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Original Article

The Bark of *Sclerocarya birrea* affect Wistar Rats Lipid Metabolism

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ABSTRACT

This work aims to determine the action of the aqueous extract of the bark of *Sclerocarya birrea* on lipid metabolism of Wistar rats in order to see the lipid-lowering effects in rats submitted to the cafeteria diet. For this, an aqueous extraction of the bark of *Sclerocarya birrea* was performed. Then the rats were subjected to a fatty diet and hyper hyper caloric said cafeteria; to be a good model for our study this scheme will be given to rats for four weeks. Finally, to evaluate the lipid-lowering activity of aqueous extract of the bark of *Sclerocarya birrea* will, we administered the extract to the 50mg dose, 100mg, 200mg, 300mg and 400mg and biochemical parameters such as blood sugar, triglycerides, total cholesterol, LDL cholesterol, and total protein in the plasma of Wistar rats are dosed. The results of taking the cafeteria diet gives us a significant increase in body weight of rats and increased biochemical parameters such as blood glucose, triglycerides, total cholesterol against the regime has no effect on the synthesis of total protein and LDL cholesterol. After treating his rats with extracts from the bark of *Sclerocarya birrea* a very significant decline is noted in all measured parameters and body mass. This decrease parameter shows the effect of the extract on lipid metabolism. The *Sclerocarya birrea* aqueous bark extracts therefore lipid lowering properties.

Keywords: *Sclerocarya birrea*, bark, lipid, metabolism, Benin.

1. INTRODUCTION

Today, diseases associated with lipid accumulation in the human body, such as obesity or atherosclerosis promoting heart disease, are of growing importance in health matters. These diseases are usually the consequence of our modern life styles that allow easy and rapid accession to a rich and abundant food coupled with a permanent sedentary lifestyle and lack of physical activity permanent. These diseases are

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consecutive to higher calorie intake to energy expenditure resulting in fat storage surplus.

The exponential growth of his illness led to the use of many plants which include medicinal *Sclerocarya birrea*.

Sclerocarya birrea, (commonly known, marula, family Anacardiaceae) is a dioecious medium single stem tree, native woodlands miombo in Southern Africa, the Sudano-Sahelian region of West Africa, and Madagascar (Coates, 1983). [1] It was reported that other parts of the plant are used in traditional medicine in South Africa as part of the management, treatment and fight against various human diseases, including infantile convulsions and epilepsy (Ojewole, 2006). [2] This plant is highly valued in traditional medicine as being very useful in many ways. For example, the powdered bark is used to treat pregnant women to determine the sex of the child. If a pregnant woman wants to have a girl, it will be enough to take a preparation of the female plant; and to have a boy, it will use the male plant. (Mutshinyalo & Tshisevhe, 2003). [3] The bark decoction is used to treat dysentery, diarrhea, and rheumatism and has a powerful prophylactic against malaria. The bark is an excellent remedy against hemorrhoids. The roots and bark are also used as a laxative (Van Wyk et al, 1997). [4] The drink made from marula the leaves are used to treat / gonorrhea / gonorrhea.

Some work done on extracts of this plant have shown promising results on this medicinal plant. For example, it has been shown that extracts from *Sclerocarya birrea* possess anti-inflammatory activity, so paying flank at the suggestion of the use of the plant in the management and / or the fight against arthritis and other inflammatory conditions in some communities of South Africa. (Ojewole et al. 2003; 2004) [5, 6]. Despite all his work done to date has not evaluated the effect of extracts of *Sclerocarya birrea* the general biochemical metabolism especially lipid metabolism of the cell view point and / or molecular. That's all that motivated this study on "Action of the aqueous extract of the bark of *Sclerocarya birrea* on lipid metabolism of Wistar rats."

2 MATERIALS AND METHODS

2. 1 Material

Different materials involved in the realization of this study, which include the biological material (plants and animals) and laboratory equipment for handling.

2.1.1 Plant Material

The plant material used is the bark of *Sclerocarya birrea*. It was harvested in June 2015 in the town of N'dali (northern Benin), identified, certified and then a specimen is deposited at the National Herbarium of Benin under the number: AA6548 / HNB.

Animal Material

These rats were provided by the animal house of the Laboratory of Biomembrans and Signalling Cell/ Department of Animal Physiology, University of Abomey Cotonou (Rep. of Benin) assessing the effect of the aqueous extract of the bark of *Sclerocarya birrea* on obesity

Livestock in this pet is performed in a controlled temperature kept under room of 23 ± 2 ° C. The animals are kept in the breeding standard conditions with alternating light / dark 12 hours for each phase. Rats are kept in metal wire cages of dimensions (50 × 30 × 20 cm 3) equipped with small feeders and water. The bottom of the cage consists of mobile systems drawers lined with wood shavings collecting faeces and urine. All animals are health status of SPF (Specific Pathogen Free of)

The rats free access to drinking water and food. They are supplied with drinking tap water and food ration is made of a standard diet, a food factory and supplied by the Animal Production Department of the Faculty of Agricultural Sciences

Study Methods

This is a prospective experimental study in vivo in Wistar rats. The aqueous extract was administered to rats orally in order to assess the effectiveness of these extracts on the study model for obesity. The animals were subjected to a hyper-fat diet called "cafeteria". This hyper-lipid diet hypercaloric and is described by Llado et al. (1991). [7] Our study has three phases:

In vitro experimentation phase: obtaining herbal drugs, decoction preparation,

An in vivo experimental phase action of watery extract of the bark of Sclerocarya birrea on lipid metabolism and an experimental phase of post processing and data analysis.

Phase of Experiments In Vitro

Obtaining herbal drugs

The collected sample was dried at a temperature of 30oC in the study for 2 weeks. It was then pulverized and stored in a suitable container and kept refrigerated at 4 ° C for our manipulations.

Preparation of extracts

This is a decoction prepared from the powder of bark *Sclerocarya birrea*. An amount of 50 g of powder is brought to boiling for 30 min in 500 mL of distilled water. After cooling, the decoction obtained is filtered and then evaporated under reduced pressure at 60 ° C using a rotary evaporator. The yield of the extract was calculated by the following formula:

R = 100 × extract the powder mass/ vegetable matter powder mass……(1)

Experimental Phase *In Vivo* Rat Wistar

Experimental model of obesity

In order to generate a significant weight gain in rats, and thus constitute a good study model for obesity, the animals are subjected to a hyper-fat diet called "cafeteria". This hyper-lipid diet hypercaloric and is described by Llado et al. (1991). [7] It induces consecutive obesity to overeating. The animals receive either the standard regimen or the cafeteria diet for a period of one month (30 day). Thus, rats were divided into two groups: A control group (or reference) of

six (6) rats with 3 male and 3 female; A lot experimental consists of thirty-six (36) rats, including 18 male and 18 females consuming the cafeteria diet, comprising 50% of standard diet and 50% of a mixture of block - crackers - cheese - chips - chocolate - peanuts in undefined proportions. Every week the weight of the rats was noted; verification of biochemical parameters is initially checked (T0) Day 14 (T14) and day 30 (T30). Individual identification of rats is at the tail by color.

It consisted in the administration of the extract to groups of Wistar rats at various doses: 50; 100, 200; 300 and 400mg / kg body weight orally. We made 6 lots of 3 male rats and 6 pack of 3 female rats.

1. Lot witness that received distilled water
2. Lot I: extract at a dose of 50 mg / kg
3. Lot II: extract at a dose of 100mg / kg
4. Lot III: extract at a dose of 200mg / kg
5. Lot IV: extract at a dose of 300mg / kg
6. Lot V: extract at a dose of 400mg / kg

Gavage rats

In this handling, it is to administer the extract of bark of the trunk *Sclerocarya birrea* to Wistar rats and having the same diet, and orally at various doses for 2 weeks. These animals received no other medication in the time outside the extract. The rats are distributed by sex in 06 batches of 03 rats (n ° 0 # 1, # 2, # 3, # 4 and # 5), then the batches respectively is attributed the doses per kg body weight body per day: 0 mg / kg, 50mg / kg; 100 mg / kg; 200 mg / kg; 300mg / kg and 400 mg / kg; and the volume is fixed to be administered at V = 01 ml. Then, weigh each rat of each batch to find the average weight and calculate the effective dose of extract to be administered to him. Then gave daily and at the same time the rats for 14 days. the control group received oral administration of distilled water instead of the aqueous extract (0 mg / Kg) of Sclerocaryaunbirreapendant14 days of trunk bark; other lots (1-2-3-4-5) are treated by oral administration at doses de50mg / kg; 100 mg / Kg; 200mg /; 300 mg / kg, 400mg / kg of the aqueous extract of the bark of the trunk of Sclerocarya birrea.

Criteria activity assessment

In order to study the action of the aqueous extract of the bark of Sclerocarya birrea on lipid metabolism, we performed the assays of biochemical parameters such as blood glucose, total cholesterol; LDL, and triglycerides, total proteins.

Blood sample

The blood was taken at the retro orbital sinus of the animal using a micropipette. The blood is centrifuged at 3000 revolutions / minute for 10 minutes and the plasma is recovered and used for biochemical assays. The animals are weighed at the start of the experiment and weekly thereafter. Biochemical parameters were measured at the beginning of the experiment (Jo) to J14, J30 after making obese rats then at the end of 14 days of feeding.

These animals received no other medication in the time outside the extract. The principle is to administer previews. For sampling the rats were fasted at least 16 hours.

Biochemical parameters

blood sugar

Principle

In the presence of glucose oxidase, glucose oxidized to gluconic acid / hydrogen peroxide liberated during the reaction, reacted under the action of peroxidase, with phenol and 4-amino-phenazone, to form a complex pink. The intensity of the color is proportional to the glucose concentration.

[Glucose] (g / l) = (abs.dosage) / (abs.etalon) x standard concentration

Total cholesterol

In food or synthetic origin cholesterol involved in the formation of the cell membrane. According to the enzymatic method described by Alain et al.

[Cholesterol T] (g / l) = (abs.dosage) / (abs.etalon) x standard concentration

LDL cholesterol

Principle

Method homogeneous bi-Reagent using the properties of a detergent specifically for the direct assay of cholesterol-LDL without sample pretreatment.

During the first phase, only the non-LDL cholesterol are solubilized by detergent. The thus generated cholesterol, subjected to an enzymatic reaction, produces a colorless reaction.

During the second phase, a specific detergent solubilized LDL cholesterol. Genetic chromo torque develops a colored reaction proportionally to the concentration of LDL cholesterol. Playback is at 546nm.

LDL cholesterol (g / l) = (Change abs.sample) / (Change abs.standard) x standard concentration

Triglycerides

Principle

Method of Fossati et principle coupled to a Trinder reaction. The absorbance of the colored complex is proportional to the triglyceride concentration in the échantillon.il is measured at 500 nm.

[ProtéineT] (g / l) = (abs.dosage) / (abs.etalon) x standard concentrations

Processing and Analysis

Statistica 7.0 software and Microsoft Excel 2007 software on Windows 7. The statistical test used to interpret the results is the analysis of variance ANOVA test to a degradation factor for all other variables analyzed. In the latter case any significant change brought us to the TUKEY test to know the meaning of significance is set at $p < 0.05$.

3. RESULTS AND DISCUSSION

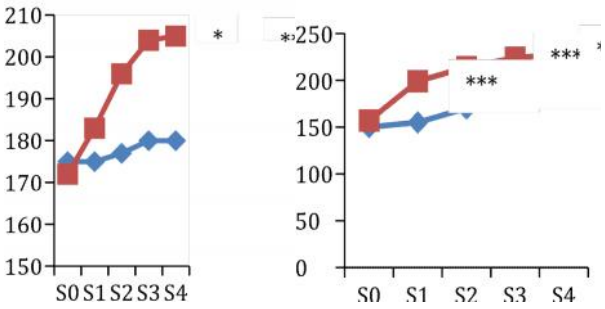
Performance of Extraction

To 100 g bark powder *Sclerocarya birrea* weighed, we obtained 0, 091g aqueous extract of red wine and appearance powder or a yield of 9.1%

Effect of Diet on Rats Cafetaria Wistar

Evolution of Body Weight of Rats

Figure No.1 below shows the change in body weight of rats in function of time. At the beginning of the experiment, body weight shows a slight increase in the rats consuming the standard diet compared to rats subjected to the cafeteria diet. However, the body weight of rats consuming the hyper fatty diet increases with time (in weeks) compared to the standard regimen. The cafeteria diet induced a significant increase in body weight of rats on this diet. In male rats the increase is observed from the first week against female rats is observed from the third week.



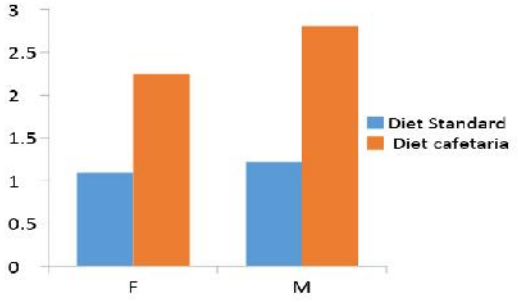
* P ≤ 0.05 (significant difference); ** P ≤ 0.01 (very significant) *** p≤0,001 (highly significant)

Fig 1: Curve showing the cafeteria effect of diet on the development of body weight over time (weeks)

DETERMINATION OF BIOCHEMICAL PARAMETERS IN RATS EXPERIMENTAL AND WITNESSES

Levels of glucose (g / L)

Figure No.2 below shows the blood sugar content in rats subjected to the cafeteria diet and rats eating the standard diet .We an increase in blood sugar content in rats subjected to the cafeteria diet compared to rats consuming the standard regime which either sex. The cafeteria diet induces a very significant increase in plasma glucose levels in experimental rats compared to rats fed the standard diet

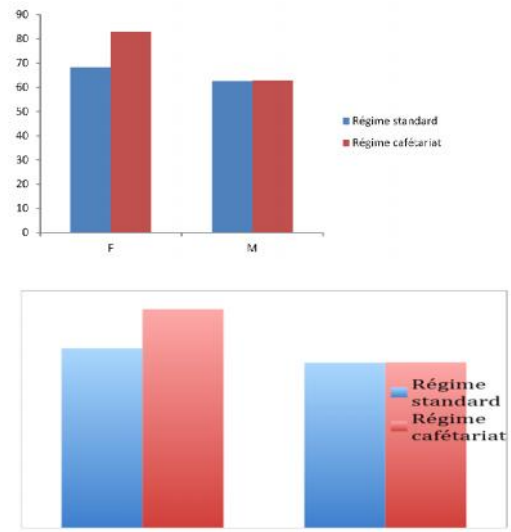


P ≤ 0.05 (significant difference); ** P ≤ 0.01 (very significant) *** p≤0,001 (highly significant)

Fig 2: Histogram showing the effect of diet on blood sugar cafeteria content

Levels of total protein (g / L)

Figure No 3 below shows the serum protein content in rats subjected to the cafeteria diet and rats eating the standard diet. No significant difference is noted at the level of serum protein in rats cafeteria diet rays compared to consuming the standard plans. The cafeteria diet does not induce protein synthesis.

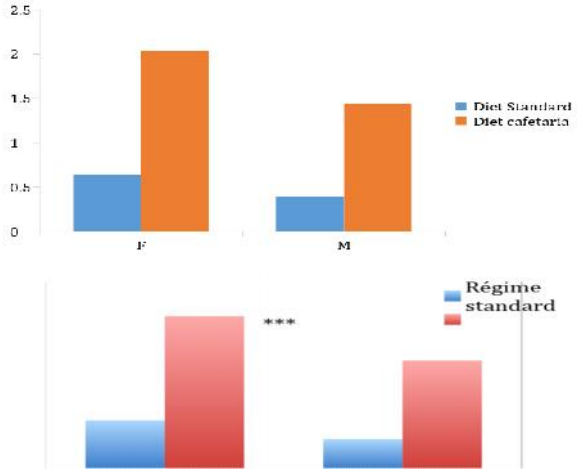


* P ≤ 0.05 (significant difference); ** P ≤ 0.01 (very significant) *** p≤0,001 (highly significant)

Fig 3: Histogram the effect of the cafeteria diet on total protein content

Levels of total cholesterol (g / L)

The control and experimental rats Figure No.4 below shows the total cholesterol content of the rats subjected to the cafeteria diet and rats eating the standard diet. The total cholesterol in experimental rats has variations compared with control values. A very significant increase in total cholesterol was noted in rats at cafeteria diet and rats eating the standard diet.



* P ≤ 0.05 (significant difference); ** P ≤ 0.01 (very significant) *** p≤0,001 (highly significant)

Fig 4: Histogram showing the effect of diet on the cafeteria total cholesterol

Levels of LDL (g / L)

Both in females than in males, there is reduction in LDL cholesterol in rats subjected cafeteria arrangements and the standard regime against male among you has decreased in LDL cholesterol in rats subjected to cafeteria diet and standard diet. These changes have no statistically significant difference ($p < 0.05$)

* P ≤ 0.05 (significant difference); ** P ≤ 0.01 (very significant) *** p≤0,001 (highly significant)

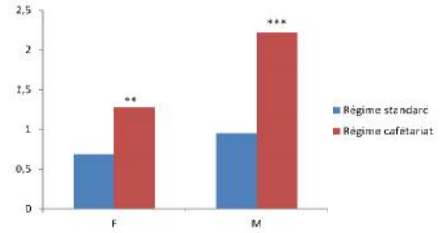
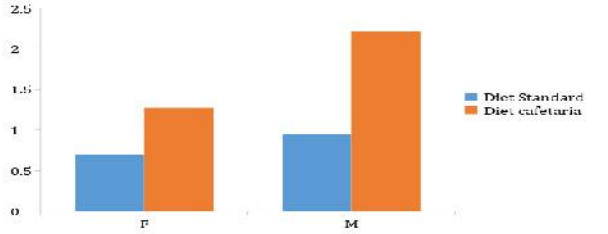


Fig 5: Histogram showing the effect of diet on the cafeteria LDL cholesterol

Triglyceride content (g / L)

Figure No.6 below shows the total cholesterol content of the rats subjected to the cafeteria diet and rats eating the standard diet. There was a significant increase in the two sex; this increase is very significant in males with ($p < 0.001$).



* P ≤ 0.05 (significant difference); ** P ≤ 0.01 (very significant) *** p≤0,001 (highly significant)

Fig 6: Histogram showing the effect of diet cafeteria on the triglyceride content

EFFECT OF AQUEOUS EXTRACT *Sclerocarya birrea* ON RATS SUBMITTED TO THE SYSTEM HYPER-GRAS

EFFECT OF THE EXTRACT ON THE GROWTH OF RATS

Figures No. 7 and 8 below show the changes in body weight of rats in function of time. In males (fig # 16) there is a statistically significant decrease in body weight in rats subjected to diet cafeteria reports by the rats eating the standard diet. This decrease was observed from the seventh day of feeding. In females (fig # 17), the aqueous Sclerocarya birrea induced no significant change in body weight extract (in grams) of the rats subjected to the cafeteria regime by reporting the rats consuming the standard diet

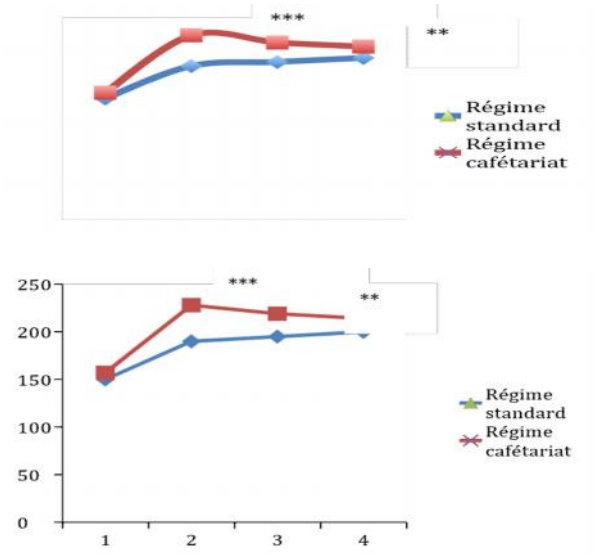


Fig 7: Curve showing the change in body weight in male rats during the water extract in treatment Sclerocarya birrea with time

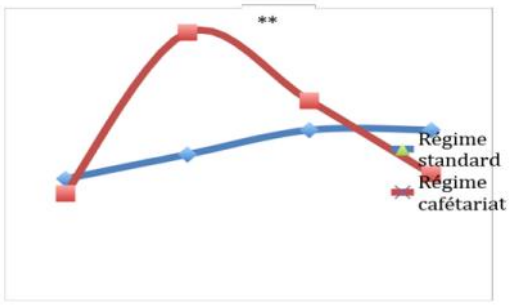


Fig 8: Curve showing the change in body weight in rats and female during processing in the aqueous extract of *Sclerocarya birrea* over time.

EFFECT OF THE EXTRACT ON BIOCHEMICAL PARAMETERS

After fourteen (14) days of gavage we found that the administration of aqueous extract of Sclerocarya birrea resulted in a highly significant ($p < 0.001$) in the parameters that are glucose (Figure No. 9); triglycerides (Figure No. 10); total cholesterol (Figure No. 11) in rats subjected to diet + extract compared to rats cafeteria diet both in males than in females. Whatever the dose (50 mg, 100 mg, 200 mg, 300 mg, and 400 mg / kg body weight) the pharmacological effect is and remains the same for the biochemical parameters mentioned above regardless of sex some rats. At the protein level (Figure No. 12) in males, the Sclerocarya birea the aqueous extract induced a statistically significant decrease in the doses of 50 mg; 100 mg; and 200mg. It is noted by cons no significant difference for the 300mg and

400mg doses in experimental rats compared with control rats.

In females a significant decrease in the concentration is noted in protein regardless of the extract dose in experimental rats compared with control rats. In males the 50 mg dose of the aqueous extract of *Sclerocarya birea* has resulted in no significant difference. By against the doses of 100 mg; 200 mg; 300 mg; 400mg and have led to a significant decrease in LDL cholesterol (Figure No. 13).

No females administered the aqueous extract of Sclerocarya birrea dose did not induce a significant difference in the LDL cholesterol in the experimental rats compared with control rats.

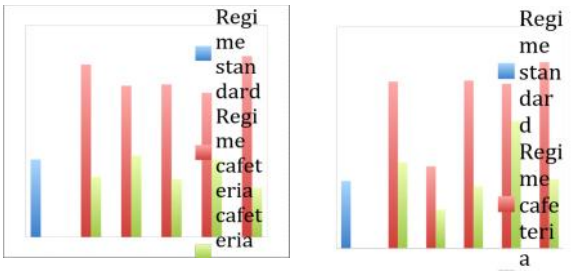


Fig 9: Histogram showing the effect of aqueous extract of *Sclerocarya birrea* on plasma glucose content

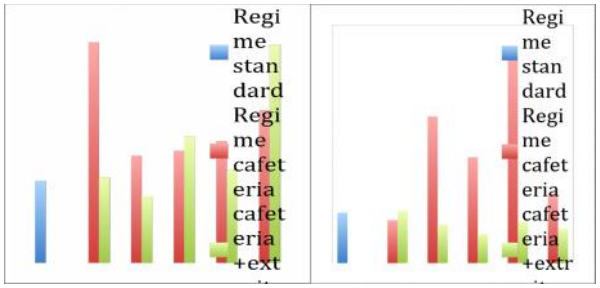


Fig 10: Histogram showing the effect of aqueous extract of *Sclerocarya birrea* on plasma triglyceride content

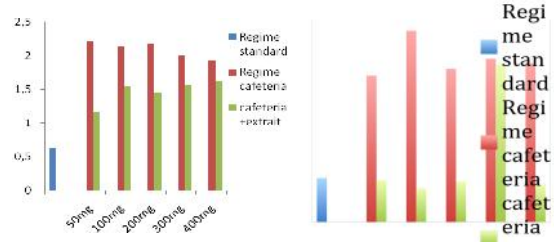


Fig 11: Histogram showing the effect of aqueous extract of *Sclerocarya birrea* on total cholesterol

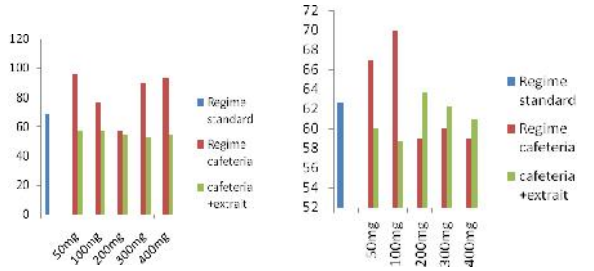


Fig 12: Histogram showing the effect of aqueous extract of *Sclerocarya birrea* on the plasma protein content

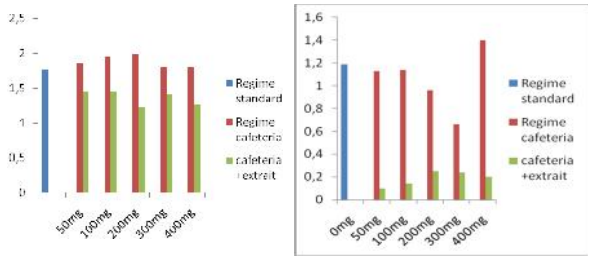


Fig 13: Histogram showing the effect of aqueous extract of *Sclerocarya birrea* on LDL cholesterol

Our study focused on the evaluation of the action of the aqueous extract of the bark of *Sclerocarya birrea* on lipid metabolism of Wistar rats submitted to the cafeteria diet (hyper hyper caloric fat). Our discussion will focus on three points:

* The effect of diet on metabolism cafeteria rats
* The effect of aqueous extract of the bark of *Sclerocarya birrea* on lipid metabolism of wistar rats subjected to diet cafeteria

The prevalence of overweight reached alarming levels around the world, they affect the majority of nations, regardless of their level of development, and rapidly increasing, for men and women (Clarke et al., 2009) [8] and, for all ages. This issue is of concern because obesity is responsible for specific medical conditions that pose a public health problem (Choquet, 2010; Deruelle, 2011). [9, 10]

Obesity models were developed in animals, using various types of diets such as the high glucose diet rich in fat and western (combined glucose / fat) (Aubin, 2009) [11]. These models provide a method for determining the number of underlying mechanisms contributing to the development of diseases associated with obesity. Among diets rich in energy, hyper lipid diets lead easier to gain weight than those with a high sugar content (s. Boozeret, 1998) . [12] To test this state of affairs on rats so that is a good model study on lipid metabolism later in our study we use the cafeteria diet. This diet is one of the experimental models of obesity nutritional currently available. This is a hyper-lipid diet and calorie it has the advantage of being similar to the majority of human cases in whom obesity is prompted by voluntary

consumption of foods high in fat and calories (Darimontet al., 2004) [13].

Our results have shown that the administration of the cafeteria diet for four (4) weeks induced regardless of sex a weight increase in Wistar rats. This increase is significant in males and is statistically observed from the second week in males. The nature of macronutrients plays a key role in the accumulation of fat; In fact, dietary fat has a higher energy value with other macronutrients, which may explain a high fat diet can lead to increased energy intake, and long term resulting in an increase in body fat. This may explain the increased weight

Experimental rats consuming the hyper-lipid diet calorie "cafeteria" in relation to their witnesses consuming the standard diet This is consistent with the work of Milagro et al. (2006) [14] who indicated that a hyper-lipid diet in Wistar rats induced an increase in food intake and body weight with lipid accumulation in adipose tissue. The administration of the cafeteria diet in male Wistar rats and female led to a hyper-glycemia, total High Cholesterol, hypertriglyceridemia very significant. This scheme has led no statistically significant change in levels of serum protein and LDL cholesterol in rats subjected to diet cafeteria and standard diet. Indeed, in obesity, increased lipogenesis is also accompanied by an alteration of the lipolytic adipose tissue function. The bad fat distribution between fat, muscle and liver play a major role in the development of insulin resistance. Sharing the same culture medium by adipocytes and myocytes, causes insulin resistance in muscle cells due to an IRS-1 and decrease of the phosphorylation kinases serine / threonine (Akt). The consequence is a decrease in translocation of GLUT- 4 and therefore of glucose uptake (Dietzeet al., 2005) . [15] This reduction is at the base of high plasma glucose. Also during an IR, FFA increase in traffic due to the inability of insulin to inhibit lipolysis and lower disposal device FFA (Kissebah and Peiris, 1989), [16] this rate increase FFA and glucose increases the concentration of circulating TG (Golayet al., 1987) [17] . This explains hypertriglyceridemia observed in our results in experimental rats consuming high calorie diet hyper lipid over their witnesses consuming the standard diet. Other studies have shown that guinea pigs, the increase in the food lipid content changes the composition of plasma lipoproteins, including increasing the portion of cholesterol esters in the VLDL and LDL, these changes composition lipoprotein are associated with increased activity 3-hydroxy-3-methylglutaryl coenzyme a hepatic reductase (enzyme involved in cholesterol synthesis) hepatic ACAT and plasma LCAT (Fernandez and McNamara, 1991; [18] Fernandez et al., 1995) . [19] In this same case, a slower disappearance of plasma LDL was also observed, as well as a decrease in the number of LDL receptors could explain liver cholesterol induced by a high fat diet (Fernandez et al., 1995). [19] On the other hand, our results show no change in plasma total protein levels in rats subjected to diet cafeteria and standard regime submitted to cafeteria diet and standard diet. Indeed, maintaining the mass of body proteins results from the balance between synthesis and protein catabolism in a rhythm dependent contributions in exogenous nitrogen (Lacoix et al., 2004), [20] and since the regime "cafeteria" is normo- protein, it allows to meet the specific needs of the organism, with nitrogen on one hand, and essential amino acids on the other hand, necessary to maintain a satisfactory physiological function. The main objective of this work is to study the action of Sclerocarya birrea on lipid metabolism.

Sclerocarya birrea is a medicinal plant known for its therapeutic properties in traditional treatment of many diseases. Several ethnobotanical surveys including one conducted particularly in Benin by the team of Sinsin et al (2011) [21] reported its use in traditional treatment of diabetes and swelling in general. The herbal drug used for this purpose within the population considers the leaves, bark and roots. In general, the traditional preparation most commonly used is the tea. So in order to stay in the same pattern as the traditional use made of the plant, we chose to perform an extraction based on the principle of the decoction which joins the principle of preparation of herbal tea. The extraction yield is 9.1%. "Active ingredients which are soluble in water, therefore extractable by solvent. Since water is a polar solvent, the extract obtained mainly contain polar chemical compounds. In addition, the yield is low compared to that of Amadou Adiza (2006), [22] which is 25.47% and Atakpa et al (2015) [23] is 16%. This difference could be explained either by extraction methods. The administration of aqueous extract of *Sclerocarya birrea* for two weeks to rats submitted to cafeteria diet induced a significant decrease in blood sugar content which joined the work of Ndifossap et al (2010) [24] who studied the effect of bluffs Sclerocarya birea on diabetic rats made dependent and insulin. Indeed these authors have shown that administration of aqueous extract of the bluffs Sclerocarya birea significantly decreased the glucose in these diabetic rats. The aqueous extract of the stem bark of *Sclerocarya birrea* has a dependent hypoglycemic activity dose in rats with normal blood sugar and made diabetic with streptozotocin. (Ojewole, 2003; Ojewole, 2004). [5, 6] This anti hyperglycaemic let us suggest that the extract exert their effects in rats treated with cafeterias improving insulin resistance.

The aqueous extract of the bark *Sclerocarya birrea* seems to act on insulin resistance, this led us to say that the likely mechanism of action that we can extract an extra-pancreatic action. As regards the effect of the aqueous Sclerocarya bark extract on serum lipids, observed in rats of groups cafeteria treated with the extract, the rate of triglyceride and total cholesterol decrease significantly by compared to the group of rats untreated cafeteria. The extract tested has an effect on these two parameters, which reduces the risk of hypertriglyceridemia which may be the cause of diabetes and hypertension. However can score no effect on LDL

cholesterol. The effect of the extract on triglycerides and total cholesterol is important since the treated rats are subjected to a high calorie diet comprising more than 30% lipid. an improvement is observed or a decrease in these parameters to adjacent normal range of those observed in the group of control rats. This effect can be explained by improvements in blood sugar and insulin resistance. The effect of extracts *Sclerocarya birrea* on proteins have decreased in the rats treated group cafeteria extract was significantly lower than the group of control rats (standard diet). Whatever the dose used (50mg, 100mg, 200mg, 300mg, 400m) the aqueous extract of the bark of *Sclerocarya birrea* administered to rats had significantly the same effect. Previous work evaluating the anti-diabetic properties of aqueous extract of the bark of *Sclerocarya birea* said that the 200mg dose would have a better effect (Atakpa et al., 2015). [23] These same authors have shown that the aqueous extract of the bark of Sclerocarya birrea activates two signaling pathways that are: insulin dependent Akt and AMPK. The aqueous extract of the bark of *Sclerocarya birrea* activates AMPK (Atakpa et al., 2015). [23] Activation of AMPK promotes the transport of glucose transporters GLUT1 and GLUT4; favors glycolysis, as AMPK inhibits gluconeogenesis and glycogen synthesis. All this helps to lower blood glucose which is consistent with our results. At the level of AMPK activation lipids promotes the capture and oxidation of fatty acids. It also inhibits the synthesis of cholesterol, triglycerides, fatty acids, and lipolysis. All these processes come into consideration for lowering plasma lipids and their return to normal. AMPK also inhibits protein synthesis, which justifies lower plasma protein levels, which is in agreement with the results obtained.

4. CONCLUSION

All of our work has highlighted the beneficial effects of administration of the aqueous extract of the bark of *Sclerocarya birrea* on lipid metabolism. First, we confirmed the lipid-lowering effect of aqueous extract of the bark of *Sclerocarya birrea* on lipid metabolism. Our results indicate that in Wistar rats daily administration of different doses of our extracts, lower biochemical parameters measured in rats with obesity was induced by cafeteria diet. This reduction results in lower blood glucose, total cholesterol, triglycérolémie, and total protein, which were up compared to normal after consumption of the cafeteria diet whose effect on obesity has also been verified.

These results suggest a great hope for the future as they will advise traditional practitioners with respect to doses, duration and mode of administration of *Sclerocarya birrea* for the treatment of patients.

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