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The effect of hydroalcoholic extracts from *Taraxacum officinale* on blood indicators of kidney and liver functions in male rats

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ABSTRACT

Background & Aim: Evaluation of the effects of medicinal herbs on the metabolism and physiology of the body is considered as one of the fundamental researches about the use of herbs in medicine. The present study aimed to investigate the effects of hydroalcoholic extract of Dandelion (*Taraxacum officinale*) leaf on liver and kidney function of the rats in normal physiological conditions.

Experimental: The Wistar adult male rats (n=32) were divided into 4 groups of control, 50, 100 and 200 based on the concentration of the hydroalcoholic extract fed to rats (mg/kg body weight). Dandelion leaf extract was administered by gavage for 20 days. Blood samples were taken from the heart to assess the health parameters of the liver (cholesterol, triglyceride and liver enzymes) and kidney (urea, urea nitrogen, and creatinine).

Results: The concentrations of cholesterol and triglyceride were significantly increased in the extract-treated groups compared to the control. Levels of Gamma-glutamyl transferase (GGT) and aspartate aminotransferase (AST) were not significantly different between the treated groups and the control. However, alanine aminotransferase (ALT) levels were significantly increased in the extract-treated groups. Kidney health assessment showed that consumption of Dandelion leaf extract reduced the concentrations of urea, urea nitrogen, and creatinine. In addition, the concentration of these indicators at lower doses of the extract (50, was more significant.

Recommended applications/industries: The present study showed that under normal physiological conditions; consumption of hydroalcoholic extract of Dandelion leaf at low doses had no negative effects on liver and kidney functions.

1. Introduction

Today, there is an increased tendency towards herbs and their medical use in the prevention and treatment of diseases because of the high costs of research, development and the side effects of chemical drugs (Ahmadiyeh, 2001). According to the World Health Organization, about 80% of people use herbs for therapeutic purposes in worldwide (Mohebbi, 2012). Herbs have more lasting effects than other medicines despite their slow impact. Moreover, herbs contain cellular compounds that increase the effects of other herbs in parallel (Blog and Studoula, 2005).

Dandelion (*Taraxacum officinale*) is from the Asteraceae family which is cultivated in different parts of the world and is used as a vegetable in most countries (Gonzalez-Castejon *et al*., 2012). Dandelion is used as a medicine to strengthen the liver and treat hepatitis in traditional medicine. The positive effects of Dandelion have been shown on blood, relieving the joint inflammation pain and rheumatic pain, lowering blood sugar, and digestive laxatives (Blumenthal *et al.*, 2000). Dandelion contains various compounds such as chicuric acid, chlorogenic acid, coumaric acid, flavonoids, coumarin, tannins and various types of minerals depending on the plant and place of the growth (Chevallier, 2016; Yarnell and Abascal, 2009). Oral administration of dandelion extract has diuretic effect in rats and mice. In a study, the effect was estimated to be equal to ferromide (Chevallier, 2016). Modaresi and Resalatpour (2012) studied the effect of different doses of the dandelion hydroalcoholic extract on Balb / C mice. They observed that hydroalcoholic extract significantly affected the number of red and white blood cells. They also found that the rate of change was dose-dependent (Modaresi and Resalatpour, 2012). The effect of dandelion on the diet of broiler chickens showed a significant increase in hemoglobin, hematocrit and erythrocyte concentrations.

Cho *et al*. (2002) reported that dandelion aqueous extract has a regulatory effect on lipid metabolism (Cho *et al.*, 2002). Yu *et al*. (2010) also reported that the dandelion root has a protective effect on the liver mainly against oxidative stress (You *et al*., 2010). Most studies have investigated the dandelion extract effect on a case-by-case basis. Therefore, conducting a fundamental study to evaluate the effect of dandelion leaf extract under physiological conditions is essential. Regarding the key role of liver and kidney in regulating the physiological balance of the body, this study was designed and performed to evaluate the effect of hydroalcoholic extract of dandelion on liver and kidney function by measuring the blood parameters.

2. Materials and Methods

2.1. Experimental animals

Male Wistar rats (N=32, weight 200-220 g) were randomly placed in four groups of treatments and eight replications. Treatments were as follows: Group 1, the control group that received no extract, group 2 which received 50 mg/kg bodyweight Dandelion extract, group 3 which received 100 mg/kg body weight Dandelion extract, and group 4 which received 200 mg/kg body weight Dandelion extract. The rats were kept in polycarbonate cages at standard temperatures of 20–24 °C during the experiment and had easy access to water and food without restriction.

Dandelion extract was fed to rats by gavage for 21 consecutive days and at a specified time (1.pm.). The blood samples were taken directly from the heart. Serum cholesterol, triglyceride, alanine aminotransferase (ALT), aspartate aminotransferase (AST), Gamma-glutamyl transferase (GGT), creatinine, urea, and urea nitrogen indices were measured by spectrophotometric method and Pars test kit. Data were analyzed by SPSS software using variance analysis.

2.2. Plant material collection and extraction procedure

Dandelion leaf samples were collected from the Isfahan region in June, 2019. After identification, the samples were dried and powdered by electric milling. Then, a mixture of 96% ethanol and water (70/30) was added to the powder, and the samples were stored in the oven for 72 h at 37 ° C. The extract was passed through a special filter and the rotary apparatus set was used to remove the ethanol. Then, the sample was placed in the oven at 37 ° C for 48 hours to prepare the powder. The obtained extracts were then mixed with distilled water (50, 100 and 200 mg/kg bw) and

transferred into the Falcon tubes and stored at 4 ° C until treatment.

2.3. Statistical analysis

Statistical significance of the values obtained from each experiment was evaluated by regression analysis and t-test using the software SPSS. Data were expressed as mean ± standard deviation (SD). The P values of less than 0.05 were considered statistically significant (P<0.05).

3. Results and discussion

The effect of hydroalcoholic extract of the dandelion leaf on blood serum triglyceride and cholesterol are shown in Table 1. The results showed that the use of dandelion extract at 100 and 200 mg doses significantly increased the triglyceride concentration compared to the control group (P<0.05). However, there was no significant difference between the extract doses. Regarding the cholesterol concentration, the 50 mg extract significantly increased the cholesterol concentration. The effects of dandelion extract on blood urea, urea nitrogen, and creatinine levels are presented in Table 2.

Table 1. Effect of hydroalcoholic extract of the dandelion leaf on serum triglyceride and cholesterol levels (mg/dl) of rats

Treated groups	Triglyceride	Cholesterol
Control[1]	76±19.3[b]	55±5.6[b]
50[2]	105±33.8[ab]	64±5.6[a]
100[3]	103±15.5[a]	68±4.3[a]
200[4]	125±22.7[a]	68±13.6[a]

1: Received no extract (zero/Control),
2: Received 50 mg/kg bw Dandelion extract
3: Received 100 mg/kg bw Dandelion extract
4: Received 200 mg/kg bw Dandelion extract

Table 2. Effect of hydroalcoholic extract of the dandelion leaf on urea, urea nitrogen and creatinine in serum (mg/dl) of the rats

Treated groups	Urea	Nitrogen urea
Control[1]	635±39.9[a]	296±18.6[a]
50[2]	500±27[c]	233±12.6[c]
100[3]	583±128.5[abc]	272±60.1[abc]
200[4]	563±37.8[b]	263±17.7[b]

1: Received no extract (zero/Control),
2: Received 50 mg/kg bw Dandelion extract,
3: Received 100 mg/kg bw Dandelion extract,
4: Received 200 mg/kg bw Dandelion extract.

The consumption of the extract, regardless of the dose, resulted in a significant decrease in urea and urea nitrogen concentrations (P<0.05). In both parameters, there were no significant differences between the control and treated group with 100 mg/kg bw of extract which could be related to the high standard deviation of the treated group. Considering the high standard deviation of the 100 mg/kg bw -treated group, it can be concluded that the treatment with 50 mg/kg bw of extract had a significant effect on decreasing the urea and urea nitrogen concentration compared to the control group. The creatinine concentration showed a similar trend as urea and urea nitrogen concentration and treatment 50 had the greatest effect on decreasing creatinine concentration. The results also showed that the treatment with 200 mg/kg bw of extract significantly increased the creatinine concentration compared to the control group.

The effects of different concentrations of dandelion extract on ALT, AST, and GGT levels are shown in Table 3. The consumption of the extract significantly increased ALT levels in treated groups compared to the control group (P<0.05). This increase was also affected by the concentration of the extract. However, there was no significant difference between the treated groups with 100 and 200 mg/kg bw of extract (P<0.05). Unlike ALT, the AST was not affected by the extract concentration. There was no significant difference between treatment 200 and other treatments which could be due to the high standard deviation of the 200-treated group. Also, the consumption of the dandelion extract had no significant effect on GGT levels (P<0.05).

Table 3. Effect of hydroalcoholic extract of the dandelion leaf on ALT, AST and GGT (U/L) levels of the rats

Treated groups	ALT	AST	GGT
Control[1]	20±9.4[c]	170±16.2[a]	2.4±1.7[a]
50[2]	37±2.9[b]	177±31.9[a]	2.7±1.74[a]
100[3]	41±8.5[ab]	179±23.8[a]	3.1±1.27[a]
200[4]	43±5[a]	228±154.1[a]	3.2±1.3[a]

1: Received no extract (zero/Control),
2: Received 50 mg/kg bw Dandelion extract,
3: Received 100 mg/kg bw Dandelion extract,
4: Received 200 mg/kg bw Dandelion extract.

The identification and evaluation of the medicinal properties of the herbs have attracted the attention of

medical researchers around the world. The growing interest of the world in herb-based therapies is because of the potency of some herbs in preventing and treating the diseases.

Given the key role of the liver and kidneys on the basal metabolism and physiological balance of the body, evaluation of their function could be a suitable indicator for the effect of herbs on the body (Bortis, 2000). This study was also designed and conducted to evaluate the effect of hydroalcoholic extract of the dandelion leaf on the function of the liver and kidney by measuring some blood parameters.

The liver plays a significant role in the synthesis of the cholesterol, so measuring the blood cholesterol concentrations is one of the indicators of liver health (the blood cholesterol decreases in liver failure) (Mojabi, 2011). In the present study, the increase in the concentration of cholesterol showed that consumption of the extract didn't have negative effects or interfered with the processes of cholesterol metabolism in the liver.

Chu *et al*. (2002) investigated the effect of aqueous extract of dandelion in diabetic rats. They reported that the aqueous extract increased the blood cholesterol concentrations (Cho *et al.*, 2002). This was in agreement with the present results. It was reported that Dandelion consumption increased food intake (Cho *et al*., 2002). Therefore, the increase in cholesterol concentration in the treatments could be due to the effect of extract on food intake.

The concentration of blood triglyceride was also increased by extract consumption. However, a minimum dose of the extract (100 mg/kg bw) is needed for the positive effects like increasing blood triglyceride concentrations. This also could be due to the extra food intake during the consumption of the extract. Moon *et al.* (2017) showed that the dandelion extract has a protective effect on the liver and concentrations of blood triglycerides so that it was increased after consumption of the extract (Moon *et al*., 2017).

ALT, AST and GGT enzyme levels are indicators of liver health. The activity of these enzymes is highly increased in acute liver diseases (Mojabi, 2011). The results of this study showed that the consumption of dandelion extract increased the levels of ALT and AST enzymes in mice and the sensitivity of ALT level to the extract was much higher than the AST. The AST level was increased only at high doses of extract (200 mg/kg bw), whereas the ALT level was significantly increased even at low doses of the extract (50 mg/kg bw). In a study by Yu *et al*. (2010), Consumption of alcoholic extract of the dandelion root in mice resulted in a decrease in ALT levels, which is inconsistent with our results (You *et al*., 2010). One explanation could be the difference in the dosage and type of the extract. Also, high concentrations of the extract can damage liver cells. Chu *et al*. (2015) showed that the blood AST of dairy cattle was increased during the use of native South Korean dandelion (Cho *et al*., 2015). They stated that this increase is due to the pressure and stress of eating the extract over 20 days.

Unlike AST and ALT enzymes, GGT enzyme levels were not affected by the extract consumption, although the results showed a relative increase in GGT levels in the extract-treated groups. Inconsistent with present findings, Moon *et al*. (2017) reported that dandelion extract consumption in mice with liver toxicity resulted in a decrease in GGT levels (Moon *et al*., 2017). Considering the importance of increased ALT and GGT enzymes in the evaluation of liver damage, the results of this study indicated that relatively high doses of the dandelion extract may have detrimental effects on the liver.

Renal impairment was assessed by measuring urea, urea nitrogen and creatinine parameters. The consumption of the dandelion extract resulted in the reduction of urea, urea nitrogen, and creatinine. The concentration of these parameters was more decreased at lower doses of the extract (50 mg/kg bw). It can be concluded that low dosage of extract has more positive effects on renal function. Di Cerbo *et al*. (2018) investigated the effects of dandelion and some other herbs on renal disorders of the cats. They reported a decrease in blood serum creatinine, which was consistent with the results of present study. However, they indicated that this decrease in creatinine concentration was due to the diuretic properties of the dandelion plant. Another study by Karakus *et al*. (2017) also showed that consumption of dandelion extract in mice treated with carbon tetrachloride decreased the urea concentration. Lee *et al*. also reported a decrease in blood urea nitrogen after the consumption of dandelion in rats.

4. Conclusion

Investigating the effects of dandelion extract on the basic physiology of the body is one of the essential researches on the application of this herb in medical cases. The present study aimed to investigate the effects of hydroalcoholic extract of the dandelion leaf on liver and kidney activities in rats under normal physiological conditions. The results of this study showed that under normal physiological conditions, 50 mg/kg dosage of the extract had positive effects on renal function. In addition, the 50 mg/kg dosage of the extract also reduces negative effects on liver activity. In general, according to the results of this study, hydroalcoholic extract of dandelion leaves reduced urea, and creatinine nitrogen in kidney, and increased triglycerides, cholesterol, GGT, AST, and ALT levels in liver.

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