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Histological Effects of Aqueous Extract of Cinnamon on the Kidney Functions of Adult Wistar Rats

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Abstract

Cinnamomum cassia (*Cinnamon*) is a traditional folk herb with anti-oxidant and anti-diabetic properties. The aim of this study was to elucidate the effect of aqueous extract of Cinnamon used as folk medicinal supplement on the kidney of Wistar albino rat. Twenty-four adult Wistar albino rats of both sexes were used for this study. They were assigned into two extract treated groups II, III, and were administered with 200 mg/kg and 300 mg/kg body weight of the extract respectively; and one control group I, administered with equal volume of distilled water. Administration was done orally (once daily) using an

orogastric tube for 21 days. At the 22nd day, all the animals were sacrificed and laparotomy was performed, the kidney was excised for histological procedures. The kidney was fixed in Bouin's fluid. In the kidneys, there were neither tubular necroses nor interstitial and glomerular congestions. Both the distal and proximal convoluted tubules were free of dilation. The glomeruli were also devoid of distortion and degenerative changes. The extract significantly reduced ($P < 0.05$) serum albumin and serum creatinine while it significantly increased ($P < 0.05$) blood urea. These findings suggest that the administration of Cinnamon has no deleterious implications on the histological profile of the kidney of Wistar rats.

Keywords: Cinnamon, Deleterious, Degenerative, Histology, Laparotomy,

Introduction

Cinnamon is a plant with scientific name "cinnamomum zelanicum" and general name "cinnamon". This evergreen shrub belongs to the Lauraceae family endemic to Sri Lanka and Southeast regions of India (Mirheidar, 2004). Although cinnamon with its peppery taste is mostly used as spices for cooking in the kitchen, its therapeutic applications should not be ignored. This plant is one of the oldest medicinal herbs which have been used in traditional medicine as an important drug. Different parts of this plant including its bark have many therapeutic effects such as strengthening of the heart, stomach, intestines, improvement of kidney function, and increase in libido (Shah et al., 1998). Cinnamon is used against important body pathogens including *Escherichia coli*, *Helicobacter pylori*, and *Candida albicans* due to its anti-fungal and anti-bacterial properties (Nir Y and Potasman et al., 2000). Consumption of this spice inhibits the oxidation of organic matter in body and reduces free radicals due to its potent antioxidant effect (Calnan, 1976).

Studies have shown that cinnamon extract is effective in healing wounds made on Wistar rats (Kamath et al., 2003). Other therapeutic effects of this plant like treatment of nausea, diarrhea, and enhancement of cognitive power have been reported (Skidmore, 2002; Adame, 2000). Moreover, researchers have shown that aqueous cinnamon extract inhibits the proliferation of acute lymphoid leukemia cell line (Schoene et al., 2005).

Plants contain numerous constituents; some tend to possess some level of toxicity. Cases

of this toxicity in plants have been reported (Santos et al., 1995; Shaw et al., 1997; Kaplowitz, 1997). The phytochemical analysis of the Cinnamon aqueous extract confirmed the presence of cinnamaldehyde, eugenol, and safrole with insulin-like activity that can be effective in diabetic treatment (Singh et al., 2007; Anderson and Broadhurst et al., 2004). Furthermore, these compounds have positive effect on reduction of triglyceride, cholesterol, and lipoprotein with blood low density (Khan and Safdar et al., 2003).

The histological effects of Cinnamon on the kidneys have not been widely elucidated, as very few literature reports have been documented. The traditional uses of Cinnamon for treatment of diseases have been validated by clinical research, where Cinnamon aqueous extract was found to exhibit a potent effect on Type II diabetes as well as lowering triglycerides levels and serum cholesterol (Onderoglu et al., 1999; Broadhurst et al., 2000; Khan et al., 2003). This may explain why it has long been used in traditional medicine to ameliorate the effects of diabetes mellitus.

Materials and Methods

Plant Material and Preparation of Extract

The bark of cinnamomi cassia was purchased from the vegetable market at Aideyan road, G.R.A, Benin City, Nigeria. The plant was identified and authenticated by Sunny Nweke of the Herbarium unit, Department of Botany, University of Benin, Benin City, Nigeria. The quills of cinnamon were allowed to dry under shade and grinded into powder form in a milling machine used in grinding plant samples. 1.428kg of the powdered material was packed into soxhlet apparatus and extracted using 1.6liter of distilled water. The extract obtained was concentrated using evaporation dish to yield 1.02kg crude aqueous extract referred to as aqueous extract of cinnamon (AEC).

Experimental Animal

Twenty-four adult Wistar rats of both sexes with average weight of 275g were purchased, and maintained in standard animal cages from the animal house section of the Department of Anatomy, University of Benin, Benin City, Nigeria. The rats were left to acclimatize to laboratory conditions for two weeks and subsequently employed to testing for three weeks, during which they were fed with commercially formulated rat feed and water was given ad libitum. The animals were exposed to natural room temperature and lighting conditions,

and handled according to standard protocols for the use of laboratory animals (National Institute of Health Guide for the Care and Use of Laboratory Animals -NIH, 1978).

Experimental Design

The rats were randomly selected and distributed evenly into three groups: I, II and III of (n=8) in each group. Groups II and III served as treatment groups while group I served as the control. The rats in the treatment groups (II & III) received 200mg/kg body weight and 300mg/kg body weight respectively of aqueous extract of Cinnamon orally through an orogastric tube on a daily basis. The control group received an equal volume of distilled water only for twenty-one days. During this period, they were weighed before and after administration of the extract for each week.

Biochemical Analysis

After administration on the 22nd day, three rats from each group were sacrificed by subjecting them to light anesthesia (with the use of chloroform) in a urethane saturated chamber. Blood samples were collected via cardiac puncture method and the serum was rapidly separated and processed for determination of serum creatinine, and serum urea using commercially available kits of Span Diagnostics Ltd, Hyderabad, India (Shirwaikar et al., 2004). Serum albumin concentration was estimated using the albumin-bromocresol green reactions describe by Grant and Kachmar (1987). Both kidneys were isolated from each rat and processed for histopathological examination (Erdem and Gondosan et al., 2000). The kidneys were sectioned longitudinally in two halves and were kept in 10% neutral formalin solution (Ogeturk et al., 2005). Both kidneys were processed and embedded in paraffin wax and sections were taken using a microtome. The sections were stained with hematoxylin and eosin and were observed under a computerized light microscope.

Statistical Analysis

Data were evaluated with SPSS/10 software hypothesis testing methods that included one way analysis of variance (ANOVA) followed by least significant difference (LSD) test. *P* values of less than 0.05 were considered to show statistical significance. All these results were expressed as mean \pm SEM for eight animals in each group.

Results and Discussion

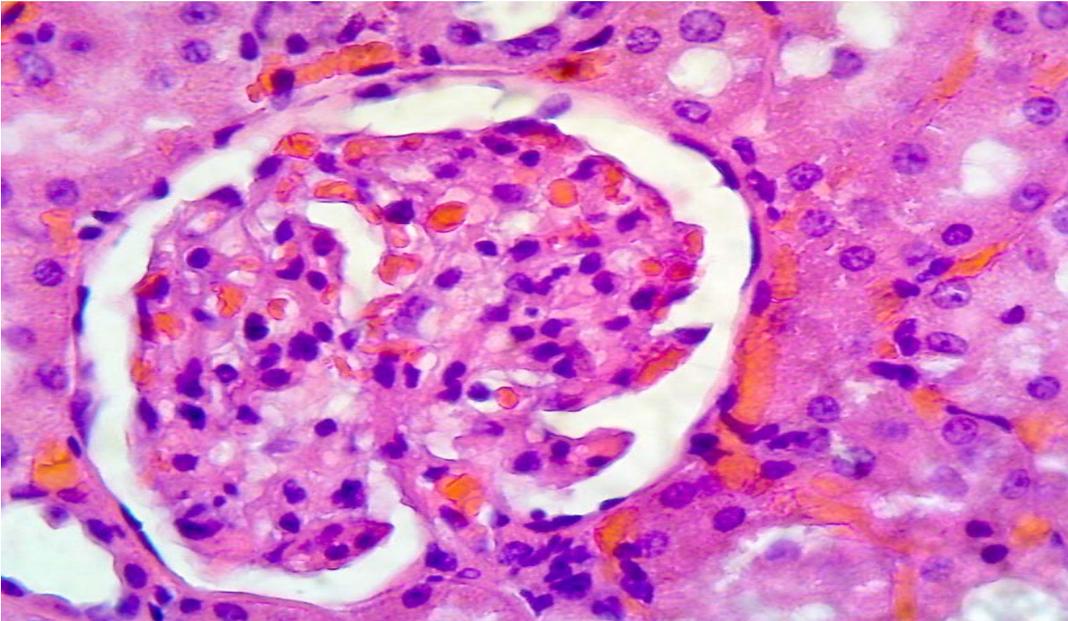


Figure 1: Control section of kidney showing cortical parenchyma with dense rounded structures, the glomeruli, surrounded by narrow Bowman's capsular spaces. H&E (X400)

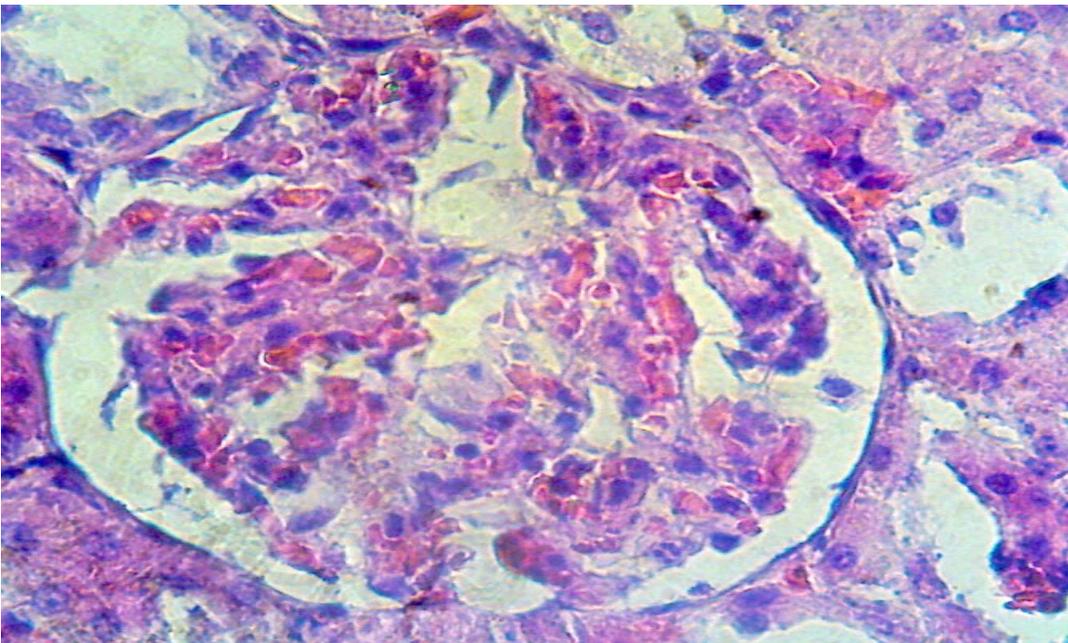


Figure 2: Photomicrograph kidney section from group III showing clusters of glomeruli with special distribution of capillaries in the glomerulus thus giving the malpighian corpuscle a complete circular appearance. H&E (X400)

Table 1: Changes in body weight (g) in Control, and Experimental groups of aqueous extract of Cinnamon

GROUPS	I	II	III
Initial body wt. (g)	256.40	235.40	244.00
Final body wt. (g)	280.20	263.80	276.40
Change in body wt. (g)	+23.8	+28.4	+32.4
Values in mean (±SD)	267.47±6.70	254.96±4.49	265.75±2.10

Values are expressed mean ±S.E.M, n=8

** P<0.05 as compared to treatment group rats*

Table 2: Effects of 200mg/kg & 300mg/kg body weight of Aqueous Extract of Cinnamon on Blood Urea, Serum Creatinine, and Serum Albumine

Groups	Blood Urea (mg.dl)	Serum creatinine (mg/dl)	Serum Albumine (mg/dl)
Group I (200mg/kg)	23.400	0.7525	2.100
Group II (300mg/kg)	25.000	0.7480	2.040
Group III (Control)	22.875	0.8550	2.260

Effects on Body Weight of Rats

Table 2 shows the effect of aqueous extract of Cinnamon on the weekly body weight of the control and experimental groups; there was a statistically significant increase in the body weight of animals in the control group (group I) by 23.8g after 3 weeks. In contrast, the Cinnamon-treated group (groups II & III) showed a statistically significant increase in weight by 28.4g and 32.4g respectively after 3 weeks, thus dose dependence.

Histological Observations of the Kidney

The histological preparations of kidney from the aqueous extract of Cinnamon treated and control rats showed that the various histological segments of kidney tubules were well preserved; no clinical signs of toxicity were observed in any of the groups during the course of the experiment and there were no significant changes when compared with the control. Abundant glomeruli, nephrons with interspersed blood capillaries were also clearly seen. Various regions of kidney tubules appeared normal without any alteration in

mesangial thickening or hyaline deposition. The renal parenchyma showed no evidence of distortion of any kind. The cyto-architecture of the rats in the control group was also well preserved (Figure 1), although the glomerulus in group III appeared hypertrophied (Figure 2)

Effects of Aqueous Extract of Cinnamon on Concentrations of some Serum Biomolecules in Rats

Effects of administration of the extract on serum urea, creatinine and albumine concentrations are shown in Table 2. The extract significantly increases serum urea concentration in a dose dependent profile, while it significantly reduces serum albumin concentration at both treatment doses when compared to control; a little or no change in serum creatinine though.

Serum urea and creatinine concentrations are used for the assessment of renal sufficiency. Higher than normal levels of serum urea and creatinine are indications of deficiency in renal function (Whelton et al., 2002). Thus, the increase in serum urea concentration without concomitant increase in serum creatinine concentrations suggests that the extract may impair renal function (Malomo and Arise et al., 2006). Therefore the increase in serum urea concentrations with concomitant increase in serum creatinine concentrations in this study suggests the beneficial effects of aqueous extract of cinnamon on the kidney.

In other words, destruction of glomeruli causes significant decrease in the glomerular filtration rate (GFR) and increases the blood urea and creatinine and this end up with chronic renal failure (Ramakrishnan et al., 1995); Since the urea and creatinine are markers of kidney function (Oudoula et al., 2007), hence all these biochemical changes as seen in this studies demonstrated that aqueous extract of cinnamon exhibited antioxidant bioactivity in intact cells.

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