2017), who determined that the tannin level was 7.52±1.01 g/100g. The total amount of phenolic (TPC) and flavonoid (TFC) chemicals in 100 g of EJL leave was (0.160, 0.01, and 0.064, respectively). According to Borges et al. (2013), numerous elements, such as soil nutrients, had an effect on phenolic compounds, and their concentrations altered from one generation to the next (Verma and Shukla, 2015). EJL also contains tormentic acid, in addition to ursolic and oleanolic acids. Its actions are hypoglycemic, anti-inflammatory, anti-atherogenic, and normoglycemic Tormenting acid (Fogo et al., 2009; Xu and Chen 2011; Wu et al., 2015). The portion of loquat leaves showed anti-inflammatory activity by reducing nuclear factor-B (NF-B) activation, nitric oxide (NO)synthase expression and NO production are inhibited, and down-regulating the secretion of pro-inflammatory cytokines like interleukin-6 and tumor necrosis factor (TNF). Since disturbed cellular oxidative status is linked to NF-B activation, antioxidant activity may also play a role (Shih et al., 2010; Alshaker et al., 2011). Increased antioxidant enzyme activity glutathione peroxidase, catalase and superoxide dismutase (GPx, CAT, and SOD), and HO\(^{-1}\), which protects against intracellular reactive oxygen species ROS, are associated with both anti-inflammatory and anti-oxidant actions of loquat leaf extract that is rich in flavonoid compounds such as triterpene acids (Li et al., 2007; Lin and Tang 2008). There have been several research on the terpenoid components of loquat
Tetrachloromethane (CCl4)-induced liver deterioration in rats with effects of the phytochemical in loquat (Eriobotrya japonica) leaves

Dalia. R. Hassan

leaf. For instance, in loquat leaves, several terpenoid compounds have been found, and flavonoid amount and activity have been linked (Li et al., 2009; Li et al. 2015)

From table (2) EJL toast at level 5% had the highest score at color, appearance, and texture across all samples in comparison with the control sample. EJL toast at levels 10% and 15 received the lowest score across all sensory evaluations, which may have been a result of containing a harsh texture due to the high quantity of dietary fibers and the darkness of the dried leaves. The present findings agree with those of Cho and Kim (2013), who found that values for all criteria dramatically reduced as EJL levels increased.

Figure 1 observed that photo (6a) represents all samples, photo (6b) represents the control wheat sample of toast, photo (6c) represents the toast sample with 5% EJL, photo (6d) represents the toast sample with 10% EJL, and photo (6e) represent toast sample with 15% EJL. From photos (6a, b, c, d, and e) it could be noticed that the toast sample of wheat flour differs in texture, volume, and pores this is due to a gluten network that traps air inside, while the three samples of toasts differ gradually in color, volume, and texture which revealed the same trend as sensory evaluation, as the best score of samples was at the toast with 5% level of EJL, this may be due to the toast color and volume. Other samples became slightly dark, which can influence the evaluation. These results were in a harmony with (Ga et al., 2021) who reported that according to the observations using a scanning electron microscope (SEM), the pores decreased and merged as the amount of loquat leaf powder rose, yet they grew bigger and fewer in number. The rice cake with 4.5% loquat leaf powder earned the highest grade in all of the sensory tests, according to sensory assessments. In conclusion, loquat leaf powder enhanced the antioxidant activity and quality attributes that might be used to make different foods.

The effects of EJL powder (5%, 10%, and 15%) on feed intake (FI), body weight gain (BWG), the feed efficiency ratio (FER), and liver weight (g) were
shown by the data in the table (3). When compared to the negative group (19.14 ±1.10), feed intake in the positive group (13.88 ±0.12g) had a significant decrease. Assessing all treated groups to the positive group, a significant increase was observed (p<0.05). The group treated with CCL4+15% EJL was (17.47 ±1.12), which is the best value for the (-ve) group, and obtained the best performance as indicated in the table (1). The findings showed that the mean BWG in the positive control group was considerably lower than in the negative control group. In comparison to the positive control group, all EJL powder treatment groups (5%, 10%, and 15%) displayed a significant increase (P <0.05). The group treated with CCL4+15% EJL achieved the best results, which is a value similar to the (-ve) control group as specified in Table (1). The feed efficiency ratio in the positive control group recorded a significant decrease as compared with (-ve) and all treated with EJL (5%,10%, and 15%) powder. When compared to the negative control group, the value of liver weight was significantly higher in the positive control group. Each group that received EJL powder treatments (5%, 10%, and 15%) demonstrated a statistically significant increase (P0.05). The group that received treatment with CCL4+15% EJL has a close value to the (-ve) group as described in Table (1). These results were in a harmony with those of Yoshioka et al., (2018) revealed that CCl4 administration increased liver weight, decreased body weight, and feed intake. Also, the result showed a significant increase at (p<0.05) in body weight in all groups treated with different levels of EJL when compared with the positive control group. It should be mentioned that body weight is rising together with the level of Eriobotrya Japonica. As opposed to the negative control group, body weight gain was higher in all groups treated with
Tetrachloromethane (CCl4)-induced liver deterioration in rats with effects of the phytochemical in loquat (Eriobotrya japonica) leaves

various doses of Eriobotrya Japonica. These outcomes were comparable to those attained by (Shafi and Tabassum 2013)
Data in table (4) showed that all parameters of total cholesterol, triglycerides, high-density lipoprotein cholesterol, and low-density lipoprotein cholesterol (TC, TG, HDL-c, and LDL-c) were significantly higher in groups of rats with liver fibrosis brought on by CCl4 injection than in the control group, with values of mg/100gm 289.6 ± 23.8, 207±5.4, 23±2.9, and 173 ± 5.03, respectively. These findings were consistent with those of Kamalakkannan et al. (2005), who reported that CCl4 injection increased total cholesterol. The results of Kamalakkannan et al. (2005) study showed that CCl4 also inhibits the synthesis of apolipoprotein, which in turn reduces the synthesis of lipoproteins, while the groups of rats fed on EJL at 5%, 10%, and 15% with CCl4 showed a highly significant decreased in TC, TG, and LDL-c and a highly significant (p<0.05) increased in HDL-c. In addition, Shih et al., (2010) and Shih et al., (2013) displayed a result of lowering body weight growth, hepatic triacylglycerol levels, adipocyte size in visceral depots, and the weight of white adipose tissue (WAT) (containing visceral fat, mesenteric, perirenal, and epididymal WAT), flavonoids like terpenoids in (EJL) showed hypolipidemic action. According to certain research, lipids deposited in peripheral adipose tissue are transferred to the liver and kidney after CCl4 poisoning and accumulate there (Kamalakkannan et al., 2005).
Additionally, loquat extractions control how lipids are metabolized and result in lower levels of triglycerides and total cholesterol (Lu et al., 2009). Treatment with CCl4 reverses the weakening of the liver cells' capacity to metabolize lipids and convert cholesterol to bile acid for excretion, while also raising blood levels of triglycerides, low-density lipoprotein cholesterol, and cholesterol while lowering high-density lipoprotein cholesterol levels. The fractions and extract of loquat helped to mitigate these effects. (Shahat et al., 2018).
addition to decreasing sterol regulatory element binding protein-1c (SREBP-1c) mRNA levels and sterol regulatory element binding enzyme levels in the liver, loquat also altered fatty acid levels and oxidation enzymes (Shih et al., 2010). The reduction in blood fat levels, including triglycerides, total cholesterol, low-density lipoprotein cholesterol, malondialdehyde, and an increase in HDL-c, may be attributable to Eriobotrya Japonica leaves having a high concentration of total sesquiterpene glycosides compounds, according to Jian et al. (2017). Loquat leaves have antioxidant properties, according to several research) Banno et al., 2005; Hong et al., 2008), and natural antioxidants work to prevent lipid peroxidation by inhibiting the enzyme xanthine oxidase.

The normal control group's biochemical characteristics served as the baseline for comparison. Serum levels of MDA, bilirubin, ALP, AST, ALT, and GGT were all significantly lower in rats fed meals with levels of (EJL) (P<0.05) when compared to the positive control group. This result was consistent with Shahat et al., (2018)'s report that fractions of EJL also significantly suppressed the CCl4-stimulated elevated amount of malondialdehyde (MDA), which was demonstrated by a decline in histopathological injuries. With increased leaf percentage in the basal diet, the improvement of all parameters was significantly increased. Aspartate aminotransferase (AST), gamma-glutamyl transferase, alanine aminotransferase (ALT), bilirubin, and alkaline phosphatase levels in rats treated with this plant were considerably decreased at (p<0.05) levels when compared with positive controls, according to research (Shahat et al., 2018). The present findings demonstrated that rat serum levels of ALP and bilirubin were increased by CCl4. Such enzymes are often found in cell cytoplasm at greater concentrations than in serum.
According to the degree of liver injury, hepatopathy induces the release of AST, ALT, and bilirubin into the circulation (Nkosi et al., 2005). According to results from another study, increased blood levels of AST, ALT, ALP, and total bilirubin in CCl₄-treated rats suggested cellular damage and loss of cell membrane function (Zeashan et al., 2008). Additionally, Shahat et al. (2018) discovered that Eriobotrya japonica leaf extracts in methanolic, ethyl acetate, aqueous, and butanol as well as their various fractions against hepatotoxicity brought about by CCL₄ resulted in a significant decrease in serum levels of liver enzymes like ALP, ALT, AST, malondialdehyde, and bilirubin.

Figure 1 shows that in rats treated with CCl₄ and given a low dosage of EJL photo (3) (50 g/kg), the hepatocytes did not return to normal. Hepatocytes were somewhat congested and had a modest degree of cellular edema in the liver slices. However, rats given CCl₄ treatment plus a high dosage (150 g/kg) of EJL supplementation had normal hepatic lobules and hepatocytes G (5). Li et al. (2014) mentioned that CCL₄ is commonly used as a model toxicant to induce chronic and acute liver injuries. Acute liver injury was successfully induced by CCL₄ as revealed by histopathological results and the significant increase in ALT and AST. Haytham et al. (2019) demonstrated the changes in the liver after four weeks of CCL₄ administration. They observed necrotic changes in the centrilobular area with swelling of the hepatocytes and infiltration of ceroid pigment-laden macrophages were seen. Many researchers hypothesized that the anti-inflammatory effects of loquat extracts were caused by a reduction in pro-inflammatory mediators or an increase in anti-inflammatory cytokine (IL-10) discharges (Fogo et al., 2009; Fang et al., 2008). Inhibiting the nuclear factor-B (NF-B) and mitogen-activated protein kinase (MAPK) signaling pathways, which were connected to this regulation were those that have been suggested as key regulators of the cellular signaling pathway's
generation of inflammatory mediators (Ullah et al., 2018 and Cha et al., 2011). Total Flavonoid (TF) extracted from Loquat Leaf, the mitigated microvascular fatty and histopathological changes in liver tissue were improved in a dose-dependent manner, and the volume and number of lipid droplets markedly decreased. TF treatment significantly ameliorated the steatosis and hepatocyte swelling, especially in the treatment of TF at a high dose of 200 mg/kg, and the morphology of the liver lobular structure recovered to nearly normal status (Tunyu et al., 2018)

**CONCLUSION:**

Since more than 500 variants of Eriobotrya plants have been identified, there is a plentiful natural supply of these plants. As a result, it is anticipated that various Eriobotrya species may display significant variations in their phytochemical composition and antioxidant activity. Understanding the antioxidant properties of different wild species might assist us in understanding their chemical characteristics and possible medicinal uses. The loquat (Eriobotrya japonica) is a significant source of physiologically active phytochemicals, including terpenoids, carotenoids, phenolic, flavonoids, vitamin C, and carotenoids. Traditional Chinese medicine utilizes the entire plant. Pharmacological research has revealed that several loquats extract exhibit anti-inflammatory, antioxidant, hypoglycemic or antihyperglycemic, gastro-protective, and hypolipidemic properties.

Generally, according to this study, the *Eriobotrya Japonica* leaves powder has a high content of nutritive value, *Eriobotrya japonica* leaves can be used for anti-oxidative damage and anti-hepatic damage.

**REFERENCES:**

Adeyemi OT, Osilesi O, Adebawo OO, Onajobi FD and Oyedemi SO (2015):

Growth performance of weaned male albino rats fed on processed Atlantic horse mackerel (Trachurus
Tetrachloromethane (CCl₄)-induced liver deterioration in rats with effects of the phytochemical in loquat (Eriobotrya japonica) leaves

Dalia. R. Hassan


Arjun K; Ekrem Y; Chase JW and Faiz T (2022): Physiology, Liver in Stat Pearls [Internet]. Treasure Island (FL): Stat Pearls Publishing;

Affiliations expand PMID: 30571059

Bookshelf ID: NBK535438 *Free Books & Documents.*


Banno N Akihisa T; Tokuda H; Yasukawa K; Taguchi Y; Hiroyuki A; Motohiko U;
Tetrachloromethane (CCl4)-induced liver deterioration in rats with effects of the phytochemical in loquat (Eriobotrya japonica) leaves

Dalia. R. Hassan

Yumiko K; Takashi S and Hoyoku N (2005):

Borges L; Alves S; Sampaio B; Conceicao E; Bara M and Paula J (2013):
Environmental factors affecting the concentration of phenolic compounds in Myrica tomentosa leaves. Braz., J. Pharmacogn. 23:230-8.

Chauhan GS; Zillman RR and Eskin, NAM (1992):

Cho HS; and Kim KH (2013):

Draper H H; Squires E J; Mahmoodi HJ; Agarwal WS and Hadley M (1993):

Fang HL; Lai JT and Lin WC (2008):
Inhibitory effect of olive oil on fibrosis induced by carbon tetrachloride in rat liver,” Clinical Nutr. 27 (6) 900–907.

Fischbach F (2004):

Fogo A.S; Antonioli E; Calixto JB and Campos AH (2009):

Friedewald WT; Levy R I and Fredrickson DS (1972):

Ga Y C; Myung H K and Young SH (2021):

Haytham SAS; Lotfy E S M; Tamer M A E and Rania AG (2019):

Hiroki Y; Tsunemasa N; Shiori F; Yoshimi I; Akito N; Masae Y; Hirohisa F and Makoto N(2018):

Hong Y; Lin S; Jiang Y and Ashraf M (2008):
“Variation in contents of total phenolics and flavonoids and antioxidant activities in the leaves of 11 Eriobotrya species,” *Plant Foods for Human Nutrition.* 63 (4)200–204.

Hui T; Tamrakar S and Kuniyoshi S (2017):
Tetrachloromethane (CCl4)-induced liver deterioration in rats with effects of the phytochemical in loquat (Eriobotrya japonica) leaves

Dalia. R. Hassan

The Potential of Triterpenoids from Loquat Leaves (Eriobotrya japonica) for Prevention and Treatment of Skin Disorder. *Int J Mol Sci.* 18(5): 1030.

Jian T; Ao X; Wu Y; Lv H; Ma L; Zhao L and Li W (2017):
Total sesquiterpene glycosides from Loquat (Eriobotrya japonica) leaf alleviate high-fat diet-induced non-alcoholic fatty liver disease through cytochrome P450 2E1 inhibition. *Biom & Pharmacotherapy.* 91: 229-237.

Kamalakkannan N; Rukkumani R; Viswanathan P; Rajasekharan KN and Menon VP (2005):

Li WL; Wu JL; Ren BR; Chen J and Lu CG (2007):

Li E.N; Luo JG and Kong LY (2009):

Li JY; Xie XM and Li QW (2015):
Dynamic change of four triterpene acids contents in different organs of loquat

Tetrachloromethane (CCl4)-induced liver deterioration in rats with effects of the phytochemical in loquat (Eriobotrya japonica) leaves

Dalia. R. Hassan


Lin JY and Tang CY (2008):

Liu. Y; Zhang W; Xu Ch; Li X (2016):

Lopes-v V; Stone MF; Ellis S and Colwell JA (1977):
Cholesterol determination in high-density lipoprotein is separated by three different methods. Clin. Chem. 23(5):882 -884.

Lu H; Chen J; Li WL; Ren RB; Wu LJ and Zhang QH (2009):
Hypoglycemic effect of the total flavonoid fraction from Folium Eriobotryae. Phytomedicine.16:967–971.

McCormick K and Jesus S (2017):
IBM SPSS Modeler Essentials: Effective techniques for building powerful data mining and predictive analytics solutions. Dec 26- 238 pages.

Nawrot H I; Granicab S; Abela R; Czapor I H and Matkowskia A (2017):
Analysis of Antioxidant Polyphenols in Loquat Leaves using HPLC-based Activity Profiling.
Tetrachloromethane (CCl4)-induced liver deterioration in rats with effects of the phytochemical in loquat (Eriobotrya japonica) leaves

Dalia. R. Hassan


Nkosi C Z; Opoku AR and Terblanche SE (2005):

Ordon JD, Gomez MA and Vattuone MI (2006):

Pande G and Akoh CC (2009):

Radwan AH and Elmaadawy AA (2022):
Potential Effects of Toast Bread Supplemented with Lemon Grass Powder on Kidney and Liver Functions in Rats. JHE, 32(1): 151-162.

Reeves PG1; Nielsen F H and Fahey GC Jr (1993):

Reitman S and Frankel S (1957):

Roy SE (1970):

Saeedeh A and Asna U (2007):
Antioxidant properties of various solvent extracts of mulberry (Morus Indica
Tetrachloromethane (CCl4)-induced liver deterioration in rats with effects of the phytochemical in loquat (Eriobotrya japonica) leaves

Dalia. R. Hassan


**Shafi S and Tabassum, N (2013):**

**Shahat AA; Ullah R; Alqahtani AS; Alsaid M S; Husseiny HA and Al Meanazel OT (2018):**
Hepatoprotective effect of Eriobotrya japonica leaf extract and its various fractions against carbon tetra chloride induced hepatotoxicity in rats. *Evidence-Based Complementary and Alternative Medicine*. 8

**Shih CC; Ciou JL; Lin CH; Wu JB and Ho HY (2013):**

**Shih CC; Lin CH and Wu JB (2010):**

**Shin SK; Kim JH; Park H; Kwon OS; Lee HJ; Yeon JE; Byun KS; Suh SJ; Yim HJ; and Kim YS (2015):**

**Song F; Gan R; Zhang Y; Xiao Q; Kuang L and Li H (2010):**

**Sundaresan S and Subramanian P (2003):**
“S-allyl cysteine inhibits circulatory lipid peroxidation and promotes...”

*Bulletin of the National Nutrition Institute of the Arab Republic of Egypt. December 2022(60) 73*
Tetrachloromethane (CCl4)-induced liver deterioration in rats with effects of the phytochemical in loquat (Eriobotrya japonica) leaves

Dalia. R. Hassan


Trang GT T; Linh NH; Linh NT T and Kien PH (2020):

Trinder P (1969):

Hepatoprotective Effect of Loquat Leaf Flavonoids in PM2.5-Induced Non-Alcoholic Fatty Liver Disease via Regulation of IRS-1/Akt and CYP2E1/JNK Pathways. Int J Mol Sci. 19(10):3005.

Ullah R; Alsaid M S and Shahat A A (2018):


Wu S; Zhang N; Shen X; Mei W; He Y and Ge W (2015):
Tetrachloromethane (CCl4)-induced liver deterioration in rats with effects of the phytochemical in loquat (Eriobotrya japonica) leaves

Dalia. R. Hassan

Wu YX; Jian T Y; Lv H; Ding X Q; Zuo YY; Ren B R and Li WL (2018):
Antitussive and expectorant properties of growing and fallen leaves of loquat (Eriobotrya japonica). *Revista Brasileira de Farmacognosia*, 28(2), 239-242

Xu H and Chen J (2011):

Yang Y; Huang Y; Huang C; Lv XW; Liu L; Wang YY and Li J (2012):

Yanwei X; Fei W and Chunhua Z (2022):

Yoshioka S; Hamada A; Jobu K; Yokota J; Onogawa M; Kyotani S and Nishioka Y (2010):
Effects of Eriobotrya japonica seed extract on oxidative stress in rats with non-alcoholic steatohepatitis. *J. of Pharm and Pharmacol*. 62(2), 241-246.

Zeashan H; Amresh G; Singh S and Rao CV (2008):
Tetrachloromethane (CCl4)-induced liver deterioration in rats with effects of the phytochemical in loquat (Eriobotrya japonica) leaves

Dalia. R. Hassan

Table (1): phenolic and flavonoid compound of Eriobotrya- japonica Leaves

<table>
<thead>
<tr>
<th>sample</th>
<th>Total phenolic g/100g</th>
<th>Total flavonoids g/100g</th>
<th>Tannins g/100g</th>
</tr>
</thead>
<tbody>
<tr>
<td>EJL</td>
<td>0.175±0.01</td>
<td>0.073± 0.01</td>
<td>6.94± 1.11</td>
</tr>
</tbody>
</table>

Table (2): Color, appearance, texture, taste, and overall quality of EJL Toast Bread (Tb)at different levels

<table>
<thead>
<tr>
<th>samples</th>
<th>Color</th>
<th>Appearance</th>
<th>Texture</th>
<th>Taste</th>
<th>Overall Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>control</td>
<td>9.8</td>
<td>9.7</td>
<td>9.6</td>
<td>9.8</td>
<td>9.7</td>
</tr>
<tr>
<td>Tb 5% EJL</td>
<td>9.1</td>
<td>9.1</td>
<td>8.9</td>
<td>8.4</td>
<td>8.87</td>
</tr>
<tr>
<td>Tb 10% EJL</td>
<td>8.5</td>
<td>8.83</td>
<td>8.4</td>
<td>7.5</td>
<td>8.31</td>
</tr>
<tr>
<td>Tb 15% EJL</td>
<td>7.9</td>
<td>8.5</td>
<td>8.1</td>
<td>7.1</td>
<td>7.9</td>
</tr>
</tbody>
</table>

Bulletin of the National Nutrition Institute of the Arab Republic of Egypt. December 2022(60) 76
Tetrachloromethane (CCI₄)-induced liver deterioration in rats with effects of the phytochemical in loquat (Eriobotrya japonica) leaves

Dalia. R. Hassan

**Figure 1** all samples, represents the wheat sample of toast

<table>
<thead>
<tr>
<th>Groups</th>
<th>F intake g/d</th>
<th>BWG%</th>
<th>FER</th>
<th>Liver weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>negative control</td>
<td>19.14 ±1.10</td>
<td>28.30 ± 2.6</td>
<td>0.10±0.04</td>
<td>5.30±0.20</td>
</tr>
<tr>
<td>positive control</td>
<td>13.88 ±0.12</td>
<td>9.19 ±1.6</td>
<td>0.03 ± 0.0</td>
<td>8.41±0.13</td>
</tr>
<tr>
<td>CCL4+5% EJL</td>
<td>16.65±1.10b</td>
<td>12.61 ±1.2</td>
<td>0.04 ± 0.0</td>
<td>7.70±0.06b</td>
</tr>
<tr>
<td>CCL4+10% EJL</td>
<td>17.42 ±0.14b</td>
<td>16.94 ±1.8</td>
<td>0.06 ± 0.0</td>
<td>7.32±0.07b</td>
</tr>
<tr>
<td>CCL4+15% EJL</td>
<td>17.47 ±1.12b</td>
<td>19.8±1.9</td>
<td>0.08 ± 0.04</td>
<td>6.65±0.06c</td>
</tr>
</tbody>
</table>

This means in the same column with completely different letters is significantly different at p<0.05.
**Tetrachloromethane (CCI4)-induced liver deterioration in rats with effects of the phytochemical in loquat (Eriobotrya japonica) leaves**

**Dalia. R. Hassan**

Table (4): Serum lipid profiles (TC, TG, HDL-c, and LDL-c) in administered CCI4 rats fed meals with levels of (EJL) (Mean ±SD).

<table>
<thead>
<tr>
<th>groups</th>
<th>TC mg/dl</th>
<th>TG mg/dl</th>
<th>HDL-c mg/dl</th>
<th>LDL-c mg/dl</th>
<th>VLDL-c mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative control</td>
<td>106.2±4.92 b</td>
<td>86.7 ± 9.2 b</td>
<td>46.6 ±3.78 b</td>
<td>42.4±1.82</td>
<td>17.34±1.5 b</td>
</tr>
<tr>
<td>Positive control</td>
<td>279.6 ± 23.8 a</td>
<td>207.6 ± 5.4 a</td>
<td>23.00 ±2.9 a</td>
<td>183.4±5.03 a</td>
<td>73.5±3.8 a</td>
</tr>
<tr>
<td>CCL4+ 5% EJL</td>
<td>208.2 ± 7.9 a,b</td>
<td>189.6 ±6.5 a,b</td>
<td>35.4±3.35 a,b</td>
<td>152.6 ± 3.36 a,b</td>
<td>37.9± 2.1 a,b</td>
</tr>
<tr>
<td>CCL4+ 10% EJL</td>
<td>151.8 ± 6.76 a,b</td>
<td>138.3±6.96 a,b</td>
<td>37.4 ± 2.72 b</td>
<td>135.4 ± 8.9 a,b</td>
<td>27.7±2.9 a,b</td>
</tr>
<tr>
<td>CCL4+ 15% EJL</td>
<td>135.3 ± 4.95 a,b</td>
<td>103.8 ±4.21 a,b</td>
<td>46.2 ± 4.92 b</td>
<td>109.4± 8.62 a,b</td>
<td>20.76±2.3 b</td>
</tr>
</tbody>
</table>

* a Significant with Negative G  
  b Significant with positive G

Table (5) serum MDA and Bilirubin) in administered CCI4 rats fed meals with different levels of (EJL) (Mean + S.D):

<table>
<thead>
<tr>
<th>groups</th>
<th>MDA μmol/l</th>
<th>Bilirubin g/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>negative control</td>
<td>1.77 ± 0.16 b</td>
<td>0.73 ± 0.16 b</td>
</tr>
<tr>
<td>positive control</td>
<td>9.16 ± 0.85 a</td>
<td>3.33 ± 0.37 a</td>
</tr>
<tr>
<td>CCL4+5% EJL</td>
<td>8.76 ± 0.92 a</td>
<td>2.77 ± 0.55 a,b</td>
</tr>
<tr>
<td>CCL4+10% EJL</td>
<td>3.64±0.44 a,b</td>
<td>1.65 ± 0.43 a,b</td>
</tr>
<tr>
<td>CCL4+15% EJL</td>
<td>2.29 ± 0.27 b</td>
<td>0.75 ± 0.20 a,b</td>
</tr>
</tbody>
</table>

* a significant with negative G  
  b significant with positive G
Table (6) Serum blood ALT, AST, ALP, and GGT (U/L) in administered CCl4-rats fed meals with levels of EJL (Mean + S.E.).

<table>
<thead>
<tr>
<th>groups</th>
<th>AST U/L</th>
<th>ALT U/L</th>
<th>ALP U/L</th>
<th>GGT U/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>negative control</td>
<td>120.15 ± 3.76b</td>
<td>64.15 ± 4.04b</td>
<td>92.9 ± 4.1b</td>
<td>0.82 ± 0.12b</td>
</tr>
<tr>
<td>positive control</td>
<td>217.80 ± 5.44a</td>
<td>173.26 ± 4.36a</td>
<td>189.5 ± 6.2a</td>
<td>14.74 ± 1.34a</td>
</tr>
<tr>
<td>CCL4+5% EJL</td>
<td>179.74 ± 9.45a,b</td>
<td>159.42 ± 4.01a,b</td>
<td>186.99 ± 4.0a</td>
<td>11.71 ± 0.99a,b</td>
</tr>
<tr>
<td>CCL4+10% EJL</td>
<td>171.40 ± 4.55a,b</td>
<td>125.49 ± 4.05a,b</td>
<td>125.16 ± 5.2a,b</td>
<td>9.10 ± 0.80a,b</td>
</tr>
<tr>
<td>CCL4+15% EJL</td>
<td>142.59 ± 3.03a,b</td>
<td>108.93 ± 6.80a,b</td>
<td>102.40 ± 8.4b</td>
<td>6.75 ± 1.39a,b</td>
</tr>
</tbody>
</table>

\[ a \] significant with negative G
\[ b \] significant with positive G
Tetrachloromethane (CCl4)-induced liver deterioration in rats with effects of the phytochemical in loquat (Eriobotrya japonica) leaves

Dalia. R. Hassan

Figure 2 Microphotograph results:

photo (1) G1 Microphotograph of rat liver section shows a normal histological pattern of hepatocytes and central vein (HE, 400x)

photo (2) G2 Microphotograph of liver showing severe multifocal macro-vesicular steatosis in hepatocytes and congestion of hepatic veins and well-formed fibrotic bands and abundant collagen fibers around the regenerative hepatocytes’ nodules (HE, x400).

photo (3) G3 Microphotograph of rat liver section shows a normal histological pattern of hepatocytes, moderate congestion of portal veins (HE, 400x)

photo (4) G4 Microphotograph of liver showing normal hepatocytes and some congested hepatic veins (HE, x400)

photo (5) G5 Microphotograph of liver showing normal hepatocytes and congested central veins (HE, x400).
Tetrachloromethane (CCI4)-induced liver deterioration in rats with effects of the phytochemical in loquat (Eriobotrya japonica) leaves

Dalia. R. Hassan

Tدهور الكبد الناجم عن رباعي كلورو الميثان (CCl4) في الجرذان مع تأثيرات المادة الكيميائية النباتية في أوراق البشم

داليا رفعت حسن عبد الرحمن

قسم الاقتصاد المنزلي، كلية التربية النوعية، جامعة الفيوم

المستخلص العربي

تؤدي شجرة الفاكهة Eriobotrya japonica (EJL) تعدد المقالة الحالية هو تحديد التأثيرات الوقائية للكبد للمكونات الفينولية والفلافونويدية في أوراق اسكدنيا (E. japonica) ضد CCl4 في الجرذان. في هذه الدراسة، تم فصل ثلاثين من ذكور الجرذان البيضاء بمتوسط 190 ± 10 جم إلى مجموعتين رئيسيتين: تم إطعام المجموعة أولي الضابطة السالبة على نظام غذائي أساسي لمدة 4 أسابيع وتم حقن الباقي بواسطة CCL4 لإصابة الكبد مرتين أسبوعياً لمدة 4 أسابيع، تم تقسيم كل الجرذان المصابة إلى 4 مجموعات فرعية. تم تغذية المجموعة الثانية بنظام غذائي أساسي بعد حقن CCL4 (2 مجم / كجم) كمجموعة Eriobotrya تحكم ضابطة موجبة وجماعات مختلفة من مستويات مختلفة من EJL (50،100 و150 جم / كجم). أظهرت النتائج أن جميع المؤشرات قد زادت بشكل كبير (malondialdehyde MDA، إنزيمات الكبد، معامل الدهون) بعد حقن CCL4، بينما عند إضافة EJL بمصادر مختلفة، انخفضت جميع المعلمات بشكل واضح عند مقارنتها بالمجموعة الإيجابية. وكان المستوي المتناقص مصحوبًا مع زيادة مستويات EJL، وهذا بسبب مركبات الفينول والفلافونويد فيها. ووحظيت نفس التأثيرات في النتائج النسيجية. كشف التقييم الحسي للخبز عن مدى استساغة هذه الأوراق، والتي يمكن استخدامها كمنتجات محسنة للكبد المصاب.

الكلمات المفتاحية: أوراق البشم –الفلافونويد- داي مالون الدهيد –وظائف الكبد