



CAMEL MILK AND THE AQUEOUS EXTRACT OF DANDELION LEAVES AS ADJUVANTS FOR CONTROLLING AGAINST LIVER INJURY

[169]

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ABSTRACT

The liver disease all over the world had a more attention towards the prevention methods; balanced diet can be effective and protective. Therefore, the objective of this study was to investigate the hepatoprotective role camel milk; fermented camel milk; the aqueous extract of dandelion leaves (prebiotic); fermented camel milk fortified with the aqueous extract of dandelion leaves as (synbiotic product); camel whey and camel casein protein against carbon tetrachloride (CCl₄) induced liver injury in rats. Rats were divided into eight groups (eight rats each). Group one was served as normal control (NC), while the other seven groups were injected intraperitoneal in beginning of experimental with single dose from (CCl₄). Animals from group three to seven received orally camel milk; fermented camel milk; the aqueous extract of dandelion leaves; synbiotic product and whey camel milk; while, group eight received basal diets in which protein was replaced with 20% camel casein. All rats were feed for 45 days. The results indicated that all previous materials exhibited scavenging activity; liver injury control group (IC) revealed significantly increased in liver function (AST, ALT and ALP) and malondialdehyde (MDA) levels; whereas, decreased body weight gain, albumin and glutathione reduced (GSH) levels. Also, histological examination of hepatic showed more alteration due to (CCl₄) induced hepatocellular damage. While, treatment by the aqueous extract of dandelion leaves (prebiotic); camel milk; fermented camel milk; fermented camel milk forti-

fied with the aqueous extract of dandelion leaves (synbiotic product); camel casein and camel whey protein resulted in a significant improvement in weight gain, liver function and oxidative stress parameters; also, suppresses the alteration in liver histology. It could be concluded that the aqueous extract of dandelion leaves (prebiotic); camel milk; fermented camel milk (probiotic product); fermented camel milk fortified with the aqueous extract of dandelion leaves (synbiotic product); camel casein and camel whey protein could be used as ingredients in functional foods for hepatoprotective.

Keywords: Camel milk, Probiotic, Dandelion, Liver Injury, Rats

INTRODUCTION

The liver is the most important organ involved in the metabolism and storage of nutrients (**Mahan and Escott-Stump, 1996**). The most common causes of liver disease (or liver failure) are toxic injury due to drug use, alcohol abuse, any type of liver infection, hypertension, sclerosing cholangitis and billiard cirrhosis (**ADA, 2000**).

World Health Organization (WHO) reported that 80% of the world population is primarily reliant on traditional methods of healing (**Mueller and Mechler, 2005**).

Many reports discussed the use of camel milk as a traditional method of healing. **Badr et al (2012)** demonstrated the benefits of why protein of camel milk for improving the healing and closure of diabetic wounds in a diabetic mice. Camel milk

might be a promising new protein source for children allergic to cow milk protein (**El-Agamy et al 2009**). Camel's milk has medicinal properties, antibacterial and antiviral activity (**El-ouardy et al 2011**) which may be related to higher content of lactoferrin (**Yagil et al 1994**). Camel milk has been widely used as a traditional medicine for treating many diseases, including liver diseases (**Magjeed, 2004**). Milk protein-derived bioactive peptides are frequent components of food additives used for the formulation of functional foods (**Huth et al 2004**). Milk proteins play an important role in promotion of health and prevention of diseases (**Meisel, 2005**).

Probiotic bacteria in fermented dairy products are of interest for human health and diseases. Incorporation of probiotics as starter organisms has positive effect on probiotic cultures (**Reid et al 2010; Heller, 2001**). Probiotics stimulate the immune system, balancing of intestinal microbiota, potential reduction of inflammation, and the prevention of allergic hypertension, and cancer. (**Parvez et al 2006**).

Dandelion has been used as an herbal medicine due to its antidiabetic, choleric, antirheumatic, and diuretic properties (**Schütz et al 2006**). Recent studies have proved that it may reduce the risk of diseases, including inflammation and tumors (**Kim et al 2007**). For this reason, chicory is widely used as a functional food throughout the world for health promoting and technological properties. It was also found to have protective effect on acute liver inflammation induced by carbon tetrachloride in rats (**Park et al 2010**).

Therefore, the objective of the present research is to investigate the hepatoprotective role of camel milk; fermented camel milk (probiotic product); the aqueous extract of dandelion leaves (Prebiotic product); fermented camel milk fortified with dandelion leaves aqueous extract (synbiotic product); camel whey proteins and camel casein against CCl₄ induced liver injury in rats.

MATERIALS AND METHODS

Materials

Camel milk was collected from Camel in Marsa Matrouh research station, Egypt; dried dandelion (*Taraxacum officinalis*) leaves were obtained from local market, Egypt. Commercial kits used for determining alanine aminotransferase (ALT); aspartate aminotransferase (AST); alkaline phosphatases (ALP); albumin; malondialdehyde (MDA) and reduced glutathione (GSH) were purchased from

Biodiagnostic Co. Dokki, Egypt. Whereas the carbon tetrachloride (CCl₄) was obtained from El-Gomhoreya Co., Cairo, Egypt. Meanwhile, 2,2-diphenyl-2-picrylhydrazyl radical (DPPH) were purchased from Sigma-Aldrich Inc. (St Louis, MO, USA). In addition to, starter cultures of ABT-1 containing of (*Lactobacillus acidophilus*, *Streptococcus thermophilus* and *Bifidobacterium bifidum*) with potential probiotic properties were procured from (Chr. Hansen Laboratory Copenhagen, Denmark). Enzymes from used: Rennet FAR-M LIQUID (Chr. Hansen Middle East, Africa).

Animals

Male Albino Wistar rats with an average weight of 140±10 g were obtained from the Organization of Biological Products and Vaccines (Helwan Farm, Cairo, Egypt).

Preparation of Aqueous Extract of Dandelion (Prebiotic)

Aqueous extract of dandelion leaves (*Taraxacum officinalis*) was prepared according to the method described by **Abdel-Salam et al (2009)**. Briefly, dandelion leaves powders was pulverized in a grinder (3 % total dry matter), then was extracted with hot distilled water in an electric blender for 15 min. The suspension was left at room temperature for one hour, and then filtered; first through cheese-cloth and then through filter paper (Whatman No.2). The clear aqueous extract was preserved in sterile dark bottles at -20°C until further use.

Preparation of probiotic and synbiotic camel milk

Fermented camel milk was prepared by adding starter cultures of (*Streptococcus thermophilus*, *Lactobacillus acidophilus* and *Bifidobacterium bifidum*) according to the traditional method described by **Tamime and Robinson (1999)**. While, synbiotic camel milk containing (probiotic and prebiotic) was prepared by combining equal volume of fermented camel milk (probiotic) with an equal volume (1:1) of dandelion aqueous extract (prebiotic).

Preparation of camel milk proteins (casein & whey)

The method described by **Mervat Gaffar, (2008)** was followed by using raw camel skim milk

pasteurized at 72°C for 15 sec., and then cooled to 35°C. Rennet was added (50ml/150 liters) to the milk and mixed for 2-3 minutes. After the complete coagulation of the milk, curd was cut into small pieces and the whey was separated by filtration through cheese muslin. The curd was washed several times with distilled water until no lactose was detected. Casein was stored at -20°C until further use. The resultant casein contained 65% total protein on solids.

Method of analysis

DPPH radical scavenging activity %

The methanolic extracts of camel milk; fermented camel milk (probiotic product); the aqueous extract of dandelion leaves (prebiotic); probiotic fortified with prebiotic (Synbiotic product); camel whey protein and camel casein were obtained as described by **Bloor, (2001)**. The ability of methanolic extract samples to scavenge 2,2-diphenyl-2-picrylhydrazyl radical (DPPH) free radicals were determined by the method described by **Brand-Williams et al (1995)**. The percentage of scavenging effect was calculated from the decreased in absorbance at 517 nm against control according to the following equation:

$$\text{Scavenging activity \%} = \frac{[(\text{Abs}_{\text{control}} - \text{Abs}_{\text{sample}})]}{\text{Abs}_{\text{control}}} \times 100$$

Biological experiment design

The experiment was conducted on sixty four male Albino Wistar rats; they were housed in special cages under controlled conditions. The animals were fed on basal diet according to AIN-93 guidelines (**Reeves et al 1993**) and were provided with water ad-libitum during the experimental period.

The rats were randomly divided into eight groups with eight rats in each group. Group one was reserved as normal control (NC). Groups from two to eight, rats were administered intraperitoneal (IP) injection with single dose of 2 ml/kg body weight by mixture of (1:1 v/v CCl₄/paraffin) according to **Malgorzata et al (2009)**. Group two kept as injury control (IC); each rat from group three to group seven received its weight corresponding dose (according to the fortnight weight) through oral gavage for camel milk; the aqueous extract of dandelion leaves; synbiotic product and whey camel milk in a dose of 1 ml/100 g body weight per

day for successive six weeks. The calculation was based on a consumption of 275 ml/day for a 70 kg human as reported by **Rouanet et al (2010)**. While, group eight received basal diets in which protein was replaced with 20% camel casein for 45 days. The changes in body weight were recorded weekly, blood samples were also taken from the retro-orbital plexus of the eyes from all rats of each group at the end of the experiment; the liver was excised immediately after bleeding for histopathological examination. Serum was obtained from blood samples by centrifugation at 1500 rpm for 15 min at an ambient temperature for analysis.

Biochemical investigation

Liver marker enzymes

The activities of serum alanine aminotransferase (ALT) and aspartate aminotransferase (AST) were determined colorimetrically at 505 nm according to **Reitman and Frankel, (1957)**. While, the activity of alkaline phosphatase (ALP) was determined according to **Tietz et al (1983)**. Whereas, serum albumin was estimated according to the method of **Doumas et al (1971)**.

Oxidative stress parameter

The Lipid peroxidation (LPO) in serum was determined by measurement of malondialdehyde (MDA) formation at 534 nm using the thiobarbituric acid reactive substances (TBARS) method as described by **Ohkawa et al (1979)**. Whereas, reduced glutathione (GSH) in the serum was estimated by its reaction with dithio-bis-2-nitrobenzoic acid (DTNB) according to **Beutler et al (1963)**.

Histopathological Examination

Autopsy samples were taken from the liver of the different groups of rats and used for histological examination as described by **Banchroft et al (1996)**.

Statistical analysis

Descriptive values of data were expressed as the Mean±SE and they were analyzed statistically using the one-way analysis of variance ANOVA followed by Duncan's test. In all cases $p < 0.05$ was used as the criterion of statistical significance by SAS program **SAS, (2003)**.

RESULTS AND DISCUSSION

Scavenging activity of Dandelion, camel milk and their different prepared treatment

The results of scavenging activity of the experimental materials are presented in **Table (1)**. The scavenging activity (%) in camel milk; fermented camel milk (probiotic product); dandelion aqueous extract (prebiotic); probiotic product fortified with prebiotic product (synbiotic product); camel whey and camel casein protein were 64.43, 75.97, 83.47, 67.43, 71.07, 45.60 % respectively. As can be noticed from the results that the highest scavenging activity were recorded in dandelion aqueous extract; these finding were coincided with those obtained by **Yansong et al (2017)** who reported that dandelion leaf crude extract possesses the highest DPPH scavenging activity than other plant parts. Followed respectively by probiotic camel milk > camel whey protein > synbiotic camel milk > camel milk > camel casein. These results are in harmonization with those obtained by **Nishino et al (2000)** who reported that increased radical scavenging activity was due to the protein peptides present in the fermentation.

Table 1. Scavenging activity % of Dandelion, camel milk and their different prepared treatment

Treatments	Scavenging activity %
Camel milk	64.43 ^d ± 0.26
Fermented camel milk (probiotic)	75.97 ^b ± 2.44
Dandelion aqueous extract	83.47 ^a ± 0.84
Synbiotic camel milk	67.43 ^{cd} ± 2.64
Whey	71.07 ^{bc} ± 1.49
Casein	45.60 ^e ± 3.04

Data are mean ± SE, n=3, Different uppercase letters in the same column represent statistically significant data at 5%.

Growth performance in rats

The initial body weights of all rats groups were not significantly different, however, after 45 days of feeding; body weight gain were significantly lower in liver injury control group (IC) treated with CCl₄ as compared to the normal control and other treatment groups (**Table 2**). On the other hand, rats received orally camel milk; fermented camel milk (probiotic product); dandelion extract (prebiotic product); ; probiotic product fortified with prebiotic

product extract (synbiotic product) and camel whey protein increased significantly in weight gain and weight gain % in comparing with normal control and CCl₄ treated groups. While, rats fed on diets contained camel casein recorded the highest body weight gain and weight gain % in comparing with other treatment groups. With occurred higher increased in body weight gain compared to IC. These results hypothesized that the applied treatments may improve appetite and enhance weight gain.

Liver function parameters

The liver play important role as a major organ for detox our body from toxicant which we exposure daily from xenobiotics and drugs. The present study was focused on investigating the role of camel milk; fermented camel milk (probiotic product); dandelion extract (prebiotic product); probiotic product fortified with prebiotic product (synbiotic product), camel whey and camel casein protein against CCl₄ induced hepatic injury and to find the possible hepatoprotection.

Rats subjected to CCl₄ developed significant hepatocellular injury as revealed from the higher serum activities of AST; ALT and ALP compared to normal control group and others treatment groups; also, the injury group noticed lower level from albumin which indicated to decreased the ability of the liver to create albumin due to liver dysfunction (**Table 3**). The increased serum of hepatic markers have been attributed to the liver injury, because these enzymes are placed in cytoplasmic area of the cell and are released into circulation in case of cellular damage **Thnaian, (2012)**.

On the other hand, treatment by camel milk ; fermented camel milk (probiotic product); dandelion extract (prebiotic); probiotic product fortified with prebiotic product (synbiotic product), camel whey and camel casein protein exhibited a significant reduction in the levels of AST; ALT and ALP as compared with liver injury control rats group; also, improved the level of albumin to return to its normal level comparing to injury group. Camel milk could induce decrease in lipid peroxidation processes as well as increase in the activities of plasma protein and albumin in animal (**Al-Fartosi, 2012**).

Oxidative stress parameters

Table (4) shows the changes in the levels of malondialdehyde as an indication of lipid oxidation

in serum of rats groups. Administration of camel
milk; fermented camel milk (probiotic product);

Table 2. Growth performance parameters of rat's different experimental groups

Parameters Groups	Initial weight (g)	Final weight (g)	weight gain (g)	weight gain %
NC*	142.4 ^a ± 1.46	150.2 ^c ± 1.02	7.80 ^c ± 2.01	5.53 ^c ± 1.46
IC**	140.0 ^a ± 2.44	116.2 ^d ± 4.694	-21 ^d ± 5.99	-15.62 ^d ± 4.24
Camel milk	147.2 ^a ± 5.49	170.8 ^b ± 4.586	23.6 ^b ± 6.852	16.67 ^b ± 5.29
FCM***	149.2 ^a ± 2.09	162.0 ^{bc} ± 3.162	12.8 ^{bc} ± 3.136	8.6 ^{bc} ± 2.11
Dandelion	142.4 ^a ± 0.40	159.2 ^{bc} ± 6.183	22.8 ^b ± 5.678	16.8 ^b ± 4.16
Synbiotic	147.2 ^a ± 5.678	158.6 ^{bc} ± 4.578	11.4 ^{bc} ± 2.039	7.9 ^{bc} ± 1.59
Whey	151.2 ^a ± 5.314	162.2 ^{bc} ± 6.931	11.0 ^{bc} ± 2.489	7.2 ^{bc} ± 1.61
Casein	144.8 ^a ± 2.576	207.2 ^a ± 3.929	62.4 ^a ± 3.187	43.2 ^a ± 2.43

Data are mean ± SE, n=5, Different uppercase letters in the same column represent statistically significant data at 5%; *Normal control group; **Injury control group; ***Fermented camel milk.

Table 3. Liver functions of different experimental groups

Parameters Groups	AST (U/l)	ALT (U/l)	Albumin (mg/dl)	ALP (U/l)
NC*	135.60 ^e ± 3.37	50.60 ^f ± 4.70	3.86 ^a ± 0.21	135.00 ^e ± 8.80
IC**	214.40 ^a ± 9.70	160.40 ^a ± 4.55	2.42 ^c ± 0.124	373.00 ^a ± 6.70
Camel milk	182.60 ^{bcd} ± 3.36	91.40 ^{bc} ± 1.50	3.04 ^b ± 0.12	294.00 ^{bcd} ± 13.27
FCM***	187.80 ^{bc} ± 4.80	95.40 ^{bc} ± 2.94	2.88 ^b ± 0.1	298.00 ^{cd} ± 6.57
Dandelion	175.20 ^{cd} ± 6.44	76.80 ^{de} ± 5.86	3.00 ^b ± 0.71	280.40 ^{cd} ± 7.53
Synbiotic	180.60 ^{bcd} ± 3.59	84.40 ^{cd} ± 4.74	3.04 ^b ± 0.12	285.00 ^{cd} ± 9.75
Whey	169.60 ^d ± 6.57	71.00 ^e ± 3.44	3.14 ^b ± 0.1	257.00 ^d ± 16.40
Casein	196.60 ^b ± 2.66	102.80 ^b ± 2.87	2.74 ^{bc} ± 0.15	327.00 ^b ± 21.19

Data are mean ± SE, n=5, Different uppercase letters in the same column represent statistically significant data at 5%; *Normal control group; **Injury control group; ***Fermented camel milk.

dandelion extract (prebiotic); probiotic product fortified with prebiotic product (synbiotic product), camel whey and camel casein protein reduced significantly the levels of malondialdehyde compared to liver injury control group which confirms that all treatment groups could effectively protect against oxidative stress induced by CCl₄.

Glutathione acts as an antioxidant according to the liver defense mechanism to eliminate the toxicants from our body. The changes in serum glutathione (GSH) level of different groups has been tabulated in **Table (4)**, rats treated with CCl₄ (IC) significantly lowered the glutathione (GSH) level. While, other protective treatment groups elevated the level of glutathione in the serum indicated the roll of camel milk; fermented camel milk (probiotic product); dandelion extract; probiotic product fortified with prebiotic product (synbiotic product), camel whey and camel casein protein to activate the glutathione function as an antioxidant to scavenging free radical; pretreatment with camel milk can prevent the occurrence of oxidative damage; this result is in agreement with that of **Houda et al (2017)** demonstrated that camel milk attributed to its wealth in vitamins A, B2, C, E and its richness in zinc and higher level in magnesium which plays an important role in the biosynthesis of GSH.

Table 4. Oxidative stress parameters of rat's different experimental groups

Parameters Groups	MDA (nmol/ml)	GSH (mg/dl)
NC*	5.7 ^d ±0.27	23.4 ^a ± 1.36
IC**	17.4 ^a ±1.21	7.0 ^d ±0.71
Camel milk	10.0 ^{bc} ±0.71	15.5 ^{bc} ±0.50
FCM***	11.1 ^{bc} ± 0.71	16.1 ^b ±0.91
Dandelion	10.8 ^{bc} ±1.15	15.9 ^b ± 1.19
Synbiotic	11.0 ^{bc} ± 1.30	15.0 ^{bc} ± 0.71
Whey	8.7 ^c ± 0.54	17.6 ^b ± 1.63
Casein	12.2 ^b ± 1.28	12.6 ^c ±0.93

Data are mean ± SE, n=5, Different uppercase letters in the same column represent statistically significant data at 5%; *Normal control group; **Injury control group; ***Fermented camel milk.

Histopathological examination

Hepatic injury by carbon tetrachloride (CCl₄) produce lipid peroxidation which caused oxidative stress; so we need to evaluate the potential protective effects of camel milk; fermented camel milk

(probiotic product); dandelion extract(prebiotic product); probiotic product fortified with prebiotic product (Synbiotic product), camel casein and camel whey protein.

Liver injury was evaluated by histopathological alterations finding in **Micrograph (1) to (8)** and **Table (5)**. There was no histopathological alteration and the normal histological structure of the central vein and surrounding hepatocytes were recorded in the normal control group (NC); (**Micrograph 1**).

Sever dilatation and congestion was observed in the central vein, associated with focal necrosis as well as focal inflammatory cells aggregation in the parenchyma. There was focal fibrosis with inflammatory cells aggregation in between the dilated central and portal veins. The portal area showed congestion in the portal vein, multiple newly formed bile ducts, few inflammatory cells infiltration and oedema were noticed in the injury control group (IC); (**Micrograph 2**).

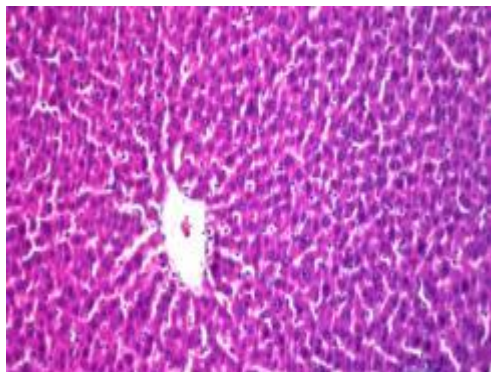
The hepatic sections obtained from animals treated with CCl₄ plus received camel milk showed very few inflammatory cells infiltration in the portal area (**Micrograph 3**). These results were confirmed by **Thnaian, (2012)** who reported that rats were treated with camel milk observed hepatic recovery and regeneration of hepatocytes; also, reduced the incidence of liver lesions induced by CCl₄.

The liver sections obtained from animals treated with CCl₄ plus received fermented camel milk observed hyperplasia in the lining epithelium of the bile ducts (**Micrograph 4**).

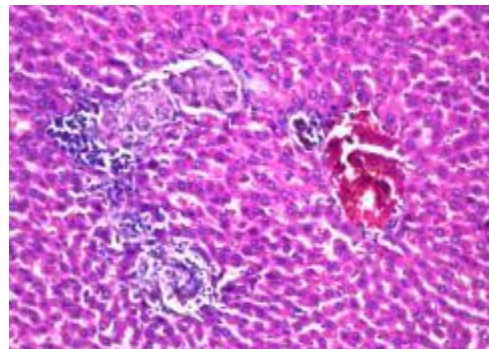
The hepatic sections obtained from animals treated with CCl₄ plus received dandelion aqueous extract showed kupffer cells were proliferated in diffuse manner between the hepatocytes in association with dilatation in the central vein (**Micrograph 5**). These results were previously supported by **Park et al (2010)** who reported that dandelion leaf aqueous extract had a protective effect against CCl₄-induced liver injury in rats.

The liver sections obtained from rats treated with CCl₄ plus received synbiotic camel milk observed mild dilatation in the central vein and sinusoids with diffuse kupffer cells proliferation between the hepatocytes (**Micrograph 6**).

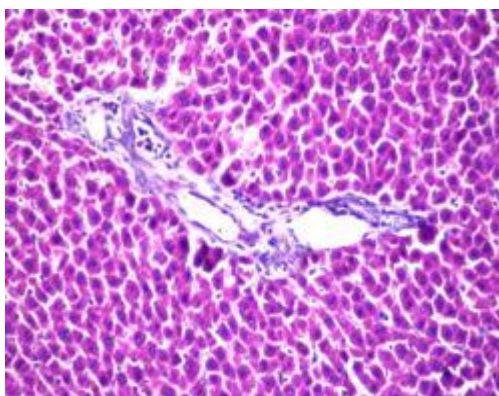
The hepatic sections from rats treated with CCl₄ plus received camel whey protein was detected inflammatory cells infiltration in the portal area as well as between the hepatocytes (**Micrograph 7**).



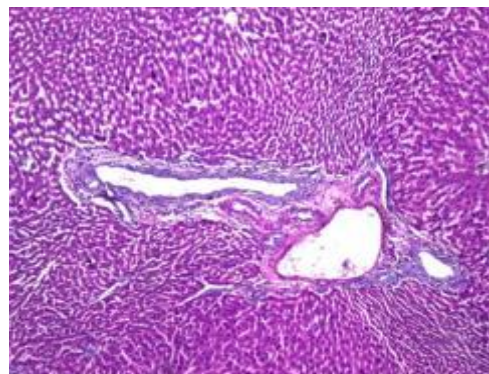
Micrograph 1. Liver of normal control rat (H & E, 40X)



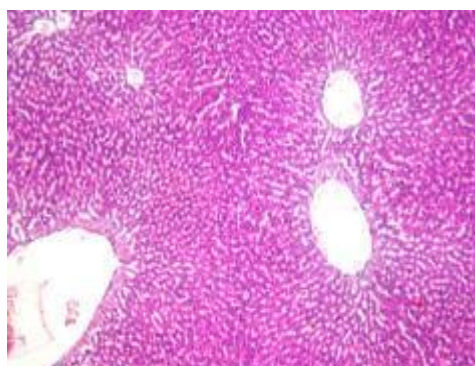
Micrograph 2. Liver of CCl₄-treated rat (H & E, 40X).



Micrograph 3. Liver of camel milk and CCl₄-treated rat (H & E, 40X).



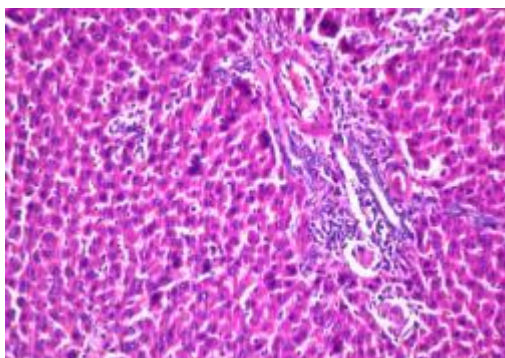
Micrograph 4. Liver of fermented camel milk and CCl₄-treated rat (H & E, 40X).



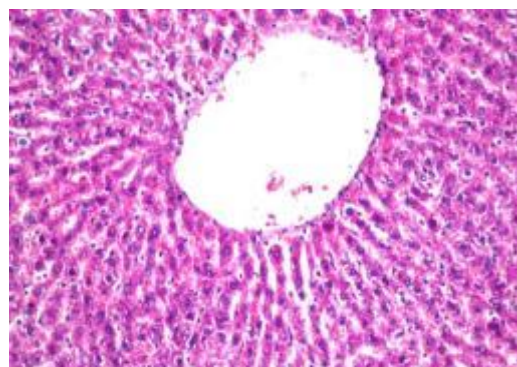
Micrograph 5. Liver of dandelion aqueous extract and CCl₄-treated rat (H & E, 40X)



Micrograph 6. Liver of synbiotic camel milk and CCl₄-treated rat (H & E, 64X).



Micrograph 7. Liver of camel whey protein and CCl₄-treated rat (H & E, 40X).



Micrograph 8. Liver of camel casein and CCl₄-treated rat (H & E, 40X).

The liver sections from rats treated with CCl₄ plus camel casein showed dilatation in the central vein. The portal area showed inflammatory cells infiltration and hyperplasia in the lining epithelium of the bile ducts. Fatty change was detected in some few individual hepatocytes (**Micrograph 8**).

The histopathological changes in treated groups with camel milk; fermented camel milk (probiotic product); dandelion extract (prebiotic product); probiotic product fortified with prebiotic product (synbiotic product), camel casein and camel whey protein as compared to that induced with CCl₄ alone indicated marked protective effects of these substances (**Table 5**).

Table 5. Histopathological severity changes in rat liver of different experimental groups

Treatment Alteration	NC	IC	Camel milk	FCM	Dandelion	Synbiotic	Whey protein	Casein
Congestion	-	++	-	-	+	+	-	+
Focal hepatic necrosis	-	+	-	-	-	-	-	-
Focal inflammatory cell in the parenchyma	-	++	-	-	-	-	-	-
Focal fibrosis in hepatic parenchyma	-	+	-	-	-	-	-	-
Portal inflammatory rectum	-	++	+	-	-	-	+	-
Hyperplasia and proliferation of bile ducts	-	++	-	++	-	-	-	+
Kupffer cell proliferation	-	-	-	-	+	+	-	-
Fatty change in hepatocytes	-	-	-	-	-	-	-	+

— : Nil; +: Mild; ++: Moderate; +++: Severe effect.

CONCLUSION

As appeared from the aforementioned data, treatment by camel milk ; fermented camel milk (probiotic product); dandelion extract(prebiotic product) ; probiotic product fortified with prebiotic product (synbiotic product), camel whey and camel casein protein improved liver function and decreased the oxidative stress induced by CCl₄ in rats; in addition, histopathological examinations in the hepatic confirmed protective ability of these treatments.

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حليب الإبل والمستخلص المائي لأوراق الهندباء كعوامل مساعدة للتحكم في الضرر الكبدي

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الموجز

أشارت النتائج إلى أن جميع المواد السابقة أظهرت نشاط إيجابيا وقد كشفت المجموعة الضابطة المصابة بالضرر الكبدي زيادة في وظائف الكبد (ALT, AST, ALP و) ومستويات المالنوالدهيد (MDA)، في حين انخفضت معدل زيادة وزن الجسم ومستويات الزلال والجلوتاثيون (GSH). أيضا، أظهر الفحص النسيجي للكبد المزيد من التغيير بسبب الضرر الكبدي المستحدث برابع كلوريد الكربون بينما ادت وساهمت المعاملة بالمستخلص المائي للهندباء، حليب الإبل، حليب الإبل المتخمّر (منتج بروبيوتيك)، حليب الإبل المتخمّر المدعم بالمستخلص المائي للهندباء (منتج بروبيوتيك)، حليب الإبل المتخمّر المدعم بالمستخلص المائي للهندباء (منتج سينايبوتيك)، كازين الإبل وبروتين شرش حليب الإبل سينايبوتيك)، كازين الإبل وبروتين شرش حليب الإبل إلى تحسن كبير في معدل زيادة الوزن ووظائف الكبد ودلائل الإجهاد التأكسدي، وأيضا منعت التغيير في أنسجة الكبد. ويمكن أن نستنتج من ذلك أن المستخلص المائي للهندباء، حليب الإبل، حليب الإبل المتخمّر (منتج بروبيوتيك)، حليب الإبل المتخمّر المدعم بالمستخلص المائي للهندباء (منتج سينايبوتيك)، كازين الإبل وبروتين شرش الإبل يمكن إستخدامها كمكونات في الأغذية الوظيفية لوقاية الكبد.

الكلمات الدالة: حليب الإبل، بروبيوتيك، الهندباء، الضرر الكبدي، الفئران

يهتم الناس في جميع أنحاء العالم إهتمام كبير بطرق الوقاية من امراض الكبد، والنظام الغذائي المتوازن يمكن أن يكون له دور فعالا ووقائيا منها. لذلك، تهدف هذه الدراسة إلى التحقق من الدور الوقائي لكل من المستخلص المائي لأوراق الهندباء (البروبيوتيك)، حليب الإبل، حليب الإبل المتخمّر (منتج بروبيوتيك)، حليب الإبل المتخمّر المدعم بالمستخلص المائي لأوراق الهندباء (منتج سينايبوتيك) وكازين الإبل وبروتين شرش الإبل ضد الضرر الكبدي المستحدث بواسطة رابع كلوريد الكربون في الفئران. حيث تم تقسيم الفئران إلى ثماني مجموعات (ثمانية فئران لكل منهما). المجموعة الأولى هي مجموعة ضابطة (NC)، في حين تم حقن المجموعات السبع الأخرى في بدايه تجربته تحت الغشاء البريتوني بجرعة واحدة من رابع كلوريد الكربون. وقد تلقت الحيوانات من المجموعة الثالثة الي السابعة عن طريق الفم المعاملات الاتيه حليب الإبل، المستخلص المائي لأوراق الهندباء، حليب الإبل المتخمّر (منتج بروبيوتيك)، منتج الـ سينايبوتيك وشرش حليب الإبل، بينما تلقت المجموعة الثامنة العليقة الأساسية التي تم فيها استبدال البروتين بكازين الإبل بنسبة 20%. واستمرت تجربه لمدة 45 يوم.

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