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The effects of aqueous extract of *Mangifera indica* on protein, glucose concentration and enzyme activities of some rat tissues

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ABSTRACT: The effects of aqueous extract of the bark of *Mangifera indica*, a widely used antimalarial medicinal plant on enzyme activities of some rat tissues were studied. The enzymes assayed were alkaline phosphatase (ALP), alanine transaminase (ALT), and aspartate transaminase (AST), protein and glucose were also analyzed.

The results obtained showed that there was decrease in the activities of these enzyme in the liver and the heart when the aqueous extract was administered to the rats, this indicates tissue damage which was complimented with an increase in the activities of these enzymes in the blood due to leakage to the blood. This shows that prolonged usage of the aqueous extract of the bark of *Mangifera indica* may lead to cell destruction.

Key Words: Medicinal plants; Antimalarial drugs; Mango (*Mangifera indica*); Alkaline phosphatase; Alanine transaminase; Aspartate transaminase.

Introduction

Medicinal plants have enjoyed a great popularity in the treatment of various disease for many centuries. The discovery of these useful plants were as a result of man's and death, man's inquisitive and inventive nature as well as necessity to feed (Sofowora, 1982). These medicinal plants are the sources of many important scientific drugs of the modern World because they possess the broadest spectrum of synthetic activity. Quinine from cinchona bark, reserpine from rauwolfia root, digitoxin from digitalis leaf are of the innumerable modern scientific drugs that are prepared from the medicinal plants which has contributed to the health care management of mankind.

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Mangifera indica is known by various names in Nigeria. The Yoruba call it Mangoro, Hausa – mangwaro and Ibo – mangolo. It is one of the recognized trees that is very useful to people in towns and villages of Nigeria.

The plant is found in other parts of the world especially tropical regions such as India, Indo-China, Indonesia, Philistines, and other South East Asian countries.

Reports have shown that preparations from various parts of the tree of *Mangifera indica* such as bark, and leaves are used medicinally as a good remedy for malaria fever (Sofowora, 1982).

An infusion of the root-bark of the tree is used to treat diarrhea and dysentery. The leaves and bark are also used as a lotion and mouth-wash to relieve tooth ache and sore gums.

Despite the obvious benefit occurring from the use of *Mangifera indica*, it is essential ensure that it does not in itself constitute a hazard to human health, hence the need for the toxicological effects of this plant.

Materials and Methods

Plant Material

The bark of *Mangifera indica* was collected from a farm in Ado-Ekiti, Ekiti State, Nigeria and duly identified in the Department of Plant Science and Forestry, University of Ado-Ekiti, Nigeria.

Six hundred grams of dried bark of *Mangifera indica* were soaked overnight in 100mls of distilled water and filtered to give an extra (6g/ml) used in the tests.

Animal Grouping

Twenty white Albino rats (*Rathus novegecus*) were used altogether. The rats weighing between 19-22 were divided into four groups of five rats each. Rats in each group one served as control.

Administration of the Extract

The aqueous extract of the bark of *Mangifera indica* (6g/ml) was administered to the rats at a dose of 1ml each orally. Rats in group 2 were given only one dose, those in group 3 were administered three doses at 24 hours interval while those in group 4 were administered with 3 doses but were left for 1 and 4 days respectively. The animals were sacrificed immediately. The control group was placed on distilled water.

Collection of Tissue

Blood samples was collected from the rats and the tissues of interest (Liver and heart) were carefully removed, homogenized and stored frozen prior to analysis.

The method used to determine ALP is the one described by Armstrong (1954) while the spectrophotometric method of Kings (1960) was used to measure AST and ALT activities. Biuret method was used for protein assay as described by Tietz (1990). Results are means of 5 determinations.

Results and Discussion

Figures 1 and 2 show the variation in ALT, AST and ALP activities with days in liver. There was a reduction in the enzyme activities of the liver immediately after the first dose of the extract. Thereafter the heart recovered by the third day with small increase in ALP activity (Figure 2). However, the reduction of these enzyme activities when compared with control values (Table I) was noticed from the fourth day until the termination of the experiment on day seven.

Figure 3 is the variation of ALT, AST and ALP with days in the blood of rat following *Mangifera indica* administration. There was an increase in the activities of all the enzymes which lasted for the

duration of the administration. A reduction in enzymes activity was obtained after the termination of the administration of the extract.

The pattern of variation in protein concentration in the liver and heart are shown in Figure 4. There was a decrease in protein concentration after the administration of the extract of the bark of *Mangifera indica* but immediately after the termination of the extract, protein recovers towards the control value.

The decrease in these enzyme activities in the liver and heart could be due to destruction of the lysosomal membrane of the liver and heart by the aqueous extract of the bark of *Mangifera indica* which leads to a loss of these enzymes (ALT, AST and ALP) from these tissues to the extracellular environment, hence, the increased activities of these enzymes in the blood (Figure 3 and Table 2). The reduction of these enzymes might also be due to inhibition of the enzyme molecules by the extract. This was in agreement with the works of Iltner and Skillen (1982) which reported that enzyme activities lost from some tissues like liver and heart are found primarily in the blood. However, this was followed by a reduction in enzymes activities when the extract administration was terminated.

The decrease in the concentration of total protein in the liver (Table 3 and Figure 6) and blood (Table 4 and Figure 6) suggests liver damage, since the liver is responsible for the synthesis of plasma protein except the immunoglobulin (Tietz, 1990).

Glucose concentration was found to reduced in the liver (Figure 4), heart (Figure 5) and blood (Figure 3) after the administration of the aqueous extract of the bark of *Mangifera indica*. This suggests that the bark of *Mangifera indica* may be used in lowering blood sugar levels most especially in diabetics.

However, recovery of the enzymes activities from the fourth day may be due to a reduction in the effect of the extract arising from its metabolism.

In conclusion, the results obtained from this study reveal that enzyme activities decreases with increase dose of the aqueous extract of the bark of *Mangifera indica* in the tissues studied except in the blood where there was an increase. But when the administration of the drug was terminated, the activities of the enzymes gradually returned to normal in all the tissue. This implies that prolong usage and high dosage of the aqueous extract of the bark of *Mangifera indica* can pose a high risk of damage to organs like liver and heart as can be seen from the results obtained from this study due to cell destruction and loss of enzyme activities.

Table 1: Activities (μ /l) of the enzymes in the liver and heart of the rats after the administration of aqueous extract of the bark of *Mangifera indica*.

TISSUE	DAY	GROUP	ALT	AST	ALP
Liver	0	1	585.5	290.5	240.0
Heart	0	1	342.0	360.0	200.0
Liver	1	2	450.2	220.0	180.5
Heart	1	2	300.1	260.5	197.9
Liver	3	3	200.0	180.0	160.0
Heart	3	3	280.0	240.0	199.8
Liver	7	4	250.3	250.5	230.0
Heart	7	4	320.0	200.0	200.0

Table 2: Activities (μ /l) of the enzymes in the blood of the rats after the administration of aqueous extract of the bark of *Mangifera indica*.

DAY	GROUP	ALT	AST	ALP
0	1	400	300	300
1	2	475	375	360
3	3	560	430	400
7	4	430	350	320

Table 3: Concentrations (mmol/l) of the glucose and protein in the tissues of rats after administration of the aqueous extract of *Mangifera indica*.

TISSUE	DAY	GROUP	PROTEIN	GLUCOSE
Liver	0	1	80	28.5
Heart	0	1	60	17.1
Liver	1	2	45	25.0
Heart	1	2	30	16.9
Liver	3	3	27.9	24.5
Heart	3	3	28	17.1
Liver	7	4	48	24.9
Heart	7	4	33	17.1

Table 4: Concentration (mmol/l) of the protein and glucose in the blood of the rats after the administration of aqueous extract of *Mangifera indica*.

DAY	PROTEIN	GLUCOSE
0	120	24.9
1	60	22.9
3	40	20.5
7	90	23.5

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