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Toxicity of Acacia Nilotica (Garad) to Nubian Goats

Medani AB*, Samia MAE[2], Ahmed EA[2]

[1]1Department of Pharmacology & Toxicology, Nile College, Sudan

[2]Department of Pharmacology & Toxicology, University of Khartoum, Sudan

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***Corresponding author**: Medani AB, Assistant Professor of Pharmacology & Toxicology, Nile College, Khartoum, Sudan, Tel: +249912369706; Email: amna_medani@ yahoo.com

Abstract

Variable plants present in nature are used by simple rural and urban people, researchers and drug manufacturers for medicinal purposes. Garad is one of the most commonly used in Sudan for both treatment and prophylaxis of infections in the respiratory and urinogenital tracts and the skin. Water extracts from *Acacia Nilotica* bods were used in this very experiment to test for their toxicity to Nubian goats at two dose rates under proper experimental conditions. The clinical, pathological, hematological and biological changes in Nubian goats given daily oral doses of 1 and 5 g/kg body weight of *Acacia Nilotica* to two groups of goats. The goats of the control group were not dosed with *Acacia Nilotica*. Other than the dose co-related mortality rates, the clinical signs were observed to be salivation, staggered gait, intermittent loss of voice and low appetite. On histopathological testing, the main lesions were hepatic centrolobular necrosis and fatty changes associated with the significant changes in GGT and ALP were indicating hepatic dysfunction .Renal malfunction is indicated by hemorrhages in addition to the change in urea concentration. The congested, hemorrhagic, emphysematous, edematous and cyanotic lungs may contribute to the development of dyspnea. *Acacia Nilotica* poisoning may lead to an immuno suppression pointed out by the lymphocyte infiltration. On evaluation of the above results *Acacia Nilotica* was considered toxic to Nubian goats at the above mentioned doses. Future work for *Acacia Nilotica* was forwarded and practical implications of the result were highlighted.

Keywords: *Acacia Nilotica*; Toxicity Data; Nubian Goats; Garad

Abbreviations: RBC: Red Blood Cells; GGT: Gamma Glutamyl Transferase; AST: Aspartate Amino Transferase; ALP: Alkaline Phosphatase

Introduction

Acacia Nilotica (Mimosaceae) is a tree found in the central and Northern parts of the Sudan and in Egypt. It is known in Sudanese folk medicine by the common name 'Garad' (Figure 1). Some 160 Acacia species are natives of Africa and the Near East. They are reported to be utilized for fuel, timber, forage, gum, tannins, fiber, medicine, food, handicrafts, domestic utensils, environmental protection, soil fertility, shade and shelter, game refuge, amenity and ornamental plantings, and agro-forestry [1]. Tannin extracts of *Acacia Nilotica* exhibited algicidal properties and molluscidal activity against the fresh water snails Bulinus truncatus and Biomphalaria pfeifferi which transmit schistosomiasis in Sudan [2-4]. The gum, stem bark, leaves and fruits of *Acacia Nilotica* have been used medicinally for colds, bronchitis, pneumonia, ophthalmic, diarrhea and hemorrhage [5]. The fruit juice and the stem bark are used as a haemostatic agent [6]. The fruit and the stem bark are regarded as tonics and astringents and are used internally to treat diarrhea and dysentery [7]. A decoction of the fruits, which is considered to be a febrifuge, is used internally as a remedy for sore throat, chest complaints, dysentery and leprosy. The water extract is used externally to treat syphilitic lesions and other venereal diseases [8-11]. In the Sudanese traditional medicine an infusion of about 5 g of the fruits of *Acacia Nilotica* in 200 ml cold water overnight is used to treat sore throat and common cold. In a report on the antibacterial effect of *Acacia Nitotica* fruit extracts by Abd M, et al. [12], 25.6 g were suspended in 250 ml water at different but constant temperatures. The filtrate was found active against some bacteria and fungi. On a study involved the evaluation of anti-inflammatory activity of *Acacia Nilotica* pods in different experimental models of inflammation, it was suggested that the mechanism of action of the methanolic extract of *Acacia Nilotica* may be related to inhibition of prostaglandin synthesis. The methanolic extract of *Acacia Nilotica* pods was found to possess a significant anti-inflammatory activity. The tannin fraction of the methanolic extract was found to be more potent than the methanol extract alone. This was supported by the literature that indicates that the major categories of compounds that modulate the inflammatory pathways are polyphenolics [6]. Aqueous

extracts of *Acacia Nilotica* pods from a commercial source were tested for its anti-inflammatory, analgesic and antipyretic properties in rat and mice models ,it inhibited the development of carrageenan induced paw edema and yeast-induced pyrexia in rats [13]. The decoction of the stem bark and root has been claimed to have an intoxicating effect as a nerve stimulant [14]. It was used traditionally for the treatment of sore throat, colds, pneumonia, ophthalmic, dysentery, leprosy ,venereal diseases and hemorrhages due to its tonic ,astringent and stimulant properties .The aqueous extract of fruits showed activity against *Candida albicans*, gram positive and gram negative bacteria [12].

Figure 1: *Acacia Nilotica* fruit.

Material and Methods

Animals

Nine 5-7 month old male Nubian goats' kids were purchased from a local livestock market in the vicinity of Omdurman and housed in pens within the premises of the Veterinary Teaching Hospital, University of Khartoum. Animals were clinically adapted to proper health conditions for a period of two weeks.

Administration of the plant fruits

At the end of the adaptation period, the animals were weighed and allotted into three groups each of three. (Group 1) were the un-dosed control group. Acacia pods were ground and given by drench at 1 g/kg/day to (Group 2) goats and at 5 g/kg/ day to (Group 3) goats.

Parameters

Clinical signs and mortality rates were recorded. Blood samples were obtained from the jugular vein before the start of the experiment and thereafter at a week interval for hematological investigations (Hb count, packed cell volume PCV, RBC ,mean corpuscular volume MCHC) and serum analysis (for activity of gamma glutamyl transferase (GGT), Aspartate amino transferase (AST), Alkaline phosphatase (ALP) and concentration of creatinine ,urea, total protein albumin, calcium and phosphorus) .

Statistical Methods

The difference between mean values of data was analyzed by the un-paired students- t-test [15].

Results

The experimental plan, doses and times of death are given in Table 1.

Table 1: Schedule of Dosing and Times of Death of Nubian Goats Dosed orally with *Acacia Nilotica*.

Group No.	Animal No..	Age (month)	Dose (g/kg/day)	No. of Death/day
Group 1	1	7	-	35(slaughtered)
	2	6	-	3
	3	8	-	35
Group 2	4	6	1	15
	5	7	1	5
	6	6	1	4
Group 3	7	9	5	8
	8	8	5	
	9	8	5	

Clinical signs

In goats of group (2) receiving oral doses of 1 g/kg/day of *Acacia Nilotica*, the clinical signs observed included salivation, intermittent loss of voice and in coordination in movement .One goat form this group died after 3 days of dosing ,another died on day 15 and the last goat in this group died on day 35.Goats of group (3) which received oral doses of 5 g/kg/day of *Acacia Nilotica* pods, the prominent signs observed from day one of dosing was the thick saliva (Figure 2), loss of voice, staggered movement, recumbence (Figure 3), loss of appetite and all goats of this group died between day 4 and day 8 of the experiment. The un-dosed control goats showed no abnormality.

Figure 2: Thick saliva of a goat given Acacia Nilotica fruit extract at a dose rate of 5 g/kg/ day.

Figure 3: Recumbence of a goat given Acacia Nilotica fruit aqueous extract at a dose rate of 5 g/kg/ day.

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Post-mortuum findings

The principal lesions in goats of group (2) that received oral doses of 1g/kg/day of *Acacia Nilotica* were congested lung and kidney, fatty liver and congested intestine. In goats of group (3) which received the fruit extract at a dose of 5g/kg/day, the lesions were almost the same, but more severe.

Histopathological signs

On microscopy, in goats of both dosed-groups were fatty vacuolations of the hepatocytes with generalized necrosis (Figure 4) congested pulmonary blood vessels, necrotic renal convoluted tubules, congested cardiac blood vessels and catarrhal enteritis. The control goats in group (1) showed normal histopathological picture (Table 2A, 2B).

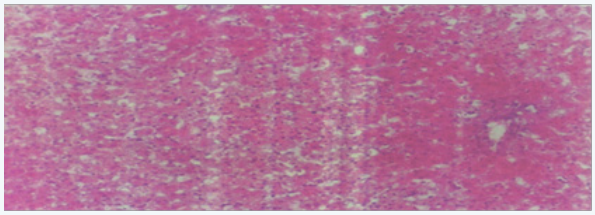

Figure 4: Fatty vacuolation of hepatocytes a goat given 5 g/kg/day of Acacia Nilotica fruit extract.

Table 2A: Changes in Serum Constituents in Goats Treated with *Acacia Nilotica*

Group/parameter	Phosphorus Mg/dl	Calcium Mg/dl	AL P (IU)	GOT (IU)	GGT (IU)
Control	0.92±0.112	7.2±0.49	218±11.54	16.3±2.79	1.47±0.29
$Group_1$ 1g/kg/day	1.53±0.141 N.S	8.83±0.79 N.S	316. 3 ±15.92 S	13±1.073 S	4.19±0.4 S
$Group_2$ 5g/kg/day	1.417±0.217N.S	9.0±0.58N.S	279.3±29.4N.S	5.8±0.12N.S	6.1±1.06N.S

Table2B: Haematological Changes in Goats Treated with *Acacia Nilotica.*

Group/parameter	Creatinine mg/dl	Urea mg/dl	Albumin g/dl	Total protein g/dl
Control	0.26±0.065	25.56±2.179	3.77±0.11	6.81±0.33
$Group_1$ 1g/kg/day	0.86±0.07 H.S	53.13±4.167 S	3.04±0.124 N.S	7.33±0.645 N.S
$Group_2$ 5g/kg/day	0.29±0.64 N.S	614±2.37 N.S	3.68±1.73 N.S	8.3±0.4 N.S

According to Table 2A, 2B, goats of group (2) dosed with the extract of Acacia Nilotica fruit at 1g/kg/day, the concentration of creatinine and the activity of alkaline phosphatase (ALP) were higher (P<0.05-0.01) than the control group. Urea concentration and gamma Glutamyl transferase (GGT) activity were found to show significant increase (P<0.05-0.01) in goats of group (2) dosed with the extract of *Acacia Nilotica* fruit at 1g/kg/day and those of group (3) dosed with *Acacia Nilotica* extract at 5g/kg/day in comparison with the values of the same parameters showed by the normal un-dosed control group. There were no changes in the concentrations of phosphorus, albumin and calcium nor in the activity of aspartate amino-transferase (AST) in under-tested goats of both groups compared versus the control group.

Haematological changes

These are given in Table 3, goats dosed orally with *Acacia Nilotica* at 1g/kg/day or 5 g/kg/day showed no changes in mean corpuscular volume (MCV), packed cell volume (PCV) and mean corpuscular hemoglobin concentration (MCHC) values. The hemoglobin concentration (Hb) and the red blood cells (RBC) counts were lower (P<0.05-0.01) than those normal values manifested by the un-dosed control group.

Table 3: Haematological Changes in Goats Treated with Acacia Nilotica

Group/parameter	Hb g/dl	MCVm^3	PCV%	RBCsX 106 mm^3	MCHC%
Control	8.99±0.29	39.93±0.73	30.4±0.76	8.85±0.11	31.51±1.11
$Group_1$ 1g/kg	7.42±0.14 S	38.27±1.63 N.S	26 ±1.53 N.S	5.697±0.27 S	26.27±0.88 N.S
$Group_2$ 5g/kg	7.29±0.02 S	40.67±3.2 N.S	28±0.58 N.S	3.45±0.37 S	27.5±1.038 N.S

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Discussion

Oral daily dosing with 1 g/kg/day of *Acacia Nilotica* showed low appetite, excessive salivation which may be due to the bitter taste of the fruit extract, intermittent loss of voice as a result of the effect of tannin and staggered gait and ataxia as an initial sign of cerebral palsy in form of polymyositis including muscle weakness and joint pain clarified in obvious clinical signs induced by *Acacia Nilotica* as a neurotoxin due to its high carbon and sulphur content [16]. Although *Acacia Nilotica* was claimed by Kannan, et al. [17] to have a protective effect against acetaminophen induced hepato cellular damage in wester rats, oral daily dosing with 5 g/kg/day of *Acacia Nilotica* caused a centrilobular necrosis accompanied by fatty change in the liver as suggestive indication of hepatic dysfunction which is also shown by the change in the activity of GGT and ALP [18]. This may target the liver as a biotransformation and detoxification engine for *Acacia Nilotica* [19]. On the other hand this may target *Acacia Nilotica* as an antioxidant drug against free radicals associated with cancer treatment in a future research recommendation [20]. The hemorrhagic kidney in addition to the change in urea concentration are functional biomarkers for renal dysfunction [21,22]. Marked pulmonary lesions were found in the under-test goats manifested by congestion, hemorrhages, emphysema, cyanosis and sometimes edema which are all biomarkers for pulmonary dyspnea [23]. The obvious lymphocyte infiltration is pointing out to the development of a cardiopulmonary complication induced by the under test herb [24] immuno suppression [25]. The high mortality rate may be explained as an ischemic sequel of dosing with *Acacia Nilotica* to tested goats [26].

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