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Protective Effects of Apricot and Avocado Kernels Powder in Carbon Tetra Chloride-Induced Liver Disorder in Rats

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Abstract:
The goal of the current research was to determine how apricot, avocado kernels, and their combined powder may influence the liver disorder rats. In this research, forty-eight grownup male albino rats have been used in this research, weighting (150±10g) were used and divided into 8 groups, 6 rats each. One of this group was used as a negative control group and the other seven groups injected with carbon tetrachloride (CCl4) to cause liver disorders. The other six groups received apricot, avocado kernels, and a combination of the two at concentrations of 2.5% and 5% from the main diet, while one remained as a positive control group. When the experiment ended, serum lipid fractions consisting of triglycerides (TG), total cholesterol (TC), low-density lipoprotein (LDL-c), very low-density lipoprotein (VLDL-c), and high-density lipoprotein (HDL-c) levels, serum glucose, liver enzyme activities such as ALP, AST, and ALT, and renal function including uric acid, creatinine, and urea which were examined. From obtained results it could be observed that the best values for protection, improvement of liver functions, lipid profiles, renal functions, and glucose levels were reported at 5.0% mix of apricot and avocado kernels powder. So, it could be concluded that apricot, avocado, and their mixture kernels powder in our regular dishes, that demonstrates the potent nutraceutical therapeutic advantages of consuming apricot, avocado kernels, and both separately and together for curing liver disorder.

Keywords*: Fruits kernels, Hepatoprotection, Rats, Liver enzymes*

Introduction

The liver, the biggest organ in our bodies, weighs over 1.5 kg in a person who has reached maturity and makes up 2% of total body weight (1). The liver is exposed to a variety of xenobiotics, chemicals, and medicines in varying amounts, ultimately leading to liver damage. Hepatic disorders have more than a thousand etiologies (2). Chemically, CCl4 is a

chemical name for carbon tetrachloride which a substance selectively damages liver, and the cytochrome which known as P450 breaks it down to highly reactive metabolites including the other two compounds like 3-chloro-methyl free radical and 3-chloro-methyl peroxy radicals (3). Liver disease treatment is significantly impacted by conventional, natural medicine. While several additional substances are believed to possess liver-protective and hepato-curative activity, numerous natural plant nutrients have been shown to be efficient hepatoprotective agents (4).

Naturally product-driven plant nutrients are thought to represent the most trustworthy and effective source for creating new medicinal products, but due to their low intake, dispersion, metabolic processes, and eradication as well as their limited toxicological characteristics, their medical application is still limited (5). The fruit apricot (Prunus armeniaca, L.) contains a lot of carotenoids, primarily b-carotene. Provitamin A is made from b-carotene. 100% of the recommended each day of provitamin A is provided by a serving size of thirty grams of dried apricot fruits or two hundred and fifty grams of natural apricots. Vitamins C and E are also present in apricots (6). The approximate chemical composition of apricot kernels was 6.1%, 25.3%, 2.32%, 47.8%, 15.62%, and 2.86%, respectively, for moisture, protein, ash, lipids, total carbs, and total fiber (7). Organic cyanogen glycoside that is amygdalin, also referred to as vitamin B17, is one of the well-known chemical compounds found in apricot seeds (8). Because of its great capacity to scavenge free radicals. Apricots fruit consuming reduced the hepatic steatosis and damage by induction of rats by carbon tetra chloride. Its effect is most likely due to the presence of strong phytochemicals and vitamins. One may believe that apricots, a natural food, might benefit for non-alcoholic hepatic steatosis (9). The apricot and plum kernel as powdered at 5.0 percent achieved the best results for protection, improving lipid fractions, renal functioning, and blood sugar degrees (10).

Avocado tree fruit (Persea americana, Mill) contains a variety of antioxidant compounds that are beneficial to health. High quantities of phytochemicals in avocado seeds are thought to be responsible for the seeds' strong antioxidant effects (11). Avocado seeds contain natural compounds, including some active compounds, which are demonstrated for reducing toxicity of liver and the resulting liver disorder (12). Additionally, avocado seeds improved liver form and function after potassium dichromate degradation in the rat animal model of damage to the liver as well as the rats' hepatic glycogen concentration (13). By improving the antioxidant defense system, reducing inflammation, reducing cell proliferation, and promoting apoptosis, organic avocado fruit extracts may have chemo-preventive adverse impacts diethyl-nitrosamine acetylaminofluorene -induced the development of liver cancer and hepatocarcinoma (14).

For that, the current study examined the biological and biochemical changes that occurred in hepatic rats when apricot, avocado, and their mixture were added in powder concentrations ranging from 2.5 to 5% in their diets.

Materials and methods

Materials:

Apricot and avocado kernels

Commercially fresh fruit such as apricots (Prunus armeniaca, L) and avocados (Persea americana, Mill) were purchased in 2022 at a local market in governorate of Menoufia. Also, the chemical kits for liver enzymes, renal functions, lipid fractions and blood glucose used in this study were provided by Al-Gomhoria Co. for Trading Drugs, Chemical, and Medical Instruments, Cairo. Diet components (casein, cellulose, choline chloride powder, and DL methionine powder) were used.

Animals

Forty-eight mature healthy male white Sprague Dawley rats averaging 140-150g was donated by Vaccine and Immunity Organization, Ministry of Health, Helwan Farm, Cairo.

Methods

Preparations of apricot and avocado kernels

The kernels of each apricot and avocado were obtained from fruit pulp, then carefully cleaned under running water, after that dried at 40 °C for three hours using an air oven, and ground into a fine powder using an air mill, high speed mixture (Molunix, France), and they were then served as powder.

Experimental approach

The research was once conducted in Animal House at the University of Menoufia in Egypt, which has been authorized, Department of Nutrition and Food Science, Faculty of Home Economics according to Ethical approval of the Science Research Ethics Committee of Faculty of Home Economics cleared the study protocol #11-SREC-01-2021.

In this study, forty-eight mature white albino male Sprague-Dawley strain rats at 10 weeks of age. All rats received a casein-based basal diet for adaptations for seven days continuously prepared in accordance with (15). Following this period of adaptation, six rats in each group were separated into eight groups, as the following groups: Group (1): Rats fed on standard diet which used a negative control. Group (2): Rats were administered 0.2 milliliters of 40 milliliters of CCl_4 that had been dissolved in paraffin oil per 100 grams of body weight three times each week for six consecutive weeks, which used as the positive control group. Group (3): Group hepatic rats fed on basal diet with apricot kernel powder by 2.5% of diet. Group (4): Group hepatic rats fed on basal diet with apricot kernel as powder by 5% of diet. Group (5): Group hepatic rats fed on basal diet with 2.5% avocado seeds of diet. Group (6): Group hepatic rats fed on basal diet with 5% avocado seeds of diet. Group (7): Group hepatic rats fed on basal diet with 2.5% a mixture of kernels. Group (8): Group hepatic rats fed on basal diet supplemented with 5% a mixture of kernels.

The research study lasted for twenty-eight days throughout the duration of the study. Each rat is weighed independently at the finish of the experiment before being slaughtered and having blood samples collected.

Blood samples

After a 12-hour fast, blood samples of each rat were obtained from the hepatic portal vein at the end of each trial. The serum was separated from the blood samples by centrifuging

them for 10 minutes at 4000 rpm after they had been drawn into dry, clean centrifuge tubes and allowed to clot for 30 minutes in a water bath (37°C). After gently collecting the serum into clean cuvette tubes, it was then frozen until analysis according to (16).

Biochemical analysis

Using (17) colorimetric procedure, the cholesterol was measured. As stated by (18 and 19), serum triglycerides were measured using enzymatic techniques. The method described by (20 and 21) was used to calculate HDL-c. According to (22), very low density-lipoprotein was estimated in mg/dl applying the formula below: Triglycerides (mg/dl) = very low density-lipoprotein cholesterol / 5. According to (22), low density-lipoprotein cholesterol was estimated in mg/dl as below: Low density-lipoprotein cholesterol = Total cholesterol - High density-lipoprotein cholesterol - Low density-lipoprotein cholesterol.

As stated by the methods of (23, 24, and 25), which evaluated the serum levels of each liver enzyme such as alanine aminotransferase (ALT), aspartate aminotransferase (AST), and alkaline phosphatase (ALP).

The (26) enzymatic approach, serum urea was measured. The calorimetric method described by (27) was used to determine the serum uric acid concentration. Using (28) kinetic technique, creatinine was measured.

Blood glucose has been determined enzymatically using method of (29).

Statistical analysis

A completely randomized factorial design was used to analyze the data when a significant main effect was discovered (30). The means of the Student-Newman-Keuls test were distributed. Differences between treatments at $P \leq 0.05$ were found to be significant using the Costat Program. In order to evaluate the biological effects, one way ANOVA was performed.

Results and discussion

The effects of apricot, avocado kernels, as well as their mixes on the liver enzyme activities of hepatic rats are revealed by the data displayed in Table (1). The results showed a significant difference between the alanine aminotransferase (ALT), aspartate aminotransferase (AST), and alkaline phosphatase (ALP) which were recorded by the positive and negative control groups. They were 93.97, 75.72&73.29 and 29.95, 20.51 &30.35 U/L on average, respectively.

Regarding the liver enzymes ALT, AST, and ALP of treated groups, it could be notice that 2.5% powdered avocado kernels group recorded the greatest ALT liver enzyme of the treatment (hepatic) rats, but the 5% mixes of apricot and avocado kernels group was significantly the lowest. The average values were 73.78, 66.89 & 56.23 and 39.75, 41.67 & 36.22 U/L, respectively. This evidence agrees with the findings of (31) who showed that administration ground apricot kernels mainly 1.5 mg/kg/BW/rat could significantly reduce fibrosis of the liver and could be applied as a treatment alternative and a preventative approach for hepatic fibrosis. Increased amounts of oleic acid and different polyphenols in apricot seeds are accountable for this liver protection.

Additionally, pre-treatment of quail with avocado extract at a dose of 200 mg/kg.bw led to considerable rate reductions at the clinical symptoms, behavioral changes, AST, and ALT levels. Effective AST level and ALT activity controls suggest that the hepatic cell's secretory mechanism is already improving. The fact that liver enzyme levels significantly dropped after pretreatment with avocado extract points to the extract's potential hepatoprotective properties (32).

Table (1) Influence of apricot, avocado kernels, as well as their mixtures on liver enzymes of hepatic rats

Parameters	ALT	AST	ALP
Groups	U/L	U/L	U/L
G1 C (-)	29.95g ±0.80	20.51g ±1.30	30.35f ±1.40
G2 C (+)	93.97a ±1.65	75.72a ±1.51	73.29a ±1.43
G3 (2.5%Avocado seeds)	73.78b ±1.50	66.89b ±1.40	56.23b ±1.35
G4 (5%Avocado seeds)	65.57c ±1.32	60.06c ±1.45	52.37c ±1.30
G5 (2.5% Apricot kernel)	64.63c ±1.27	57.19d ±1.20	51.27c ±1.25
G6 (5% Apricot kernel)	58.73d ±1.20	53.40e ±1.14	47.21d ±1.17
G7 Mixture (2.5%)	51.14e ±1.02	53.96e ±1.15	47.98d ±1.20
G8 Mixture (5%)	39.75f ±0.73	41.67f ±1.04	36.22e ±0.96
LSD (P≤0.05)	1.878	1.275	1.157

ALT=Alanine aminotransferase. AST= Aspartate aminotransferase.
ALP Alkaline phosphatase. Each value represents the mean ± SD of three replicates. Means in the same column with different letter are significantly different (P<0.05).

The data in Table (2) demonstrate the impact of apricot and avocado kernels as well as their powdered blends on blood glucose quantities of rats with liver damage. The changes between the higher glucose level which was reported for the positive control group and the lower glucose level observed for the negative control group were significantly. These estimated levels were 166.68 and 101.35 mg/dl, respectively. It should be noted that adding more apricot, avocado kernels, or combination levels led to the best reduction in glucose level. The lowest glucose level was significantly obtained for 5% a mix of apricot and avocado kernels as powder; however, the highest value was recorded in the hepatic group rats fed with 2.5% avocado seeds powder. The indicated values had been 152.16 and 133.67 mg/dl, respectively. Such outcomes support the findings of (33), who claimed that due to the many phytochemicals observed in the apricot kernel, oral administration of apricot kernel extract confirmed a reduction in the excessive ranges of serum glucose in diabetic rats in alloxan-induced diabetes in tests rats and may be successful to alleviate type two diabetes and problems of diabetes.

Additionally, feeding on mango, avocado kernels, as well as their combination powdered led to a substantial drop in serum glucose level, reflecting the potent nutraceutical therapeutic impact of feeding on mango, avocado seeds, as well as their combination powdered for treating diabetic rats (34).

Furthermore, a 5 percent seed combination of avocado and mango was noted as an excellent therapy that demonstrated the best glycemic range decrease through a decrease of carbohydrates breaking down enzymes and enhancement antioxidant properties (35).

Table (2) Influence of apricot, avocado kernels, as well as their mixtures on glucose level of hepatic rats

Parameters Groups	Fasting glucose level mg/dl
G1 C (-)	101.35f ±2.20
G2 C (+)	166.68a ±4.43
G3 (2.5%Avocado seeds)	152.16b ±4.30
G4 (5%Avocado seeds)	148.04c ±4.23
G5 (2.5% Apricot kernel)	146.88c ±4.15
G6 (5% Apricot kernel)	140.72d ±3.70
G7 Mixture (2.5%)	141.18d ±3.80
G8 Mixture (5%)	133.67e ±2.90
LSD (P≤0.05)	3.908

Each value represents the mean ± SD of three replicates.
Means in the same column with different letter are significantly different (P<0.05).

Table (3) displays the impact of apricot avocado kernels and their mixes on total cholesterol (TC) and triglycerides (TG) of hepatic albino rats. The acquired results showed that TC and TG values for positive control groups were significantly (P≤0.05) higher than those for negative control group. The corresponding readings were 202.75 & 172.75 mg/dl and 95.25 & 78.50 mg/dl, respectively.

The obtained results indicated that the treatment group that consumed 5% of a mixture of apricot and avocado kernels had the lowest TC and TG, then that of treated group consumed 2.5% of powdered avocado seeds which had the significantly greatest value, the average readings were respectively 109.25&121.75 and 171.75& 154.60 mg/dl. These findings are consistent with (36); they showed that a high-avocado diet might significantly elevate cholesterol in a week. Each day, 300g of avocado was substituted for all other fats in the diets of the thirty individuals' people who regularly consume cholesterol daily and the 37 people with moderate to excessive cholesterol-15 of whom additionally had diabetes of the second type. Individuals with ordinary cholesterol mentioned a decrease in whole cholesterol at the give up of the period (7days), but these with mild to high cholesterol levels also suggested decreasing in TC.

These findings support the findings of Kutlu et al., (37) which showed that oral apricot kernel treatment reduced the diet containing high ratio of cholesterol-induced rise of malondialdehyde and caused a considerably lower its content in liver homogenates.

The effects of apricot, avocado, as well as their combinations on the blood lipid fractions that is low-density lipoprotein (LDL-C), very low-density lipoprotein (VLDL-C) and high-density lipoprotein (HDL-C) of albino rats with liver damage are displayed in Table (4). The findings revealed that, the LDL-C and VLDL-C ranges of control positive groups had considerably

greater values when compared to control negative groups, which have been 135.15 & 34.50 and 39.50 & 15.70 mg/dl, and the vice versa with HDL-C, being 50.52 & 33.10 mg/dl, respectively.

Table (3) Influence of apricot, avocado kernels, as well as their mixtures on total cholesterol and triglycerides of hepatic rats

Parameters Groups	Total cholesterol mg/dl	Triglycerides mg/dl
G1 C (-)	95.52g ±1.20	78.50g ±0.55
G2 C (+)	202.80a ±3.30	172.75a ±3.30
G3 (2.5%Avocado seeds)	171.75b ±2.41	154.60b ±2.25
G4 (5%Avocado seeds)	160.75c ±2.25	151.00c ±2.70
G5 (2.5% Apricot kernel)	161.75c ±2.10	143.75d ±2.32
G6 (5% Apricot kernel)	127.00e ±1.62	135.30e ±1.60
G7 Mixture (2.5%)	141.75d ±1.40	137.80e ±1.78
G8 Mixture (5%)	109.25f ±1.63	121.75f ±1.65
LSD (P≤0.05)	3.027	2.867

TC = Total cholesterol. TG= Triglycerides. Each value represents the mean ± SD of three replicates. Means in the same column with different letter are significantly different (P<0.05).

Regarding groups that have received CCl4, it should be observed that the best possible LDL-C and VLDL-C ranges have been recorded for 2.5% avocado seeds, while the lowest values had been recorded for 5% mixes kernels with substantially differences, the corresponding average have been 102.14 & 30.92 and 37.39 & 24.35 mg/dl, and vice versa with HDL-C, being 47.51 and 38.19 mg/dl, respectively. These consequences are consistent with (38), who reported that when in contrast to the raw seeds group, the purified apricot kernels group had considerably higher ranges of high-density lipoprotein and triglycerides, which were 48.79 & 15.09% and lower ranges of whole cholesterol, low-density lipoprotein, and very low-density lipoprotein, the values were 6.99, 22.95 & 7.90%, respectively. Furthermore, it should be noted that a straightforward, secure, domestic, and affordable process might effectively detoxify wild apricot kernel powder. This technology also has the potential to be used to create protein supplements and food products with additional value. Additionally, according to Olagunju et al., (39), avocado (Persea americana) lowers the triglycerides/high density lipoprotein ratio, increasing the healthy cholesterol that is beneficial to heart wellness.

The effects of apricot, avocado, as well as their combinations on renal biomarkers (urea, uric acid, and creatinine) of hepatic male albino rats are displayed using the information in Table (5).

The obtained results indicated that the positive control groups had higher values (P≤0.05) of renal functions such as serum urea, uric acid, and creatinine than negative control, the mean corresponding values were 34.27, 9.99 & 1.48 and 20.02, 5.91 & 0.77 mg/dl, respectively. Regarding groups that have received CCl4, it should be observed that the best renal functions ranges have been recorded for 5% mixes kernels, whilst the highest values had been

recorded for 2.5% avocado kernels with substantially differences, the corresponding average have been 21.30, 6.59 & 0.80 and 28.10, 9.65& 1.14 mg/dl, for serum urea, uric acid, and creatinine respectively. These results are in line with (40) who stated that within 7 days of dosing, avocado can return renal biomarkers that is BUN and serum creatinine to acceptable values in albino rats receiving meloxicam. Meloxicam's BUN and serum creatinine-lowering effects were best achieved with a daily dosage of 10gm/kg BW.

Table (4) Influence of apricot, avocado kernels, as well as their mixtures on lipid fractions of hepatic rats

Parameters Groups	HDL-C mg/dl	LDL-c mg/dl	VLDL-c mg/dl
G1 C (-)	50.52a ±0.70	29.30g ±0.91	15.70f±0.85
G2 C (+)	33.10g ±0.90	135.15a ±1.97	34.55a ±0.88
G3 (2.5%Avocado seeds)	38.19f ±0.88	102.14b ±1.13	30.92b±0.92
G4 (5%Avocado seeds)	40.81e ±0.50	89.74c ±0.95	30.20b±0.85
G5 (2.5% Apricot kernel)	43.22d ±0.88	89.78c ±0.86	28.75c±0.98
G6 (5% Apricot kernel)	46.05c ±0.95	53.89e ±0.96	27.06d±0.96
G7 Mixture (2.5%)	46.38b ±0.92	67.81d ±0.86	27.56d±0.66
G8 Mixture (5%)	47.51b ±0.77	37.39f ±0.66	24.35e±0.66
LSD (P≤0.05)	1.266	1.428	1.028

LDL-C=Low-density lipoprotein. VLDL-C. Very low-density lipoprotein. HDL-C= High-density lipoprotein. Each value represents the mean ± SD of three replicates. Means in the same column with different letter are significantly different (P<0.05).

Additionally, some renal biomarkers like creatinine and urea can point to renal dysfunction and the stimulation of dead cellular indicators, which could suggest severe renal damage brought on by methotrexate. Nephrotic dysfunction and mortality are hallmarks in kidney disorders, which can be treated with prophylactic dose of apricot (41).

Table (5) Influence of apricot, avocado kernels, as well as their mixtures on renal functions of hepatic rats

Parameters Groups	Urea mg/dl	Uric acid mg/dl	Creatinine mg/dl
G1 C (-)	20.02f±0.98	5.91d±0.92	0.77b±0.15
G2 C (+)	34.27a±1.55	9.99a±0.99	1.48a±0.56
G3 (2.5%Avocado seeds)	28.10b±1.40	9.65a±0.66	1.14a±0.48
G4 (5%Avocado seeds)	25.86c±1.13	7.90b±0.75	1.08ab±0.30
G5 (2.5% Apricot kernel)	26.27c±1.42	7.17c±0.83	0.94b±0.41
G6 (5% Apricot kernel)	22.56d±1.08	6.80c±0.89	0.88b±0.20
G7 Mixture (2.5%)	25.74c±1.17	7.33b±0.80	1.03b±0.30
G8 Mixture (5%)	21.30e±1.08	6.59c±0.60	0.80b±0.17
LSD (P≤0.05)	0.869	0.651	0.4105

Each value represents the mean ± SD of three replicates.
Means in the same column with different letter are significantly different (P<0.05).

Conclusion

Our research showed that feeding apricot, avocado kernels, and mixture powder to experimental animals led to a strong therapeutic impact on rats with liver disease, as evidenced by an improvement in the profiles of the liver, kidney, glucose, and lipids fractions as compared to the positive control group.

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دراسة تأثير بذور الأفوكادو ونوى المشمش على الخلل الحادث فى الكبد للفئران بواسطة رابع كلوريد الكربون

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الملخص العربي:

كان الهدف من الدراسة الحالية هو تقييم تأثير نوى المشمش والأفوكادو ومخلوطهم كمسحوق على الفئران المصابة باضطراب الكبد. في هذه الدراسة، تم استخدام ثمانية وأربعين من ذكور فئران الألبينو البالغة وزنها (١٤٠ - ١٥٠ جم)، تم تقسيم الفئران إلى ثماني مجموعات، ستة فئران لكل منها. تم الاحتفاظ بإحدى المجموعات كمجموعة ضابطة سالبة، بينما تلقت المجموعات السبع الأخرى حقناً من رابع كلوريد الكربون للإصابة باضطرابات الكبد، ستة مجاميع منهم حصلوا على نوى المشمش والأفوكادو ومخلوطهم بتركيزات ٢,٥٪، ٥٪ من النظام الغذائي الرئيسي، بينما بقيت المجموعة الاخرة كمجموعة ضابطة موجبة. في نهاية التجربة، تم تقدير صورة دهون الدم بما في ذلك الكوليسترول الكلي، والدهون الثلاثية، والليبوبروتين منخفض الكثافة، والليبوبروتين منخفض الكثافة جدا، الليبوبروتين عالي الكثافة وكذلك مستويات سكر الجلوكوز وأنشطة إنزيمات الكبد (ألانين أمينوترانسفيراز ، أسبارتات أمينوترانسفيراز ، الفوسفاتير القلوي) ووظائف الكلى بما فى ذلك مستويات الكرياتينين وحمض البوليك واليوريا. من النتائج التي تم الحصول عليها أن أفضل القيم للحماية، وتحسين وظائف الكبد، وخصائص الدهون، ووظائف الكلى، ومستويات الجلوكوز تم تسجيلها عند تركيز ٥٪ من مخلوط مسحوق نوى المشمش والأفوكادو. ولذلك، يمكننا التوصية باستخدام مسحوق نوى المشمش والأفوكادو ومخلوطهم معا في الوجبات اليومية، مما يعكس التأثير العلاجي القوي للتغذية على نوى المشمش والأفوكادو ومخوطهما لعلاج اضطرابات الكبد في الفئران.

الكلمات الكاشفة: نوى الفاكهة . وقاية الكبد . الفئران. انزيمات الكبد.