



Effect of the Aqueous Extract of *Corchorus olitorius* L. on the Lipid Parameters of Rats Subjected to a Hyperlipidic Diet

Kamenan Koua Christ Delor ^{a*},
Brahima Kouamé Koffi Raoul ^a
and Ackah Jacques Auguste Alfred Bognan ^a

^a Department of Biochemistry-Microbiology, UFR Agroforestry, Jean Lorougnon Guédé University, Côte d'Ivoire.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Advances in physiological data, clinical research and medico-economic findings have led to considering obesity as a pathogenic situation, even a real disease. Measures should be taken to stop the spread of this pathology associated with abnormalities in glucose and lipid metabolism. Thus, a plant species was tested to assess its effect on lipid parameters.

Method: the aqueous extract of the plant *Corchorus olitorius* L. was tested on female rats subjected to a hyperlipidic diet and the biochemical parameters were evaluated. In addition, a phytochemical characterization was carried out.

Results: The high fat diet led to overeating and weight gain. The aqueous extract of *Corchorus*

*Corresponding author: E-mail: kouachristkam94@gmail.com;

olitorius L. contains bioactive molecules, which favored the reduction of plasma and tissue levels of cholesterol, triglycerides, LDL and an increase in HDL levels in rats subjected to a hyperlipidic diet.
Conclusion: The aqueous extract of *Corchorus olitorius* L. has beneficial effects on lipid disorders.

Keywords: High fat diet; lipid parameters; *Corchorus olitorius* L.

1. INTRODUCTION

Obesity has become a pandemic, affecting adults and children all over the world [1]. It is usually the result of an imbalance between calories consumed and calories expended [2]. It is the result of a failure of the system for regulating energy reserves by external (sedentary lifestyle, environment) and internal (neuro-hormonal, psychological, biological and genetic) factors [3]. Obesity is largely due to the westernization of the diet [4,5]. This westernization is accompanied by a significant lipid intake. The epidemiology of obesity is characterized by a spread in almost all countries. Obesity can no longer be considered just a North American phenomenon [6]. It affects all social classes and all countries of the world.

According to the latest WHO estimations, the global prevalence of obesity has almost tripled since 1975. The prevalence of overweight and obesity among children and teenagers aged 5 to 19 has increased dramatically, from barely 4% in 1975 to just over 18% in 2016 [7]. Côte d'Ivoire is not spared by this scourge of modern times. In 2019 abdominal obesity was very common with the population of the center of Côte d'Ivoire, specifically in the city of Bouaké [8]. Current research in the treatment of obesity highlights the areas of dietetics and lifestyle [9]. However, the WHO encourages more research of solutions that turn to traditional treatments based on medicinal plants [10]. For some years, Phytotherapy which is the treatment by plants is gaining momentum and is the subject of such great interest for scientists [11]. Indeed, medicinal plants contain bioactive molecules which are secondary metabolites with high therapeutic activity [12]. Thus the plant species *Corchorus Olitorius* L. used in traditional environment in Côte d'Ivoire for the treatment of some metabolic diseases such as hypertension, stroke, heart failure, motivated this work whose general objective is to evaluate the effect of the aqueous extract of *Corchorus Olitorius* L. on the lipid parameters of rats subjected to a hypercaloric diet. medicinal plants contain bioactive molecules which are secondary metabolites with high therapeutic activity [12].

Thus the plant species *Corchorus Olitorius* L. used in traditional environment in Côte d'Ivoire for the treatment of certain metabolic diseases such as hypertension, stroke, heart failure, motivated this work whose general objective is to evaluate the effect of the aqueous extract of *Corchorus Olitorius* L. on the lipid parameters of rats subjected to a hypercaloric diet.

2. MATERIALS AND METHODS

2.1 Plant Extraction

The plant substance used for this study is a powder obtained from the dried plant of *Corchorus olitorius* L. The animals used were female albino rats of the Wistar strain (*Rattus norvegicus*).

The plant was cleaned, sorted, washed, then dried away from the sun for several days and then ground into powder. The extract was prepared by infusion according to the following protocol: 30 g of plant powder was dissolved in 100 ml of boiling distilled water. The whole was left to stand for 10 min then filtered successively on absorbent cotton and on wattman paper. The filtrate obtained with a concentration of 300 mg/kg of body weight was administered by gavage to the animals.

2.2 Animals Grouping

The distribution of the spleens according to the treatments was made as follows

three (3) batches of four (4) animals each were made up as follows:

- 1 batch of animals subjected to the normal diet receiving distilled water 10mL/kg;
- 1 batch of animals subjected to the hyperlipidic diet (SH) receiving distilled water 10mL/kg;
- 1 batch of animals subjected to the hyperlipidic diet (SH) treated with the aqueous extract of *Corchorus olitorius* L at a dose of 300mg/kg.

2.3 Experimental Design

The extract was administered by gavage twice a day: in the morning and in the evening for three weeks. The weight of the spleens was measured every three days, during the period of the experiment. Twenty-four hours after the last gavage the rats were fasted for 14 hours. The animals were then sacrificed and the blood collected. Blood samples were centrifuged at 3000 rpm for 5 minutes. The collected serum was aliquoted then sent for the assay of the biochemical parameters to the clinical biochemistry laboratory of the "Institut Pasteur of Cote d'Ivoire.

The phytochemical tests of the aqueous extract were carried out by the technique of qualitative characterization of the coloration. The four main chemical groups saponosides, sterols and terpenes, alkaloids and phenolic compounds were searched.

2.4 Statistical Analysis

Statistical analyzes were performed using Graph Pad Pism 5 Demo software. The results are presented as the mean (\pm). The Student test and the ANOVA test were used for the comparison of means. A value of $p < 0.05$ was considered significant. Significant statistical differences are indicated in Table 2 by a star (*), very significant statistical differences by two stars (**), and very very significant statistical differences by three stars (***)

3. RESULTS

The results summarized in Table 1 show weight gain or loss. The body weight shows significant variations between the different batches of rats. Indeed, the rats consuming the high-lipid diet (RL) have a significantly higher weight than those of the control rats. Statistical analyzes of these values indicate that the rats treated with the extract and subjected to the high-fat diet did not show any significant value on their body weight compared with the control rats.

The results of the lipid parameters are summarized in Table 2. In this table the different values of glycemia (GLU), total cholesterol (CHO), triglycerides (TRIG), and LDL in rats

subjected to the untreated hyperlipidic diet are significantly higher ($p < 0.05$) than those of control rats while HDL decreases.

4. DISCUSSION

The link between health and food is more topical than ever. During recent decades, significant socio-economic changes in most countries have undeniably affected people's dietary patterns and physical activity levels. Experimental and epidemiological data suggest that a diet high in fat promotes the development of obesity and that there is a direct correlation between the lipid intake and the degree of obesity [13].

The analysis of the body weight of rats subjected to the high-lipid diet without treatment leads to a progressive increase in body weight. It is a hyperlipidic and hypercaloric diet associated with an accumulation of adipose tissue and weight gain in both humans and rats [14]. In our study, the high fat diet induces weight gain caused by hyperphagia [15]. The increase in weight in rats fed a high fat diet is associated with the increase in the weight of adipose tissue and its enrichment in lipids, confirming the obesogenic properties of the high fat diet.

A significant increase in the values of lipid parameters such as cholesterol, triglycerides and LDL was observed. Effect Consumption of a high fat diet has caused metabolic disturbances in rats. Hyperlipemia, characterized by an increase in cholesterolemia, triglyceridemia and C-LDL, with a reduction in plasma content of C-HDL is noted. Our results on dyslipidemia confirm those of Wansi (2013) [16]. Hypertriglyceridemia noted in experimental animals may be due to increased hepatic production of very low density lipoproteins VLDL [17], probably linked to a high content of substrates for triglyceride biosynthesis and resistance to the inhibitory effect of insulin on the production and secretion of VLDL. The hypercholesterolemia noted in rats may be due to the activation of HMGCoA (3-hydroxy-3-methyl-glutaryl-CoA), a key enzyme in cholesterol biosynthesis [16]. After oral administration of the extract, a slight increase in body weight is observed on the treated rats compared to the control rats. This weight increase without significant difference is due to the normal growth of the rats.

Table 1. variation in body weight of control rats and rats treated with the extract

	Day 3	Day 6	Day 9	Day 12	Day 15	Day 18	Day 21
Witness	+ 1.16	+0.46	+0.45	+0.19	-0.03	+0.48	+0.45
RL	+ 1.60	+ 1.40	+ 1.80	+ 2.2	+2.4	+2.9	+3.4
RL + Extract	+ 1.11	- 0.59	- 1.16	+0.08	+0.11	+0.46	+0.35

(-): weight loss (+) weight gain

Table 2. Assay of the lipid parameters of the control rats and those treated with the extract

	GLUE	CHO	TRIG	LDL	HDL
WITNESSES	0.73	0.68	0.86	0.18	0.398
RL	0.98**	1***	1.2***	0.22*	0.15***
RL + EXTRACT	0.76	0.50**	0.56***	0.12	0.266***

The phytochemical tests that we carried out revealed the presence of saponosides, sterols and terpenes, alkaloids and phenolic compounds in the extract of *Corchorus olitorius*. Our results are similar to those of Mohamed et al., 2020, which show that the medicinal use of *Corchorus olitorius* is justified by its nutritional virtues: rich in proteins, lipids, carbohydrates, mineral salts, vitamins (A, B1, B2, B3, B5, B9 and C), omega 3 fatty acids, calcium, magnesium, phosphorus, iron, flavonoids, alkaloids, saponosides, polyphenols, anthraquinones, sterols, terpenes, and glucosides cardiotonics [18]. In addition, the plant has biological activities such as antidiabetic activity [18;19], anti-obesity [20].

The extract aqueous *Corchorus olitorius* L. leads to a significant decrease in serum cholesterol and triglyceride levels on treated rats, showing a hypolipidemic effect of the extract. The phytochemicals of the aqueous extract of *Corchorus olitorius*, such as saponins have anti-hyperlipidemia, anti-hypercholesterolemia, hypotensive and cardio-depressant properties according to the work of Price et al., 1987 and those of Özlem and Giuseppe, 2007 [21;22]. In addition, some studies have attested that saponins have an anti-obesity property [23]. The anti-hypercholesterolemia effect of saponins may be due to the inhibition of the activity of acyl-CoA cholesterol acyl transferase (ACAT) [24], and due to the inhibitory effect of saponins on the absorption of cholesterol [25].

The presence also of alkaloid in the aqueous extract of our plant could be at the origin of the fall of the cholesterol and triglyceride levels by the increase in the expression of hepatic receptor of low density lipoproteins in LDL and inhibited lipid synthesis in human hepatocytes through activation of AMPK [26]. Indeed the hypocholesterolemic action of our plant extract is perhaps due to the improvement of the secretion

of cholesterol in the bile or to the inhibition of the biosynthesis of hepatic cholesterol or to the inhibition of the intestinal absorption of cholesterol. As for the hypotriglyceridemic effect, it can be attributed to the improvement of hepatic lipoprotein catabolism or to the inhibition of VLDL secretion by the liver. The work of Heidarzadeh et al., 2013 showed that phenolic, steroidal, terpenic and glycoprotein compounds present in medicinal plants have good fat reduction properties [27]. These results are in agreement with our results.

5. CONCLUSION

This work consisted in the study of the effect of the aqueous extract of *Corchorus olitorius* L. on the lipid parameters of rats subjected to a hyperlipidic diet. This allowed us to show that the hyperlipidic diet leads to weight gain as well as a significant increase in lipid parameters such as triglycerides, total cholesterol and LDL. The aqueous extract of the *Corchorus olitorius* L. plant induces hypolipidemia by reducing these parameters for doses equal to 600 mg/kg of body weight. Alkaloids could be the basis of the antihyperlipidemic activity of our plant.

ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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