

Full Length Research Paper

Haematological profile of rats treated with aqueous extracts of common dandelion leaf (*Taraxacum officinale* Weber) against carbon tetrachloride (CCl₄) toxicity

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The effect of aqueous extract of common Dandelion (*Taraxacum officinale* Weber) on the hematological profile of Wistar Albino rats poisoned with carbon tetrachloride (CCl₄) was investigated. Results of this study revealed an elevation in the levels of White Blood Cell (WBC) and Bilirubin and a decrease in Packed Cell Volume (PCV) and Hemoglobin (Hb) occasioned by CCl₄ relative to control samples. The increase in the WBC is attributed to stimulation of the immune system response caused by the toxicity of CCl₄; there was also an indication of anemia and hemolysis in the blood of the experimental rats. After three weeks of oral administration of 100mL and 200mL aqueous extract of common Dandelion, there was significant decreasing ($p < 0.05$) in WBC and Bilirubin levels, with a corresponding increase on PCV and Hb. It was also observed that the functional recovery of these blood indices is concentration dependent. The efficacy claims of common Dandelion by traditional healers can further be validated in this study.

Key words: Hematology, common Dandelion, Packed Cell Volume, Bilirubin, Carbon tetrachloride.

INTRODUCTION

Vegetables are important components of our diet because of their chemical composition of vitamins, minerals and antioxidants for nutritional balance of its consumers. This awareness is on the increase and has resulted to the domestication of some of these plants (Eka, 1977). The common Dandelion (*Taraxacum officinale*, Weber) is a member of the *Asteraceae/Compositae* family. It is a perennial herb native to the Northern hemisphere and found growing wild in meadows, pastures, and waste grounds of temperate zones (Medline plus, 2008). The tap root is dark brown on the outside, white and milky within. The leaves are long, shiny and without hairs, the margin of each leaf is cut into great jagged teeth, either upright or pointing somewhat backwards to resemble the canine teeth of a lion, that gives the plant its most familiar name of Dandelion in English, *Dent de lion* in French, *Dens leonis* in Latin, *Leontodon* in Greek (Grieve, 2000)

and in Nigeria the Ijaws (Bayelsa State) of the Niger Delta called it *Edule Imimi*.

The young fresh leaves if blanched are eaten and mostly used for making salad, but the full-grown leaves are bitter and not seldom eaten (Grieve, 2000). The efficacy of medicinal plants is the result of many active agents acting together in the body system. Multiple drug therapy is a common phenomenon with traditional medicine practitioners. Common Dandelion roots and leaves are applied medically for gastrointestinal ailments. The European scientific cooperative on Phytotherapy (ESCOP) recommends Common Dandelion root for the restoration of Liver function and to treat stomach upset and loss of appetite (Medline plus, 2008; Akhtar et al., 1985). In Traditional Chinese medicine, it is also acclaimed as a nontoxic herb with exceptional values for its choleric, diuretic, anti-rheumatic and anti-inflammatory properties (Williams et al., 1996). In the South-South region of Nigeria, traditionalist use the leaves of Common Dandelion in combination with other plants as remedy against several ailments of liver dysfunction, diabetes and anti-

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inflammatory conditions (Sofowora, 1982). The medicinal potency claims of the plant by traditional and scientific researchers necessitated this study, the authors therefore investigated the effect of aqueous extract of common Dandelion leaf (*T. officinale* Weber) on the hematological indices of rats poisoned with CCl_4 .

MATERIALS AND METHODS

Plant Materials

Fresh leaves of Common Dandelion (*Taraxacum officinale* Weber) were collected from a local farm in Kaiama Kolokuma/Opokuma Local Government Area of Bayelsa State, Nigeria. They were identified and authenticated in the Herbarium Unit of the Department of Plant Science and Biotechnology, University of Port Harcourt.

Preparation of Extract

The fresh leaves of *T. officinale* were washed with distilled water to remove extraneous matters, air dried for seven days and occasionally turning them to avoid fungal growth. The leaves were pulverized using Thomas-Willey milling machine. 100grams of the dried powdered leaves were soaked in 100mL of distilled water in a 500mL conical flask. The content was vigorously shaken for about 10minutes and allowed to stand for 24 hours. The mixture was filtered using a clean handkerchief cloth and re-filtered using Whatman No. 42 (125mm) filter paper. Desired concentrations of the extract were made with distilled water for analysis.

Acute Toxicity Test

This test was performed with 9 rats assigned in three groups of three rats each. Each group was injected intraperitoneally with one of the following doses, 0.5mL/kg, 1.0mL/kg and 2.0mL/kg of CCl_4 . A mixture (1:1 v/v) of CCl_4 and vegetable oil (solvent carrier) was used to determine the LD_{50} level (Bruckner *et al*, 1986). After 24 hours, the mortality of each cage was assessed.

Experimental Animals

Sixteen (16) albino rats weighing between 150-200g were obtained from the animal house unit of the Department of Biochemistry, University of Port Harcourt. The animals were maintained in cages (at room temperature) fed with standard laboratory chow obtained from Pfizer feeds Plc, and water given ad libitum.

Experimental Design

The animals were randomly divided into four (4) groups of 4 rats each.

Group A: Rats in this group served as the control, they were fed with normal commercial feed and had water freely throughout the period of the experiment.

Group B: These rats were fed with the commercial feed, water and 0.5mL/kg CCl_4 .

Group C: These rats were fed the commercial feed, water, 0.5mL/kg CCl_4 and 100mg/kg extract of Common Dandelion for the three weeks of the experiment.

Group D: These were fed with commercial feed, water, 0.5 mL/kg CCl_4 , and 200mg/kg of Common Dandelion extract for the three weeks of the experiment.

At the end of each week of treatment, blood samples were collected from one rat in each group by direct cardiac puncture under ether anesthesia which was immediately transferred into a lithium heparin bottle for hematological study (Jain, 1986). Histopathological examination of the rat liver from each group was carried out after being sacrificed as described by Drury *et al.*, (1967).

Phytochemical Screening

Chemical tests were carried out on the aqueous extract of *T. officinale* and on the powdered specimen using standard procedures to identify the constituents using methods described by Harbone (1973), Evans (2002), Van-burden and Robinson (1981) Edeoga *et al.*, (2005) and Obadani and Ochuko (2001).

Test for tannins: About 0.5 g of the dried powdered samples was boiled in 20 mL of water in a test tube and then filtered. A few drops of 0.1% ferric chloride was added and observed for brownish green or a blue-black colouration.

Test for saponins: About 2 g of the powdered sample was boiled in 20 mL of distilled water in a water bath and filtered. 10ml of the filtrate was mixed with 5 mL of distilled water and shaken vigorously for a stable persistent froth. The frothing was mixed with 3 drops of Olive oil and shaken vigorously, then observed for the formation of emulsion.

Test for cardiac glycosides (Keller-Killani test): 5 ml of the extract was treated with 2 mL of glacial acetic acid containing one drop of ferric chloride solution. This was underlayered with 1 mL of concentrated sulphuric acid. A brown ring of the interface indicates a deoxysugar characteristic of cardenolides. A violet ring appeared below the brown ring, while in the acetic acid layer, a greenish ring formed just gradually throughout the thin layer.

Table 1. Phytochemical Analysis of Common Dandelion Extract.

Sample	Alkaloids	Saponins	Tannins	Glycosides
Dandelion	+	+	+	+

+ = Present

Table 2. Effect of *T. officinale* leaf extract on Packed Cell Volume (PCV%) of rats.

Group/Concentration	Week One	Week Two	Week Three
Group A Control	36.30 ± 0.41	34.80 ± 0.21	33.50 ± 0.17
Group B CCl ₄ Toxicity	20.60 ± 1.01*	22.50 ± 0.33	22.90 ± 0.71*
Group C 100mg/kg Ext.	33.93 ± 0.54*	0.53*	0.71*
Group D 200mg/kg Ext.	0.54*	34.40 ± 0.45*	34.75 ± 0.63*
	34.20 ± 0.75*	0.00*	

Mean ± SD for n = 3

* Significantly different compared to Control (P<0.05).

Table 3. Effect of *T. officinale* leaf extract on White Blood Count (WBC mm⁻³/L) of rats.

Group/Concentration	Week one	Week Two	Week Three
Group A Control	3933.33 ± 33.33	4111.11 ± 239.91	3933.33 ± 33.33
Group B CCl ₄ Toxicity	9433.33 ± 88.19*	9333.33 ± 89.90*	9111.11 ± 71.17*
Group C 100mg/kg Aq. Extr	6466.66 ± 66.66*	6700.00 ± 0.00*	5833.33 ± 33.33*
Group D 200mg/kg	5933.33 ± 66.66*	6066.66 ± 266.66*	5600.00 ± 115.47*

Mean ± SD for n = 3

* Significantly different compared to Control (P<0.05)

Test for Alkaloids 0.1g of the dried plant sample was weighted into 100mL conical flask. 0.1mL of 1.0% HCl was added and filtered. The filtrate was divided into three portions and tested with Mayer's, Dragendoff's and Wagner's reagent respectively. Orange coloration and reddish-brown precipitate were evidence for the presence of Alkaloid.

Statistical analysis

Statistical analysis was presented as mean ± SD and the statistical significance between all groups and control were analyzed by means of an Analysis of Variance (ANOVA) followed by Dunnett's multiple comparison test. P-values less than 0.05 were considered significant.

RESULTS AND DISCUSSION

Results of the phytochemical tests of extract of Common Dandelion (*Taraxacum officinale* Weber) are presented in Table 1. It revealed the presence of

medicinally active constituents like alkaloids, saponins, tannins and cardiac glycosides.

The acute toxicity studies showed that the CCl₄ produced an LD₅₀ with rats injected 0.5mL/kg CCl₄ intraperitoneally. The rats that received high dose of CCl₄ were immobile and remained flat on their abdomen. There was significant (p<0.05) increase in the levels of the White Blood Cell (WBC), and Total Bilirubin (TB), while the Packed Cell Volume (PCV), Hemoglobin (Hb) level were significantly (p<0.05) reduced. Histopathology examination of the liver of the rats in the CCl₄ treated group (B) showed an intense distortion in the liver architecture.

Packed Cell Volume (PCV)

Table 2 shows results of the Packed Cell Volume. It revealed that there was a decreasing (group B) in the level of PCV relative to the control (group A) when CCl₄ was given to the rats. The low values can be attributed to anemic conditions caused by the toxic CCl₄. The administration of aqueous extract of *T. officinale* (groups C and D) for the 3 weeks period showed a significant

Table 4. Effect of *T. officinale* leaf extract on Hemoglobin Concentration (Hb g/dl) of rats.

Group/Concentration	Week one	Week Two	Week Three
Group A Control	18.00 ± 0.15	16.00 ± 0.12	18.00 ± 0.12
Group B CCl ₄ Toxicity	7.26 ± 0.49*	9.26 ± 0.29*	7.26 ± 0.29*
Group C 100mg/kg Aq. Extr	12.16 ± 0.20*	12.43 ± 1.13*	10.26 ± 0.21*
Group D 200mg/kg	14.66 ± 0.35*	12.03 ± 1.09*	8.23 ± 1.76*

Mean ± SD for n = 3

* Significantly different compared to Control (P<0.05).

Table 5. Effect of *T. officinale* leaf extract on Bilirubin

Group/Concentration	Week One	Week Two	Week Three
Group A Control	16.66 ± 0.33	15.33 ± 0.33	16.33 ± 0.33
Group B CCl ₄ Toxicity	59.33 ± 0.66*	59.33 ± 0.66*	56.33 ± 0.33*
Group C 100mg/kg Aq. Extr	26.00 ± 1.00*	21.33 ± 0.66*	19.00 ± 0.00*
Group D 200mg/kg	20.33 ± 0.33*	20.33 ± 0.33*	16.00 ± 0.00*

increase ($p \leq 0.05$) in the serum level of packed cell volume. This was evident by the third week of treatment, where it increased to $34.75 \pm 0.63\%$ at the higher concentration of 200mg/kg (group D).

White Blood Cell (WBC)

The introduction of foreign body by the CCl₄ toxicant increased the WBC values to 9433.33 ± 88.79 (group B) compared to the control (group A) of 3933.33 ± 33.33 as shown in Table 3. The elevated WBC can be due to the stimulation of immune defence system (Kashinath, 1990). Similarly literature have shown that increased concentration of antigen in the body results in high values of WBC (Schalm et al., 1975; Hooney, 1985). In this study it was observed that on the administration of aqueous extract of *T. officinale* significantly decreased to 5600.00 ± 115.47 by the third week of the 200mg/kg. This trend agrees with earlier results obtained by Adisa et al (1999) and Ezekiel and Onyeyili (2007).

Haemoglobin

Hemoglobin concentration reflects the supply of oxygen to an organism. Results of the effect of Common Dandelion leaf extract on the hemoglobin concentration are as presented in Table 4. It showed a decreasing on rats injected with CCl₄ (group B). This is an indication of hemolysis and the decreasing in hemoglobin has a corresponding increasing in methemoglobin content which affects the oxygen carrying capacity of the blood, caused by the toxicant (Tilak et al, 2007). Treatment with aqueous extract of *T. officinale* significantly ($p < 0.05$) increased the hemoglobin level to 14.66 ± 0.35 , one week after (group D) in comparison with animals treated

with CCl₄ only (group B). These results is in agreement with reports of Adeyemo (2007) and Vinodhini and Narayanan (2009).

Total bilirubin

Bilirubin is a metabolic waste product formed from the breakdown of erythrocytes (Klyszejko and Lyezywek, 1999). The CCl₄ toxicant (group B) increased the total bilirubin value to 59.33 ± 0.66 compared to the control (group A) 16.66 ± 0.33 as presented in Table 5. This increasing can be due to damage to the liver cells and obstruction of the bile duct (Arthur et al, 1986, Khaleifat et al, 2002). The administration of aqueous extract of Common Dandelion (*T. officinale*) significantly ($p < 0.05$) decreased the serum total bilirubin level close to normal by the third week to 16.00 ± 0.00 (group D). Results from this study conforms with report of previous researchers (Nwamba et al, 2006) but inconsistent with report by Kori-Siakpere Ovie (2008).

CONCLUSION

Hematological parameters such as PCV, Hb, WBC and Total Billirubin are used to provide useful information for diagnosis in routine clinical evaluation of the state of health of a patient. This study revealed the reversal effect of Common Dandelion (*Taraxacum officinale* Weber) leaf extract on some hematological parameters of rats inflicted with carbon tetrachloride, which was observed to have raised the levels of WBC and Billirubin and decreased the levels of PCV and Hemoglobin. We also demonstrated that the higher concentration of the extract significantly lowered the elevated parameters and increased the reduced indices back to levels close to their normal state, indicating that

it is concentration dependent. The dose dependent effect of the leaf extract in the test animals suggest a cumulative action of the active ingredients present in the leaves of the plant. These bioactive constituents of the plant include; tannins, saponins, alkaloids and cardiac glycosides. The ameliorating effect of *T. officinale* leaf extracts on liver enzymes had been documented (Berezi and Monago, 2010), similarly reports of the effects of these substances in other plants such as *Nauclea latifolia* Smith. (Akpanabiatu et al., 2005), *Tridax procumbens* L. (Nwajo et al, 2007) and *Vernonia amygdalina* Del. (Nwajo,2005; Arhoghro et al, 2009) are recorded. The prophylactic and therapeutic claims of Common Dandelion (*Taraxacum officinale* Weber) by traditionalist can thus be confirmed with this study.

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