



The effect of carbon tetrachloride (CCl₄) contaminated extract of *Irvingia wombulu* (kernel) on the haematological indices (PCV, Hb, WBC, RBC), serum electrolytes (Na, K⁺, Cl⁻) and serum enzymes (AST, ALT, ALP) in Albino wistar rats

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Abstract

The toxic effect of *Irvingia wombulu* contaminated with carbon tetrachloride (10% CCl₄) on serum electrolytes (Na, K⁺, Cl⁻), haematological indices (PCV, HB, WBC, and RBC) and serum enzymes (AST, ALT, ALP) on albino wistar rats. Twenty albino wistar rats of both sexes were divided into four groups (A, B, C, D). Group A is the control while group B, C, and D are the test animals. The test animals (B, C and D) were fed at 100mg/Kg, 200mg/Kg and 300mg/Kg body weight of the contaminated extract for a period of twenty-one days. The animals were sacrificed and the serum electrolytes (K⁺, Na and Cl⁻), haematological indices (PCV, HB, WBC, and RBC) and serum enzymes (AST, ALP, ALT) were determined.

There was significant increase in sodium, potassium and chloride ions of rats that were fed with CCl₄ contaminated extract compared to the control. The serum enzymes assayed shows a decrease in ALT with an increase Alkaline phosphatase and Aspartate amino transferase as compared with the control and is dose dependent. The haematological indices shows a significance difference at P < 0.05. This indicate that the CCl₄ contaminated extract is toxic to the albino wistar rats at this dose level.

Keywords: *Irvingia wombulu*, AST, ALP, ALT, electrolytes

Introduction

The plant *Irvingia wombulu* (kernel) is a common tree that grows to (15 – 40) m high and commonly found in the lowland forest, widely distributed in Africa. They possess edible fruits and are valued for their fats and oils. Apart from the fruits, all parts of this plants had been found useful in one form or the other. (Harris 1996, Lowe *et al* 2000, Atzengana *et al* 2002) ^[1, 2]. The fruits are extracted and made into palm oil that is used in cooking soup and in making soap.

Carbon tetrachloride (CCl₄) which has been used extensively as cleansing agent, fire extinguisher, organic solvent and grain fumigant (Kim 1999). This compound had been known to cause liver necrosis and liver cirrhosis (McGregor and Lang 1996) ^[12].

The problem of study in the research is to assessed the effect of carbon tetrachloride contaminated extract of *Irvingia wombulu* (kernel) on the serum electrolytes, haematological indices and serum enzymes in albino wistar rats.

Method

a) Sample preparation

The plant material (*Irvingia wombulu*) was obtained from Anyiyba market, dried, crush and extracted with ethanol. The extracted sample was mixed in 10% carbon tetrachloride.

b) Experimental Design

The albino wistar rats were divided into four groups of five each. Group A is the control, Group B were fed at 100mg/Kg body weight, Group C at 200mg/Kg body weight and Group D at 300mg/Kg body weight. The feeding was through oral incubator for a period of twenty one days. The

albino wistar rats were sacrificed and blood sample were collected for analysis.

c) Test for serum electrolytes

1. **Sodium:** This was determined using the (Maruna 1958, Trinder 1974). The sodium precipitated as a triple salt (sodium magnesium uranyl acetate) which react with ferrocyanide producing a chromophore whose absorbance varies with the concentration of sodium.
2. **Potassium:** The method of Teri and Session 1958 was used. Sodium tetraphenyl boron react with potassium to produce a colloidal suspension and the absorbance is proportional to the concentration of potassium.
3. **Chloride:** Modification of colorimetric method of Skegge and Gochstrasses (1964) was used. Chloride form a soluble non-ionized compound with mercuric ions. The release thiocyanide ions react with ferric ions to form a coloured complex that absorbs light at 180nm. The intensity of the colour produced is directly proportional to the chloride ions.

d) Determination of plasma enzymes

1. **Alkaline phosphatase:** The method adopted in determination was that of Roy (1970) ^[10]. The ALP act on alkaline reagent, sodium thymolphthalein. This stop the action of the enzyme producing a chromogen which is measured photometrically.
2. **Alanine amino transferase:** The method of Henry 1974 was used. Alanine react with 2-oxoglutarate to form pyruvate which is converted to lactate in the presence of enzyme lactate dehydrogenase using NADH and hence the rate of oxidation of NADH is measured at 340nm.

3. **Aspartate amino transferase:** The method of Henry 1974 was used. The reaction between Aspartate and 2-oxoglutarate to form oxaloacetate which react under the enzyme methyl dehydrogenase to convert NADH to NAD⁺ the activity of this enzyme is measured by the oxidation of NADH.

e) Haematological parameters

The blood samples of each of the albino wistar rats was applied to the Abacus haemocytometer and the values of this parameters were recorded.

Results

Table 1: Effects of 10% CCl₄ contaminated extract and uncontaminated extract on the haematological parameters after administered to albino wistar rats.

Experimental Groups	Mean value PCV (%)	Mean value HGB (g/L)	Mean value RBC (x10 ⁹ /L)	Mean value WBC (x10 ¹² /L)
A (control group)	37.80±0.34	1.95±0.34	10.8±0.42	3.8±0.02
B (100mg/Kg)	33.2±1.42	1.62±4.20	9.5±0.33	5.20±6.10
C (200mg/Kg)	31.52±1.80	1.86±3.42	8.20±0.06	6.2±0.00
D (300mg/Kg)	29.20±0.92	1.52±3.30	5.92±1.20	7.60±0.72

Values are mean ±SD (n = 5) {P < 0.05}

Table 2: Effects of the contaminated and uncontaminated extract of *Irvingia wombulu* on the serum electrolytes level of Sodium, Potassium and Chloride of albino wistar rats.

Experimental Groups	Mean value Sodium	Mean value Potassium	Mean value Chloride
A (control group)	128.65±0.23	64.14±2.50	96.30±0.91
B (100mg/Kg)	120.60±0.72	42.30±0.05	122.60±4.5
C (200mg/Kg)	92.80±0.20	32.60±0.56	137.22±2.30
D (300mg/Kg)	163.54±0.21	19.20±2.80	175.20±1.20

Values are mean ±SD (n = 5) {P < 0.05}

Table 3: Effects of contaminated and uncontaminated extract of *Irvingia wombulu* (kernel) on the activity of AST, ALT and ALP in albino wistar rats.

Experimental Group	Mean value ALT (U/L)	Mean value AST (U/L)	Mean value Alp (U/L)
A (control group)	740.15±3.00	1686.34±3.52	24.68±0.53
B (100mg/Kg)	456.20±2.70	1567.22±2.42	19.67±0.65
C (200mg/Kg)	256.27±3.96	1538.46±6.49	18.76±0.52
D (300mg/Kg)	225.52±1.31	1338.68±7.28	16.57±0.42

Values are mean ±SD (n = 5) {P < 0.05}

Discussion

The percentage yield of ethanolic extract of *Irvingia wombulu* indicate that a large portion of the kernel consumed is non-digestive component which may have influence on toxicity of its contaminated sample.

Consumption of CCl₄ contaminated extract as food exposes the consumers to several toxicity associated CCl₄ contamination and causes damage to vital organs of the body, such as the liver, kidney and heart (Dashi *et al*, 1989). There was a reduction in growth rate of albino wistar rats treated with CCl₄ contaminated sample compared with the control (Ngondi *et al*, 2005). The result of the haematological parameters of these albino wistar rats fed with contaminated sample of *Irvingia wombulu* shows a significance decrease in Packed cell volume (PCV), haemoglobin (HGB) and Red blood cell count (RBC), White blood cells count (WBC) increased as compared with the normal group: Damage to liver and heart could induced this problem (Mc Gregor and Lang 1996)^[12].

There was a decrease in serum electrolytes (Na⁺ and K⁺) of the treated and untreated albino wistar rats while that of Cl⁻ shows a significance increase at P < 0.05. This is been due to the CCl₄. This disturbance in electrolyte Concentration is been due to acute renal failure (Behar – Cohen *et al*, 1996,

Rodney, 1995, Cohen *et al*, 2008)^[13].

The measurement of enzymes activity are sensitive indicators of damage to vital organs such as liver, kidney, lungs etc. The general changes in the concentration of serum enzymes for the albino wistar rats that received the CCl₄ contaminated sample compared to the control group (A) is as a result of toxicity posed by the CCl₄ and a probable damage to the vital organs.

Conclusion

The research above shows that contaminated sample of *Irvingia wombulu* (kernel) with CCl₄ had a significant effect on growth, haematological indices, serum electrolytes and serum enzymes in albino wistar rats and even at a higher concentration or even on exposure for a long period of time can lead to the death of the organism (albino wistar rats).

Hence care should be taken in the constant use of this chemical for food preservation and food addictive.

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