International Research Journal of Biochemistry and Bioinformatics (ISSN-2250-9941) Vol. 6(1) pp. 001-006, December, 2016
DOI: http:/dx.doi.org/10.14303/irjbb.2016.100
Available online http://www.interesjournals.org/IRJBB


*Full Length Research Paper*

# Antioxidant, hypolipidemic and cardio-protective properties of chloroform extract of *Mansonia altissima* (*Sterculiaceae*) in rabbits

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## ABSTRACT

**The interest of peoples for medicinal plants continues to grow. Among these plants, *Mansonia altissima* is used against leprosy and tuberculosis. The aim of this study was to evaluate antioxidant, hypolipidemic and cardioprotective effects of chloroform extract from *Mansonia altissima* in rabbits. Increasing doses (4.7-75 mg/kg) of chloroform extract were administered in 36 rabbits. Antioxidant activity was evaluated by indirect determination of free radicals (TBARS) using modified method of Yagi and the total antioxidant power by the test of reduction of iron FRAP Benzie and Strain. Serum triglycerides, total cholesterol, HDL and LDL cholesterols were perfumed with multiparatemers analyzer. We noted a significant decrease ($P < 0.05$) concentration of TBARS (2.42-2.25 nmol/L of MDA) in plasma. It also noted a significant increase ($P < 0.01$) in time the total antioxidant power (22-27 mmol/L of $Fe^{2+}$) of extract at non-lethal doses. A beneficial effect was also observed on the atherogenic risk with a significant decrease in plasma of total cholesterol, triglyceride and LDL-cholesterol concentrations, associated with a cardio protective effect resulting of HDL-cholesterol and atherogenic index elevation. Chloroform extract of *M. altissima* has antioxidant hypolipidemic and cardio protective properties in rabbits.**

**Keywords:** *Mansonia altissima*, Antioxidant, Cardio-protective, Lipideminic

## INTRODUCTION

Although the oxygen is an essential molecule for life, however, it is likely to cause adverse effects in the body by forming free radicals and activated oxygen species (AOS). Among these reactive oxygen species oxidize slowly biological molecules and can cause many diseases such as cancer, neurodegenerative diseases, and cardiovascular diseases such as atherosclerosis, stroke and non insulin dependent diabetes (Adéoti et al., 2015).

In this context, medicinal plants are extensively used either for prevention or for therapy of many diseases. The interest in medicinal plants does not stop growing. So does same for scientific experimentation that took a vertiginous expansion and allowed to isolate several natural substances and their origins find therapeutic virtues (Bidié et al., 2011). This is the case of aspirin (acetylsalicylic acid) initially isolated from the leaves and bark of *Salix alba* L. (Salicaceae) (Colgate and Molyneux, 1993).

In Côte D'Ivoire, the work carried out on medicinal plants is abundant (Djaman et al., 1998). Among these plants, we can mention *Mansonia altissima*, traditionally used as a poison for hunting spear, and criminal purposes, *M altissima* treat diseases such as leprosy, yaws, syphilis and tuberculosis (Terrieux, 1952).

The screening phytochemical carried out of *Mansonia altissima* extracts from bark were described the presence of active compounds such, alkaloids, tannins, saponins,

polyphenols, terpenes, flavonoids and cardiac glycosides (Adéoti et al., 2015). Some of these secondary metabolites have effects on lipid metabolism such as steroid hormones and particularly on lipids and cholesterol (Clerc, 1935), although to date no evidence has been provided on the effects of cardiac glycosides and on cholesterol synthesis. Today, herbal treatments come to the fore, because the effectiveness of drugs made from plant derived compounds such as polyphenols and particularly flavonoids which are powerful antioxidants that may inhibit the formation of radicals free and to oppose the oxidation of macromolecules (Iserin, 2001; Van Acker et al, 1995), is well established.

Our study is related to the context of an herbal approach to the treatment of diseases by plants or extracts, this work aims is to evaluate the antioxidant, lipid-lowering and cardioprotective effects of chloroform extract of *Mansonia altissima* bark in New Zealanders rabbits.

## MATERIEL AND METHODS

### Materiel

### Plant material

This study required the used of chloroform extracts of bark of *Mansonia altissima*, obtained by the own technique laboratory (Guédé-Guina, 1989; Adéoti et al., 2013).

### Animal material

The animal material is comprised of 36 New Zealanders Cunistar-type rabbits weighing 1.5 ±0.24 kg and 8 weeks old. They were apportioned equitably into 6 groups of 6 rabbits each, including a control group. These animals were acclimated according to standards norms of OCDE into central animal facility house from UFR of Pharmaceutical and Biological Sciences of Félix Houphouët-Boigny University.

### Methods

### Administration of extract solutions

Concentrations of chloroform extract were administered intraperitoneally at doses below at DMT (75 mg/kg/b.w.) following the completion of an acute toxicity study. Thus the concentrations of chloroform extracts administered to different groups of rabbits are 4.7 mg/kg, 9.4 mg/kg, 18.7 mg/kg, 37.5 mg/kg and 75 mg/kg during two weeks. The samples are collected at fasting, via marginal vein each week, with one needle (23G). The blood collected was centrifuged at 3000 rpm/min for 10 min, then the serum collected were stored at -20 °C.

### Dosage of TBARS

The products of lipid peroxidation (TBARS) were measured in the extract using method Yagi, modified by Sess et al. (1992). The TBARS assay is based on the determination in acetic acid medium at temperature to 95 at 100 °C, end products of lipid peroxidation (MDA and alkanals alkenals), which are substances that react with thiobarbituric acid (Yagi, 1987). During the reaction, two molecules of thiobarbituric acid (TBA) react with one molecule of malondialdehyde (MDA) and leads to the formation of a rose color rendered fluorescent complex by addition of N-butanol. The coloration obtained is measured in a spectrofluorimeter at specific wavelengths (515 and 553 nm). These respectively correspond to the excitation wavelength and emission. The entire of substances reacting (TBARS) are expressed in MDA.

### Determination of total antioxidant activity

The total antioxidant activity of extract is determined by iron reduction test FRAP (ferric reducing ability of plasma) (Benzie and Strain1996). This method is based on the acidic medium in reduction of ferric ion ($Fe3^{+}$) to ferrous ion ($Fe2^{+}$) which reacts with the tripyridyltriazine (TPTZ) to form a blue complex (Fe (II) -tripyridyltriazine) absorbed to 593 nm (wavelength optomale)

### Determination of lipid and lipoprotein parameters

Lipid and lipoprotein parameters in plasma as well total cholesterol, triglycerides, HDL-cholesterol were analyzed using enzymatic techniques on an automated multiparameter. The concentration of LDL-cholesterol was calculated by using the Friedewald formula. Also, atherogenicity index (AI) was determined by calculating the ratio HDL-Cholesterol / total Cholesterol.

### Statistical analysis

The results obtained are expressed as mean values followed by the standard error of the mean (±SEM). Statistical analysis of results was performed using analysis of variance (ANOVA ONE WAY). The comparison of means pairs was performed according to t test of Student. The difference is considered significant at probability level $p < 0.05$.

## RESULTS

### Total antioxidant activity

The total antioxidant activity increases significantly ($P < 0.01$) according to dose-response of chloroform extract of *Mansonia altissima* (Figure 1).

**Table I**.Plasma lipid parameters in rabbits at T0

| Parameter | Means ±SEM |
|---|---|
| Weight (kg) | 1.5 ±0.24 |
| Total cholesterol (g/L) | 0.55 ±0.35 |
| LDL-cholesterol (g/L) | 1.03 ±0.15 |
| HDL-cholestérol (g/L) | 0.38 ±0.04 |
| Triglycerides (g/L) | 1.95 ±0.85 |
| AI (HDL-chol./Total chol.) | 0.69 ±0.11 |
| TBARS (nmol/l MDA) | 2.47 ±0.13 |

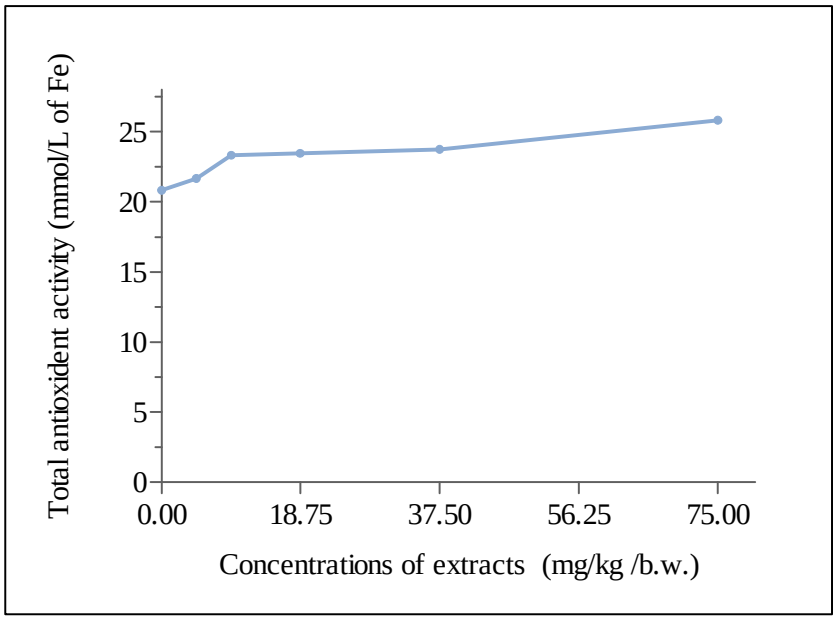


**Figure 1**. Evolution of total antioxidant activity of chloroform extract of *Mansonia altissima* in rabbits

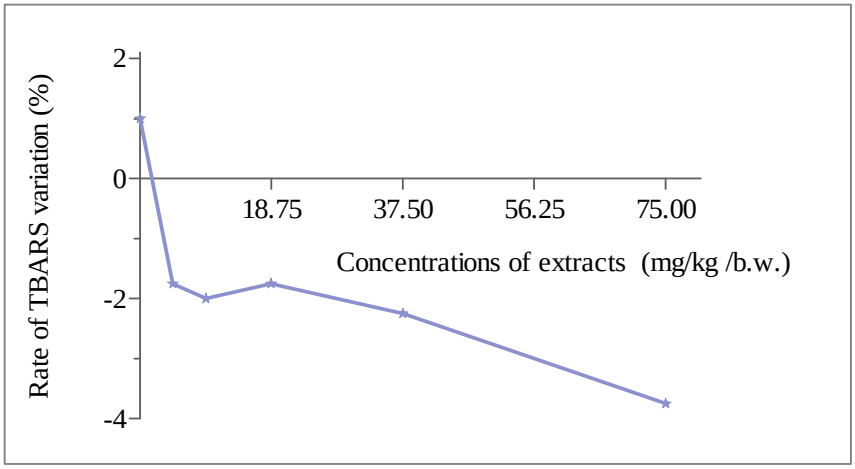


**Figure 2**.Evolution of plasma concentration of TBARS in rabbits treated by chloroform extract of *Mansonia altissima*

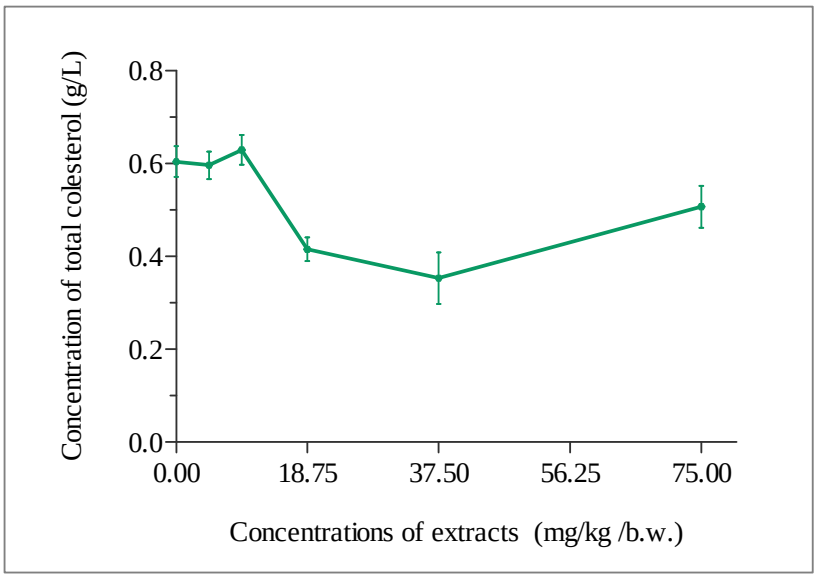


**Figure3**. Evolution of plasma concentration of total cholesterol in rabbits treated by extract *M. altissima*

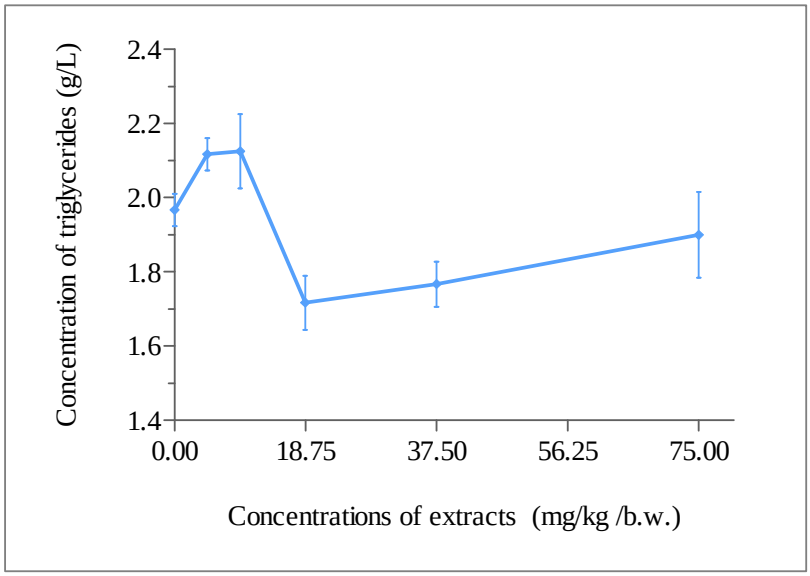


**Figure 4**. Evolution of plasma triglycerides in rabbits treated with chloroform extracts of *M. altissima*

**Reduction of TBARS**

Plasma concentration in rabbits of TBARS decreased significantly ($p < 0.05$) after administration of chloroform extract of *M. altissima* (Figure 2)

**Lipid parameters in rabbits**

In rabbits, initial values of total cholesterol and triglycerides in plasma were respectively 0.55 ±0.35 and 1.95 ±0.85 g/L. The total cholesterol rate decreased significantly ($p < 0.01$) at concentration of 9.4 mg/kg body weight during the second week of study (Figure 3). There is a significant reduction of triglycerides after injection of the solution concentration of 9.4 mg/kg/b.w. (Figure 4).

**Hypolipidemic and caidioprotevive activities**

The HDL-cholesterol levels increased significantly ($p <0.05$) in subjects receiving extract of *M. altissima* as treatment

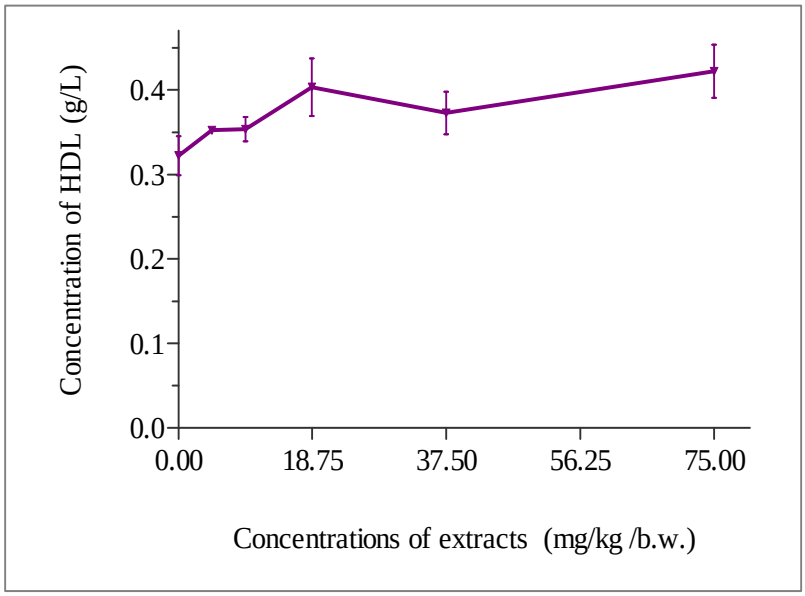


**Figure 5**. Evolution of the HDL-cholesterol in rabbits treated with chloroform extracts of *M. altissima.*

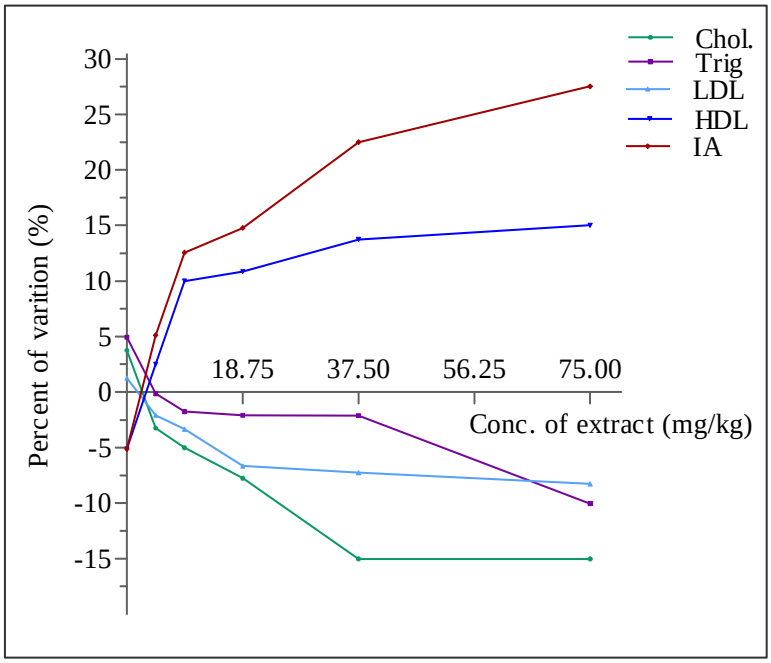


**Figure 6**. Evolution of lipid parameters in rabbits according to increasing concentrations of extracts of *M. altissima.*

(Figure 5). Is there a significant decrease ($p < 0.05$) the plasma levels of total-cholesterol, LDL-cholesterol or triglycerides and elevated atherogenic index consecutive to increased HDL-cholesterol. All effets of chloroform extract of *Mansonia altissima* was resumed in figure 6.

## DISCUSSION

This study has shown that the administration of increasing doses of chloroform extract of *M. altissima*, reduced progressively and significantly ($p < 0.05$) markers of lipid

peroxidation (TBARS) in plasma. This justifies the antioxidant effect. In addition, we observed a hypo-lipidemic and cardioprotective effects of chloroform extract of *M. altissima* justifying his ancestral used

**Antioxidant effect of chloroform extract of *M. altissima***

The antioxidant effect obtained in this study is in agreement with those of work Bidie et al. (2011) about the antioxidant activity of ten medicinal plants of the Ivorian pharmacopoeia. According to these results, the plants that contain compounds such as tannins, polyphenols, flavonoids have a strong trapping activity. Indeed, previous work (Adéoti et al., 2015) have realized a phytochemical trapping of this extract (chloroform) *M. altissima* showed it contained secondary metabolites, mainly alkaloids, tannins, saponins and polyphenols flavoides.

The values of plasma TBARS obtained in this work are similar to those of other authors (Briens et al., 2005). These latter reported a significant decrease values (2.7nmol/L and 1.86 MDA) in rabbits after administration of plant extracts containing antioxidants. These results confirm the assertion of other studies (N'Guessan et al., 2007; Zhi et al., 2008). According to these authors plants containing flavonoids express good antioxidant activity. Our findings could be explained by the chemical components contained in extracts of *M. altissima* which possess antioxidant properties.

These secondary metabolites including flavonoids through their ortho-dihydroxy structure on the ring B, and the presence of the double bond in C2-C3 conjugation with 4-oxo bond express antioxidant activity by scavenging free radicals. Antioxidants are free radical scavengers that protect the human body against the free radicals which can cause pathological conditions such as ischemia, anemia, asthma, arthritis, inflammation, Parkinson's disease, mongolisme, the aging process and sometimes dementia (Polterait et al., 1997).

**Hypolipidemic and cardioprotective effects of chloroform extract**

The study of lipid and lipoprotein parameters showed hypomipideùic and cardio-protective effects in rabbits. However, these results are lower than those proposed as referential values on the New Zealanders cunistar-rabbit in Côte d'Ivoire (Coulibaly et al., 2007). The chloroform extract of *M. altissima* administration at a dose of 75 mg/kg during three weeks to rabbits showed an effect on lipid metabolism with progressive and significant decrease cholesterol.

Our results are in agreement with those of Oyesola et al. (2011) on antioxidant, hypoglycemia and hypolipidemic of alcohol extract from the leaves of *Lawsonia inermis*. According to these authors the decrease of total cholesterol concentration is associated with flavonoids in the extract administered. The decrease of cholesterol level in rabbits is related to the presence of flavonoids in the chloroform extract of *M. altissima*.

The decrease in blood of cholesterol levels is also associated with the presence of cardiac glycosides such as *Mansonin*e, a cardiotonic molecule extracted of *M. altissima* (Guédé- Guina et al., 1998). These authors demonstrated a significant effect of *Mansonine* on decreasing of cholesterol levels associated with increased atherogenic index. The *Mansonine* would therefore by the inhibition of the activity and expression of the 3-hydroxy-3-methylglutaryl-coenzyme A reductase (HMG-CoA reductase), the rate limiting enzyme the speed of synthesis cholesterol.

The significant decrease of plasma cholesterol levels in rabbits could be explained by the presence in the extract of *M. altissima* phytochemicals various active compounds such as saponins and cardiac glycosides (Temitope et al., 2012). Indeed, saponins are glycosides content as well in triterpenes as steroids, which possess hypotensive and cardiac depressants effects. They have been characterized in over seventy families of plants whose bark extracts *Mansoni altissima* (Basu and Rastogi, 1967; Olaleye, 2007). Saponins by binding to cholesterol form insoluble complexes gut level and combine with endogenous cholesterol then be excreted via the bile. This process prevents cholesterol reabsorption and results in a reduction of serum cholesterol (Cheeke, 1971).

Triglycerides and LDL-cholesterol decreased significantly compared to initial parameters in rabbits. These results are similar to those work Bopanna et al. (1997); Katsumata et al. (1999), according to which the significant decreases in triglyceride and LDL-cholesstérols are associated with flavonoids, phenols, saponins and sterols present in the plant extract.

## CONCLUSION

*Mansonia altissima* belongs to the group of digitalis from the African pharmacopoeia. It has antioxidant properties, hypolipidemic and cardio-protective effects and appears to have many advantages in the context of research on new molecules. Therefore, it may be used in the prevention of hyperlipidemia and the management of cardiovascular diseases. Additional studies should revaluate a better understanding and mastery of the pharmacological mechanisms of action of extracts of *M. altissima* for its further use in cardiovascular therapy.

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