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Effects of Ethanolic Fruit Extract of *Parinari polyandra* (Rosaceae) on Serum Lipid Profile and Some Electrolytes in Pregnant Rabbits

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Abstract: The effects of the ethanolic fruit extract of *Parinari polyandra* on lipid profile and electrolyte levels in pregnant rabbits were investigated. Graded concentrations of 0, 10, 50 and 250 mg kg^{-1} body weight of the extracts were administered by gastric intubations for a period of 14 days from the 12th -25th day of gestation after which they were fasted for 18 h. The following lipid profiles were examined in the serum. Triglyceride, Total Cholesterol, High Density Lipoprotein (HDL) and Low Density Lipoprotein (LDL) cholesterol. Serum electrolytes also examined were: Sodium (Na^+), Potassium (K^+), Calcium(Ca^{2+}), Chloride (Cl^-), Bicarbonate(HCO_3^-) and Phosphorus (P). After these durations of treatment, there was significant elevation in triglycerides ($p<0.01$). The LDL/HDL Cholesterol ratio was greater than 0.3 in all the treated groups. Also, there were significant elevations in Na^+ ($p<0.05$), Cl-($p<0.05$), P ($p<0.05$) and Ca^{2+} ($p<0.05$). The result therefore suggests that the ethanolic fruit extract of *Parinari polyandra* may predispose to hyperlipidemia and electrolytes imbalance leading to hypercalcaemia and high risk of raised blood pressure in pregnant rabbits.

Key words: *Parinari polyandra*, hyperlipidemia, electrolytes imbalance, raised blood pressure

INTRODUCTION

Medicinal plants are increasingly being used as herbs in most part of the world today (Aliyu *et al*., 2007; Adewunmi and Ojewole, 2004). Many medicinal plants are locally used as contraceptive (to prevent ovulation and fertilization), abortifacients (to prevent implantation), emmenagogues (to stimulate uterine blood flow) or oxytocic (to prevent uterine contraction in labour) (Ritchie, 2001). Women are increasingly using fertility-enhancing plants to combat among other things, the negative effects of industrial pollutants on fertility (Lans, 2007).

Parinari polyandra belongs to the family, *Rosaceae* and found mostly in the tropical regions including: Nigeria, Ghana, Senegal, Ivory Coast, Cameroon and Sudan among others. The common local names are *Gwanjan kusa* (*Hausa*), *Abaddima* (*Nupe*) and *Aboidefin or Abere* (*Yoruba*). In South-western Nigeria, the leave extract of *Parinari polyandra* is used to enhance fertility. It is traditionally used to relief painful and inflammatory conditions (Vongtau *et al*., 2004). The hypoglycemic activity of the methanolic stem extract of *parinari polyandra* has been established (Vongtau *et al*., 1997). Some species of *Parinari* have been used for the treatment of veneral diseases and erectile dysfunctions (Lans, 2007). Preliminary phytochemical screening of the plant extracts showed the presence of flavonoids, tannins, saponin glycosides (Vongtau *et al*., 2004).

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Cardiovascular diseases are the leading cause of death both in men and women, medicinal plants are being used for the treatment of these diseases (Adebayo *et al*., 2006).

Hypertension is a common medical disorder that affects about 20-30% of adults in the United States and complicates about 5-8% of all pregnancies. Hypertensive disorders of pregnancy rank among the leading causes of maternal morbidity and mortality. Approximately 15% of maternal deaths have been attributed to hypertension and this makes the second leading cause of maternal mortality in the United States alone. Severe hypertension increases the mother's risk of heart attack, cardiac failure, cerebro-vascular accidents and renal failure. The mother is not the only one affected, the fetus and neonate are also at risk from complications such as poor placental transfer of oxygen, fetal growth restriction, preterm birth, placental abruption, stillbirth and neonatal death (Alan and Nathan, 2007).

The elevation of serum total cholesterol and more importantly low density lipoprotein concentration have been implicated as primary risk factors for cardiovascular diseases (Edijala *et al*., 2005). Also, elevated serum levels of high-density lipoprotein lead to lowered atherosclerotic disease conditions (Anonymous, 1993).

Recknagel (1983) has also shown that high blood lipids are associated with hypertension and lipid peroxidation. Some herbs taken by people have been reported in the literature to be associated with changes in blood serum lipids (Perez *et al*., 1999; Jones *et al*., 1997; Dominquez *et al*., 1996; Cignarella *et al*., 1998; Campillo *et al*., 1994). Electrolytes like K^+ and Na^+ play important role in cardiovascular activity (Nurminen *et al*., 1998). Reduction in the amount of sodium intake results in decrease in blood pressure while potassium which is an intracellular electrolyte has a protective effect against hypertension (Nurminen *et al*., 1998).

There are insufficient and relevant scientific information on medicinal plants against the high incidence of cardiovascular and other related diseases. The frequent uses of extracts of *Parinari polyandra* by pregnant women to enhance fertility also necessitate this research. Thus, the study is aimed at investigating the effects of the ethanolic fruit extract of *Parinari polyandra* on lipid profile and some electrolytes on pregnant rabbits.

MATERIALS AND METHODS

Plant Material and Experimental Animal

The plant part used for this research was the fruit of *Parinari polyandra*. It was taken from representative portions of different plants. The plant part was bought from Mushin market in Lagos state, Nigeria and identified by Professor Olowo Kudejo of the Department of Botany, University of Lagos, Nigeria as *Parinari polyandra*. Twenty female rabbits weighing between 1.6 and 1.3 kg were used in the study. They were bred in the animal house of the college of medicine of the University of Lagos, Idi-Araba, Lagos State, Nigeria where this study was conducted in February, 2003.

Treatment of Plant Material

The fruit of *Parinari polyandra* was dried in the oven at 105°C and pounded in the mortar. Hundred gram of the sample was subjected to soxhlet extraction in 80% ethanol.

The extraction processes were allowed to continue for about 18 h; thereafter, the extract was concentrated using a rotary evaporator and finally dried in an open beaker (6 h duration). The extract was kept in clean, dried bottle which is placed in a desiccator until it was ready for use.

Treatment of Animals

The rabbits were allowed to acclimatize to the environment for two weeks and maintained at room temperature (temperature 23±2°C, Humidity 65-70%) and 12 h dark/light and fed with standard commercial rabbits pellet and tap water *ad libitum*.

The experimental design involves the administration of fruit extract of *Parinari polyandra* to 20 female rabbits which were grouped into four groups (Group A, B, C and D) each containing 5 rabbits per group on the basis of uniform average weight. Group A received distilled water and served as the control group. Graded doses i.e., 10, 50 and 250 mg kg^{-1} body weight) of the fruit extract were administered by gastric intubations for a 14 day period beginning from the 12th day of gestation. After treatment, they were subsequently subjected to fasting for 18 h.

Collection of Blood and Preparation of Serum Sample

At the end of the treatment, animals were anaesthetized using chloroform vapour in an enclosed chamber prior to dissection. Blood was collected by cardiac puncture into labeled sterilized drug bottles and allowed to clot by standing at room temperature for one hour and centrifuged at 3500 g for 15 min. The serum (supernatant) was isolated and stored at -30°C until required for analysis.

Determination of Lipid Profile and Electrolytes

The sera prepared above were used to estimate total cholesterol, High Density Lipoprotein (HDL), Low Density Lipoprotein (LDL) cholesterol, Triglycerides, Sodium (Na), Potassium (K^+), Calcium (Ca^+) Phosphorus (P), Chloride (Cl^-) and Bicarbonate (HCO_3^-). Total Cholesterol was estimated using the method of Braun (1984). Triglyceride was estimated using the method of Stein and Myers (1995). HDL-Cholesterol was estimated using the method of Hiller (1987). Determination of LDL cholesterol concentration was by the method of Friedewald *et al*. (1972). All the serum electrolytes were determined by using an electrolyte analyzer called synchron EL-ISE electrolytes system (Beckman) by the method of Kinsley and Schaffert (1953).

Statistical Analysis

Statistical analyses were performed with the aid of SPSS for Windows software programme (Release 10.0). Group comparisons were done using the analysis of variance (ANOVA) and the Student's t-test. A p-value of <0.05 was considered statistically significant.

RESULTS

The results of the effects of ethanolic fruit extract of *Parinari polyandra* on the lipid profiles and electrolytes after 14 days treatment are summarized in the Table 1 and 2, respectively. The result showed a significant increase of triglycerides in doses 50 and 250 mg kg^{-1} body weight which were statistically significant at $p<0.01$ and $p<0.05$, respectively. There were dose dependent decrease in cholesterol concentrations between the treated groups and control groups though not statistically different. There was however no statistically significant effects ($p>0.05$) in HDL and LDL cholesterol between the treated and control groups. However, the LDL/HDL ratio was greater than 0.3. Also in Na^+ concentration, there was a significant increase ($p<0.01$) in the groups administered with 10 mg kg^{-1} whereas other groups showed no significant effects. There were no significant effects ($p>0.05$) in K^+, Cl^- and HCO_3^- in all the treated groups, although insignificant decrease in K^+ ions was observed at

Table 1: Effects of ethanolic fruit extracts of *Parinari polyandra* on some serum lipid profiles in pregnant rabbits

Groups	Dose (mg kg^{-1})	Triglycerides	Total cholesterol	HDL cholesterol	LDL cholesterol
		(nmol L^{-1})			
A (Control)	0	0.41±0.46	2.25±1.77	1.70±1.87	0.37±0.28
B	10	0.89±0.34	2.51±0.69	1.49±0.20	0.62±0.75***
C	50	1.78±0.32**	2.21±0.03	0.87±0.11	0.52±0.21***
D	250	1.37±0.16*	1.54±0.02	0.29±0.02	0.63±0.11***

Tabulated values are Mean±SD of 5 determinations, * $p<0.05$ vs control ** $p<0.01$vs control. ***LDL/HDL>0.3 vs control

Table 2: Effects of ethanolic fruit extracts of *Parinari polyandra* on some serum electrolyte levels in pregnant rabbits

Groups	Dose (mg kg^{-1})	Na^+	K^+	Ca^{2+}	Cl^-	HCO_3^-	P
		(nmol L^{-1})					
A (Control)	0	129±90.90	8.60±1.90	1.97±1.46	104.65±2.9	12.55±0.8	1.19±0.8
B	10	136±12.02**	7.65±1.46	3.87±0.25*	107.00±1.2	8.50±1.0	1.60±0.1
C	50	119±19.80	8.50±2.10	6.21±1.55**	107.70±0.14	6.20±3.1	3.20±2.0
D	250	126±12.02	7.85±0.20	10.06±4.19	100.10±0.9	9.50±0.14	7.60±6.2

Tabulated values are Mean±SD of 5 determinations. * $p<0.05$ vs control **$p<0.01$ vs control

10 mg kg^{-1} body weight. There were statistically significant increases ($p<0.05$ and $p<0.01$) in Ca^{2+} in groups treated with 10 and 50 mg kg^{-1} of the extract, respectively. There was also a dose dependent elevation in Cl-ion in the groups administered with 50 and 250 mg kg^{-1} body weight.

DISCUSSION

The major sterol in animal tissues is cholesterol and it occurs in the cell membrane due to its amphipathic nature (Nelson and Cox, 2000). Cholesterol is abundant in the adrenal glands, liver as well as the brain and the nervous system (Osmund, 2001). Dietary cholesterol is obtained from animal products and about 300 mg is required by an adult per day. However in the absence of enough dietary cholesterol, the liver synthesizes sufficient cholesterol for normal body functions and it is carried in the blood in the form of lipoproteins (Osmund, 2001). There are five kinds of lipoproteins, they include: chylomicrons, Very Low-Density Lipoproteins (VLDL), intermediate-density lipoproteins, Low-Density Lipoproteins (LDL) and High Density Lipoproteins (HDL) (Adebayo *et al*., 2006). High concentrations of all lipids except the HDLs are associated with an increased risk of atherosclerosis. High serum levels of triglycerides and the LDLs are associated with coronary artery disease (Eisenhaver *et al*., 1998; Hornstra *et al*., 1988; Sundram *et al*., 1995).

Parinari polyandra fruit extract administered at doses of 50 and 250 mg kg $^{-1}$ body weight showed that serum triglycerides levels were significantly elevated ($p<0.05$). The phytochemical screening of the plant indicated that it contains flavonoids, tannins and saponin glycosides.

The presence of flavonoids and tannins play significant roles in the metabolism of lipids. Flavonoids inhibit specific enzymes. For example, flavonoids block the Angiotensin-Converting Enzyme (ACE) that raises blood pressure: By blocking the suicide enzyme cyclooxygenase that breaks down prostaglandins, they prevent platelet stickiness and hence platelet aggregation. Flavonoids also protect the vascular system and strengthen the tiny capillaries that carry oxygen and essential nutrients to all cells (Chang *et al*., 2001). Tannins form complexes with proteins and make them unavailable to the cells (Reeds, 1995; Owen and Johns, 1999). The observed significant increase in serum triglycerides may be due to the ability of the stimulated lipid metabolizing enzymes (HMG CoA reductase and cyclooxygenase) by *Parinari polyandra* extracts to form complexes with tannins. Thus preventing the normal metabolism of the enzymes leading to the accumulation of lipids (triglycerides) in the serum. The ratio of LDL cholesterol to HDL cholesterol has also been used as an indicator for cardiovascular diseases (Panagiotakos, 2003) and the values observed could further justify the hypertriglyceridemic effect observed in *Parinari polyandra* fruit extracts.

The results of the blood serum electrolytes showed that there was significant elevation ($p<0.05$) of calcium ion concentrations at 10, 50 and 250 mg kg^{-1} body weight of extract compared with the control groups. Overloaded calcium either from the bone or intestine is efficiently excreted into the urine. However, when a greater amount of calcium than the kidney can excrete is loaded, it results in hypercalcaemia (Masafumi and Kiyoshi, 2002). This may be the reason for the elevated level ($p<0.05$) of calcium ions in the serum of the treated rabbits compared with the control groups.

The elevated levels of sodium ion ($p<0.05$) of *Parinari polyandra* at a dose of 10 mg kg^{-1} body weight may also increase the risk of raised blood pressure because sodium and chloride ions have been

reported to be distributed majorly in the extracellular fluid and this is associated with their retention (Etukudo *et al*., 1999) and increased in sodium retention has been shown to increase blood pressure (Kotchen and Kotchen, 1997). Also the insignificant reduction in the levels of potassium at a dose of 10 mg kg^{-1} body weight further shows that the plant extract could lead to raised blood pressure in the user since potassium has been shown to have a protective effect against hypertension (Nurminen *et al*., 1998). The Na^+-K^+ ATPase may also be affected by the presence of tannins found in the plant extract. Na^+-K^+ ATPase also helps in the movement of these electrolytes across the membrane and ensures that the there is a balance in the system.

The elevated levels of sodium ions which can lead to raised blood pressure as well as hyperlipidemic effect of the plant extract may also subject the users of this plant extract to increased risk of cardiovascular diseases.

In the light of the foregoing, it is clear that ethanolic fruit extracts of *Parinari polyandra* may predispose to hyperlipidemia, as well as serum electrolytes imbalances leading to raised blood pressure and hypercalcaemia in women that use the plant part for fertility enhancing purpose. As at date no work has been reported on the use of this plant part in laboratory animals to determine the effects on serum lipid profile and electrolytes levels. However, the work of Adebayo *et al*. (2006), on the effects of Ethanolic leaf extract of *Commiphora africana* on lipid profile levels in rats indicated that some medicinal plant extracts have antilipidaemic and anticholesterolaemic properties. This research has made it possible to show the effects of the fruit extract of *Parinari polyandra* on lipid profile and to link it with electrolytes levels in pregnant rabbits. These two parameters (lipid profile and electrolytes levels) are very important factors during pregnancy. It is suggested that further phytochemical analysis, purification and characterization of the plant extract be carried out to establish potent active principles responsible for the raised triglycerides and other electrolytes.

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