



## THE EFFECT OF "GADAGI" TEA ON LIVER FUNCTION AND SERUM GLUCOSE CONCENTRATION IN ALBINO RATS

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### ABSTRACT

**Effect of oral administration of "Gadagi" tea on liver function and serum glucose concentration was assessed on thirty (30) healthy non – pregnant female albino rats. The animals were grouped and administered different doses (mg/kg) i.e. (low dose; 0.75mg/kg for "Sak," 1.40mg/kg for "Sada" and 2.10mg/kg for "magani." Standard dose; 1.50mg/kg for "Sak," 2.80mg/kg for "Sada" and 4.20mg/kg for "magani." High dose; 3.00mg/kg for "Sak," 5.60mg/kg for "Sada" and 8.30mg/kg for "magani") for a period of one week. Animals that were not administered the tea constituted the control group. At the end of one week, the animals were sacrificed and their serum alanine transaminase (ALT), aspartate transaminase (AST), alkaline phosphatase (ALP), bilirubin (total and direct) and glucose levels were determined. Mean serum glucose level of the control animals was significantly higher ( $p < 0.05$ ) than that of the experimental animals. Mean serum ALT, AST and ALP activities and serum bilirubin levels (total and direct) were found to be higher in the experimental animals, than in control group suggesting liver function impairment. Chronic and acute hepatitis were observed from histopathology test in 65% of the experimental animals. Thus, it can be concluded that all the "Gadagi" tea preparations studied are hepatotoxic particularly at standard and high doses.**

**Keywords:** "Gadagi" tea, Liver function, Toxicity, Serum glucose

### INTRODUCTION

"Gadagi" tea is a new comer to the Nigeria's world of beverages. It is still a new entrant as a stimulant. Its preparation is not radically different from the way normal tea is prepared. It is a mixture of sugar and tea of highland brand boiled in water with some plants such as African mahogany (*Khaya senegalensis*) lemon grass (*Cymbopogon citratus*) and mint plant (*Mentha palustris*). It is consumed as a hot beverage mostly by drivers and commercial motorcyclists in Northern Nigeria and more particularly in kano state. Other silent users are tailors and labourers involved in strenuous physical jobs. Those who use it believe that, it can increase their power of endurance, and their ability forego food and sleep. It is also believed to be a source of energy probably due to its enriched sugar content. There are three major types of "Gadagi" tea, viz: "Gadagi" tea (I) "Sak", which is a mixture of sugar, tea and mint plant (*Mentha palustris*) boiled together in water. Gadagi" Tea (II) - "Sada" is a mixture of sugar, tea, lemon grass (*Cymbopogon citratus*), Negro pepper (*Xylopiya aethiopicum*) and ginger (*Zingiber officinale*) boiled together in water. "Gadagi" Tea (III) - "Magani", which is a mixture of sugar, tea, African Mahogany (*Khaya senegalensis*), *Fagara zanthoxyloides*, *Thonningi sanguinea* and garlic (*Allium sativum*) boiled together in water. Some of the users add some drugs such as Alabukun (acetylsalicylic acid), marijuana and buta (butazoladene) to enrich the "Gadagi" tea.

Its negative effect to the society is most seen in road users, many of whom get involved in accidents often attributed rightly or wrongly to the use of "Gadagi" tea. Serious harm to the liver caused by drugs or by combination of drugs and other substances is an important public health problem (<http://www.fda.gov/cdev/livertox/default2001.htm>). Therefore this research work is aimed at finding the acute hepatotoxic effect of "Gadagi" tea public health implications.

### MATERIALS AND METHODS

#### Experimental Animals

Thirty(30) non pregnant female albino rats (130 – 230g) selected at random from the Department of Biological Sciences, Bayero University, Kano, were used in this study. Twenty seven (27) of the rats were divided into three (3) equal groups (each consisting of nine (9) rats. Rats in Group I were orally administered with "Sak", group II with "Sada" and group III with "Magani". The remaining three rats were used to serve as control. Each of the three (3) groups were further divided into 3 equal sub experimental groups i.e low dose group, (3 animals), standard dose group and high dose group(3 animals). The different doses of the tea were administered orally once daily using a disposable syringe. All the rats were allowed free access to food and water during the course of the experiment.

Volume of the three common types of "Gadagi" tea administered as the standard dose was determined based on the average weight of the rats in each of the three groups in relation to 70kg man that normally consumes 500cm<sup>3</sup> of the tea daily using the following relation.

$$\text{Volume (cm}^3\text{)} = \frac{500\text{cm}^3 \times \text{Average weight of the rat (Kg)}}{70\text{Kg}}$$

$$\text{Volume of low dose (cm}^3\text{)} = \frac{\text{Volume of standard dose}}{2}$$

$$\text{Volume of high dose (cm}^3\text{)} = \text{Volume of standard dose} \times 2$$

Dosage of each of the three types of "Gadagi" tea administered in mg/kg body weight was determined based on the average weight of the rats in each of the 3 groups in relation to the quantity of the tea (500cm<sup>3</sup>) normally consumed by a 70kg man daily using the following relation.

$$Q_1 = \frac{V \times W}{500}$$

$$Q_2 = \frac{Q_1 \times 1000}{\text{Average weight of rats}}$$

Where: V<sub>1</sub> = Volume of the tea to be administered

W<sub>1</sub> = Weight of dried residue of the tea (100mg for "Sak", 150mg for "Sada" and 200mg for "Magani")

Q<sub>1</sub> = Quantity of the ingredients in the volume of the administered.

Q<sub>2</sub> = Concentration (mg/kg) of each type of the tea administered

After one week of "Gadagi" tea administration, all the 30 rats (in the three different groups and those in the control group) were sacrificed by decapitation and their blood samples were collected separately into clean test tubes, and centrifuged at 1000 revolution per minute for ten minutes. Serum was obtained and used for the biochemical analysis.

#### **Preparation of "Gadagi" tea**

##### **1. "Gadagi" tea (I) - "Sak":**

This is a mixture of sugar (76g), highland tea (5.69g) and mint plant (0.3g) (*Mentha palustris*) boiled together in water (1 litre).

##### **2. "Gadagi" Tea (II) - "Sada":**

This is a mixture of sugar (114g), highland tea (5.60g), lemon grass (0.30g) (*Cymbopogon citratus*), negro pepper (0.34g) (*Xylopi aethiopica*) and ginger(4.40g) (*Zingiber officinale*) boiled together in water (1 litre).

##### **3. "Gadagi" Tea (III) - "Magani":**

This is a mixture of sugar, tea, African Mahogany (*Khaya senegalense*), leaves of river red gum (2.50g), *Thonningi sanguinea* (0.89) and garlic (1.00g) (*Allium sativum*) leaves of *Citrus aurantifolia* (3.50g) boiled together in water(1litre).

#### **Analyses of Biochemical Parameters**

Serum aspartate transaminase and serum alanine transaminase activities were estimated using the method of Reitman and Frankel (1957). Serum alkaline phosphatase activity was determined using King and Armstrong (1964) method, serum glucose was estimated as outlined by Trinder (1969). Serum total and direct bilirubin was determined by kingsley et al (1953).

#### **Statistical Analysis**

Values obtained were analysed statistically using students "t"-test.

#### **RESULTS AND DISCUSSION**

Form the results of this study, mean serum activities of ALT, AST and ALP in the experimental rats was found to increase as the dose was increased (Table 1). Also, mean serum level of bilirubin (total and direct)

and glucose increased in a dose dependent manner. However, mean serum glucose levels of the control albino rats was found to be significantly (p<0.05) higher than that of the experimental rats (Table 2).

ALT, AST and ALP activities were observed to be higher in experimental animals than in controls. A primary purpose of non clinical studies is to discover target organ toxicity. Liver is the major target organ in repeated dose non – clinical trials. Hepatic changes are identified by comparison of data in animals given drugs to that in appropriate controls and from understanding the utility of group and individual mean (FDA, 2000).

Increase in the mean serum enzyme activities and in the level of bilirubin (both of which serves as biochemical markers for the assessment of liver function) indicate possible hepatotoxicity of the "Sak", "Sada" and "Magani" forms of "Gadagi" tea. The increase in the serum levels of these biochemical markers for the assessment of liver function (Tables 1 and 2) was found to be higher for the "magani", followed by "Sada" and lastly "Sak". Based on this observation, "magani" could be considered as more hepatotoxic followed by "Sak" than "Sada". Increase of these enzymes is expected in acute liver damage. They are useful in assessing liver cytolysis (Wada and Snell, 1962).

Serum blood glucose level was found to be higher in control animals than in experimental animals. This is likely due to reduced food intake by the experimental animals (observed) and reduced liver function owing to its impaired ability to carryout glycogenolysis and gluconeogenesis. Reduced food intake is common among "Gadagi" tea users as attested by those who take it (oral communication). This could probably lead to hypoglycemic condition as found in the experimental animals studied (Tables 1, 2 and 3). Hyperactivity (listlessness) was initially observed in the experimental animals, but toward the end of the experiment hypoactivity and loss of body weight were observed.

The results of hitopathological study showed that "Gadagi" tea is hepatotoxic to the experimental animals studied (Table 4).

Although, literature reports indicate that most of the plants used in preparing "Gadagi" tea have medicinal uses such as antioxidative and hepato protective actions of *Thonningi sanguinea* (Butterworth and Moss, 1998), prevention of blood clotting and cholesterol lowering property of ginger

and garlic (Mary Medical Center Programmes, 2002), the result of this work appears to be contradictory. This contradiction can be attributed to the fact that, at each plant level the anti-hepatic property can be manifested, but their combined effects in "Gadagi" tea may lead to hepatotoxicity. The quantity of the plants used in preparation of the tea could also cause hepatotoxicity.

**Table 1: Serum activities of ALT, AST, ALP and bilirubin level in albino rats after seven days of oral administration with low dose, standard dose and high dose of "Sak."**

Dosage (mg/kg)	ALT (U/l)	AST (U/l)	ALP (U/l)	T.B (mg/dl)	D.B (mg/dl)	Glucose (mmol/l)
<b>"SAK"</b>						
Low dose (0.75) n = 3	50.3±2.89	29.7±2.31	267±16.17 <sup>g,h</sup>	0.65±0.110	0.093±0.081 <sup>c</sup>	4.53±0.115 (1)
Standard dose (1.50) n = 3	51.3±1.15 (2)	32.7±2.89	304±0.00 (2) <sup>g,i</sup>	0.69±0.064	0.190±0.087	4.60±0.200 (2)
High dose (3.00) n = 3	51.3±0.58 (3)	32.7±2.89	368±15.59 (3) <sup>h,i</sup>	0.76±0.105	0.34±0.081 (1) <sup>e</sup>	4.67±0.237 (3)
Control n = 3	24.3±1.15	28.3±2.31	129±16.17 (4)	0.61±0.064	0.047±0.081	5.47±0.115

Results are expressed as mean ± standard deviation.

n = number of albino rats in each group.

Value bearing similar letters in each column are significantly different at P<0.05 compared to each other.

Values bearing number in bracket in each column are significantly different at P<0.05 compared to control using students "t"-test,

T.B = total bilirubin, D.B. = direct bilirubin

**Table 2: Serum activities of ALT, AST, ALP and bilirubin level in albino rats after seven days of oral administration with low dose, standard dose and high dose of "Sada."**

Dosage (mg/kg)	ALT(U/l)	AST(U/l)	ALP(U/l)	T.B (mg/dl)	D.B (mg/dl)	Glucose (mmol/l)
<b>"SADA"</b>						
Low dose (1.40) n = 3	41.3±6.66 (1)	31.3±4.51	266.7±16.17 (5) <sup>c,d</sup>	0.65±0.110	0.14±0.00 <sup>f</sup>	4.37±0.058 (4) <sup>a,b</sup>
Standard dose (2.80) n = 3	43.7±3.06 (2) <sup>a</sup>	32.7±2.89 <sup>b</sup>	313±15.59 (6) <sup>c,e</sup>	0.72±0.121	0.190±0.087	4.67±0.115 (5) <sup>a,c</sup>
High dose (5.60) n = 3	52.7±3.06 (4) <sup>a</sup>	39.3±2.89 (4) <sup>B</sup>	368±15.59 (7) <sup>d,e</sup>	0.79±0.058 (8)	0.38±0.081 (9) <sup>f</sup>	5.17±0.058 (6) <sup>b,c</sup>
Control n = 3	24.3±1.15	28.3±2.31	129±16.17	0.61±0.064	0.6±0.081	5.47±0.115

Results are expressed as mean ± standard deviation.

n = number of albino rats in each group.

Value bearing similar letters in each column are significantly different at P<0.05 compared to each other.

Values bearing number in bracket in each column are significantly different at P<0.05 compared to control using students "t"-test.

**Table 3: Serum activities of ALT, AST, ALP and bilirubin level in albino rats after seven days of oral administration with low dose, standard dose, and high dose of "Magani"**

Dosage (mg/kg)	ALT (U/l)	AST(U/l)	ALP(U/l)	T,B (mg/dl)	D,B (mg/dl)	Glucose (mmol/l)
<b>"MAGANI"</b>	a	c	e,f	h,i	j	k,l
Low dose (2.10) n = 3	53.3±2.31 (b)	41.3±5.51 (4)	267±16.15 (7)	1.06±0.075 (10)	0.19±0.087	3.87±0.115 (7)
Standard dose (4,20) n = 3	b 62.7±3.06 (2)	d 52.7±6.03 (5)	e,g 322±15.59 (8)	h 1.30±0.100 (11)	0.38±0.081 (13)	k 4.33±0.058 (8)
High dose (8.30) n = 3	a,b 76.7±5.69 (3)	c,d 77.3±11.06 (6)	f,g 368±15.59 (9)	i 1.53±0.153 (12)	j 0.53±0.087 (14)	f 4.53±0.115 (9)
Control n = 3	24.3±1.15	28.3±2.31	129±16.17	0.61±0.064	0.047±0.081	5.47±0.115

Results are expressed as mean ± standard deviation.  
n = number of albino rats in each group.

Value bearing similar letters in each column are significantly different at P<0.05 compared to each other.

Values bearing number in bracket in each column are significantly different at P<0.05 compared to control using students "t"-test.

**Table 4: Physical and Histopathology Test Results**

Type of "Gadagi" Tea	Dose (mg/kg)	Physical Analysis	Histopathology Test Results
"SAK"	0.75	Multi – lobed liver measuring 6x5.3x2cm and weighs 18g	Unremarkable (normal liver).
	1.50	Multi-lobed liver measuring 7x6x3cm and weighs 30g. cut surfaces are homogenous tan with patchy whitish areas	Extensive hepatocellular necrosis haemorrhage and mild infiltration. Severe acute hepatitis.
	3.00	Multi lobed liver measures 6x5x1.5cm and weighs 15g	Chronic acute hepatitis.
"SADA"	1.40	Measure 6x3x2cm and weighs 12g	Unremarkable
	2.80	Measures 7x6x4cm and weighs 40g	Hepatocellular necrosis. Chronic active hepatitis
	5.60	Measures 6x5 x 2cm. dark brown external surfaces and weighs 17g. transection shows homogeneous tan surfaces.	Severe hepatic vein congestion, parchy necrosis. Chronic active hepatitis.
"MAGANI"	2.10	Measures 8x5 x 3cm and weighs 28g. Light brown external surfaces with homogenous tan cut surfaces	Unremarkable
	4.20	Measures 7x5x3cm and weighs 22g. It has homogenous tan external surfaces with tan cut surfaces	Pybrosis, fatty change, hepatocellular necrosis severe hepatitis.
	8.30	Measure 7x4.5x3cm and weighs 22g. It has homogenous tan external surfaces.	Hepatocellular necrosis. Fibrosis and chronic active hepatitis

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