Hepatotoxicity of *Ipomoea Batatas* Leaf Extract on Male Wistar Rats

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Abstract  

The hepatotoxic potential of *Ipomoea batata* leaf extract on the liver tissues as well as the characteristics of the liver pathology on mature male wistar rats was determined. Mature leaves of *I. batata* were obtained and air dried for two days after which there were subjected to oven drying at 20°C for two minutes and then pulverized using an electric blender. Mature wistar rats of twelve weeks old weighing between 154-170g were fed with varying doses of feed/ extract mixture viz: 0g/0.643kg (Group 1) as control, 6g/0.648kg (Group 2), 8g/0.666kg (Group 3) and 10g/0.678kg (Group 4) for two weeks. After the treatment, the animals were sacrificed and the liver excised and weighed. Sectioning and slide preparation of the liver and histological examination of the liver were carried out using the light microscope. Thereafter, a photomicrograph of the slides were taken. The result shows that there was a significant increase (p<0.05) in the mean weight of the liver in the four groups of albino rats while the photomicrograph shows variations in the normal cyto-architecture of the liver in the various groups. These variations suggest that there is hepatocellular injury resulting from the extract fed the rats. The leaf extract therefore, is hepatotoxic at the doses fed the animals.  

Keywords: Hepatotoxicity, potential, *Ipomoea batata*, male, leaf extract, rats  

Introduction  

It is a known fact, from prehistoric times, that vegetables constitute the dietary requirements of most animals. Akindahunsi and Salawu (2005), maintain that vegetables serve as an indispensable constituent of the human diet supplying the body with minerals, vitamins and energy. However, there are some used and inexpensive leafy vegetables whose nutritive and anti-nutritive potentials are yet to be adequately studied and utilized. Among these leafy vegetables are the leaves of sweet potatoes. Beside the tuberous root, the young leaves of sweet potatoes serves as a vegetable source for man and animal. The leaves serve as fodder for cattle and other domestic ruminants (Oyenuga, 1998). Because of the fact that the leaves are more traditionally used as feed for domestic animals, it is considered as a poor man’s vegetable.
Imafidion (2000), reported that wistar rats fed for four weeks with the extract of *I. batatas*, *Telfairia occidentalis* and *Jatropha tanjorensis* had significant (P<0.05) decrease in plasma cholesterol and LOL-cholesterol levels.

HOL-cholesterol levels increased and were significant (p<0.05) in all test rats while plasma triglyceride level of rats differ significantly (P<0.05) when compared with that of control rats. Davidson *et al.*, (1985) reported that the presence of tannins in leaves is however known to inhibit the bioavailability of protein and minerals. In the same vein, the presence of oxalate and phytic acid in the leaf could be quite toxic to humans however, cooking properly before consumption significantly reduces the total oxalate of the leaves or vegetables (Akwoawo *et al.*, 2000). Hepatotoxicity (injurious effect on the liver cells) due to herbal remedies is being increasingly recognized.

Though *I. batatas* leaf contains some anti-nutritive substances like oxalates, tannins, phytic acid and cyanide, (Antia *et al.*, 2006). According to Jorge and Jorge (2005), hepatotoxicity associated with the ingestion of *Centella asiatica* was studied on human beings and confirmed as a potential etiology of hepatic injury associated with apoptosis and necrosis and, in some cases with development of autoantibodies. This herb was considered healthy with no association with toxic effects prior to the study. This present study is aimed at determining the hepatotoxic effect of *Ipomoea batatas* leaf extract on the weight of liver, liver tissues and cells of male wistar rats.

**Materials and Methods**

**Experimental site**

The experiment was carried out in the Animal House, Department of Genetics and Biotechnology, University of Calabar.

**Experimental animal**

Sixteen sexually matured male wistar rats of twelve weeks old weighing between 154-170g were used. They were collected from the animal house, Department of Zoology, University of Calabar. The rats were housed in cages under controlled temperature of 28±2°C.

They were fed with growers mash obtained from vital feeds limited, Calabar. The water and feed were provided *ad-libitum* to the animals. The animals were allowed to acclimatize for a period of seven days before treatment with the extract. Saw dust was used as bedding in the cages and was replaced with fresh one every two days.

**Extract preparation**

Fresh matured leaves of *I. batatas* were collected from University of Calabar farm. They were washed to remove debris and air dried for two days. The dried leaves were then pulverized into powder using electric blender (Model 4250 Braun Germany) and the powdered sample weighing 800g was stored in air tight container.

**Experimental procedure**

The sixteen male wistar rats were divided into four groups randomly distributed, each having four rats. The four groups consist of group 1 (0g/0.643kg) which served as control, group 2 (6g/0.648kg), group 3 (8g/0.666kg) and group 4 (10g/0.678kg). After the treatment regimen, the rats were placed in an anesthesia using chloroform. After one minute, the animals were sacrificed and the liver was neatly excised and then preserved in formalin solution contained in bottle labeled, control, GP2, GP3 and GP4 respectively for histological studies. The samples collected were taken to the histology lab, Department of Anatomy, University of Calabar, for histological analysis.

**Data collection and analysis**

After the experiment, data were collected on the weight of the excised liver after sacrifice; the histology of the liver was analysis using standard laboratory procedures.
Results

Weight of the liver

It was observed that the liver slightly increase in weight across the groups (Fig 1). This implies that the liver cells and tissues were affected due to the treatment doses administered to the rats.

![Graph showing weight of liver](image)

**Fig 1: Weight of the liver of rats treated with leaf extract of *Ipomoea batata***

Histology of the liver

The photomicrograph of the control (0g/0.643kg) shows the central vein lined by single layer of endothelium. The hepatocytes in plates radiating outwards from the central veins, each having distinct dark staining nuclei and well delineated borders. Sinusoids separating the hepatic plates and kupffer cells seen in some of them. Portal tract and triad are not seen. This result shows a normal liver histology. The photomicrograph in control (0g/0.643kg) also shows that central vein endothelium is partially denuded with multiple cellular debris within its lumen. Portal tracts are seen with portal traids whose hepatic vein component shows similar features as in the central vein, bile ducts are dilated. Branch of hepatic artery is normal.

Hepatocytes are hypertrophied. Sinusoids are dilated and contain many small dark staining cells. The cytoarchitecture is mildly distorted and no fibrotic non necrotic lesions are seen. This gives an impression of hepatocellular congestion, hypertrophy, kupffer cell, hyperplesia and billiary congestion. Bile duct is dilated and have much foreign cells surrounding it. Hepatocytes are hyperplastic (more numerous), there are more sinusoid and more kupffer cells. Liver cytoarchitecture is slightly distorted. This result also gives an impression of hepatocellular hyperplesia.
The photomicrograph in group 2 (6g/0.648kg) shows marked portal fibrosis, biliary congestion, hepatocellular hypertrophy with sinusoidal fibrosis and mild kupffer cells hyperplasia. Central vein is diminished in size and congested. This also gives an impression of hepatocellular hypertrophy with biliary fibrosis which may progress to liver cirrhosis.

The photomicrograph in group 2B shows dilated, congested central vein, hepatocellular hypertrophy and hyperplasia, mild sinusoidal fibrosis with proliferation of the kupffer cells. Liver cyto-architecture is mildly distorted. This result also gives an impression of hepatocellular hyperplasia and hypertrophy. The photomicrograph in group 3 (8g/0.666kg) shows dilated central vein, diffused infiltration of polymorphonuclear cells into the tissue, with total hepatocellular necrosis and loss of liver architecture. This result gives an impression of acute hepatitis with fulminant hepatic failure.

Plate 1: Photomicrograph of the liver cell in the control (0g/0.643kg)
Key: 1 central vein, 2 Hepatocytes, 3 Sinusoids.
Plate 2: Photomicrograph of the liver cell in group 2 (6g/0.648kg) showing acute hepatocellular congestion and hepatocellular hyperplasia

Key: 1 central vein, 2 hepatocytes, 3 sinusoids, 7 branch of bile duct, 8 branch of hepatic vein, 9 branch of hepatic artery
Plate 3: Photomicrograph of liver cells in group 3 (8g/0.666kg) showing hepatocellular hypertrophy and biliary fibrosis progressing to liver cirrhosis.

Key: Central vein, 2 Hepatocytes, 3 Sinusoids, 5 Kupffer cells, 7 Branch of bile duct, 10 fibrosis.

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Plate 4: Photomicrograph of liver cells in group 4 (10g/0.648kg) showing acute hepatitis with fulminant hepatic failure, and diffused hepatocellular necrosis with multiple polymorphonuclear cellular infiltrate

Key: 1 central vein, 2 hepatocytes, 3 sinusoids, 5 kupffer cells, 6 inflammatory cells.

Discussion

Hepatitis is associated with inflammation of the liver which encompasses swelling, congestion, stasis and infiltration of the liver tissues with polymorphonuclear leucocytes (Neutrophil). There is usually hepatomegaly presenting. This liver congestion and stasis accompanied by oedema (swelling) of the tissues accounts for the increase in size and weight of the liver as observed (Viney et al., 2005). There was gradual increase in the weight of the liver after sacrifice beginning from the group receiving the low dose.

This gradual increase is explained by the gradual hypertrophy in the low doses (6g/0.648kg), hypertrophy and hyperplesia in the intermediate dose (8g/0.66kg) group and crank hepatitis and associated liver necrosis noticed by weight in the high dosed group. The substance fed the animals may therefore be said to have deleterious effect on the liver, that is, hepatotoxic at the dose fed the animals in group 4 (10g/0.678kg).
However, the lethal dose and the therapeutic dose (effect dose) of the substance cannot be verified from the method alone.

The gradual introduction of the substance to the animals may in some way have a better effect since the liver cells would be given more time to cope with the treatment. According to Vinay et al., (2003), hyperpotrophy of the liver cells is due to increase in the cytoplasm of the cells which is accounted for by the induction of metabolizing enzymes. This induction could have been stimulated by the tannins present in the extract, which are alkaloids from the leaves fed the animals. According to Vinay et al. (2005), hyperplasia is accounted for by an increase in stimulus on the liver cells, forcing them to divide more to produce more cells to take care of the increased tannins or substances in the extract fed. There may also be direct stimulus in the nucleus to bring about increased cellular replication, which could account for hypertrophy. It is also said that the extract of the leaves contains vitamin A which may increase the activity of the cells synthetic machinery. Necrosis and death of the liver cells as seen in group 4 (10g/0.678kg) micrograph may have been due to increased hyperplastic and hypertrophic changes in the liver resulting to decrease in adequate perfusion caused by a greater injury due to higher dose of the substances fed the animals. Increased quantity of Vitamin A is toxic to the endothelial cells of the sinusoids and the bile duct epithelium.

It is also toxic to the hepatocytes themselves. This would account for the infiltration and inflammation that was noticed in this high dosed group leading to diffused liver cell necrosis (Vinay 2005). Therefore at dose (10g/0.678kg), the substance fed is deleterious to the liver or hepatoxic. According to Antia et al., (2006), the leaf extract of I. batatas contains an appreciable amount of proteins, minerals, fats, fibre, carbohydrate, calorific (energy) values and low levels of toxicants except for Oxalate whose values can be reduced by cooking and therefore could significantly contribute to the nutrient requirements of man and animals.

The dose given to animal in the low dosed group did not produce any deleterious effect thereby corroborating with the report of Antia et al. (2006). It can therefore be concluded that the leaf extract of I. batata is hepatotoxic at the different dose administered to the rats.

References


