Journal of Food and Nutrition Sciences
2025, Vol. 13, No. 5, pp. 237-245
https://doi.org/10.11648/j.jfns.20251305.12

Research Article

Evaluation of the Nutritional and Physiological Impact of Oil Extracted from the Seeds of *Citrullus Lanatus* (Cucurbitaceae) in the Wistar Rats

Robet Emilie Jocelyne[1, *], Nagalo Ousmane[1], Abale Louise Christelle Akouasso[1], Meite Alassane[2], Amoikon Kouakou Ernest[2]

[1]UFR Sciences et Technologies, Université Alassane Ouattara, Bouaké, Côte d'Ivoire
[2]UFR Biosciences, Université Félix Houphouët Boigny, Abidjan, Côte d'Ivoire

Abstract

Citrullus lanatus (Cucurbitaceae) seed oil, pumpkin seeds, is classified among the linoleic and linolenic oils. This work aims to promote dietary diversification through the consumption of local food products. The evaluation of the nutritional and physiological impact of the oil was therefore carried out. To do this, the study of nutritional parameters, the dosage of serum metabolites and the biometry of the nutritional regulatory organs are carried out in rats. The nutritional parameters reveal that this oil leads to regular growth during the 21 days of experimentation. Then, associated with carbohydrates, this oil is able to ensure satisfactory energy coverage allowing an optimum concentration of proteins in the formulated food, thus improving its efficiency (6.97 ± 0.47 g; 0.22 ± 0.02; 0.52 ± 0.01; respectively the dry matter ingested, the food efficiency coefficient and the lipid efficiency coefficient). Finally, its consumption does not cause any disturbance of metabolic activity (5.10 ±0.02 g/L; 48.7 ±0.47 mg/L; 5.6 ±0.32 g/L; 0.95 ±0.34 g/L; 0.98 ±0.02 g/L; respectively for uremia, creatinine, blood sugar, triglyceride content, total cholesterol content) nor any hypertrophy of the organs regulating nutrition. Ultimately, *Citrullus Lanatus* oil (Cucurbitaceae) is a healthy oil, which, like Sunflower oil, could be recommended in the diet of populations in Côte d'Ivoire.

Keywords

Citrullus Lanatus, Oil, Growth, Healthy, Côte d'Ivoire

1. Introduction

Since 2009, African oil needs have continued to increase due to the growing African population and rising living standards [1]. Encouraging these populations to incorporate other, less popular oils into their diets is therefore necessary to maintain a balanced intake of different fatty acids [2].

In Côte d'Ivoire, Citrullus lunatus (Cucurbitaceae) seed oil, commonly known as pistachio, is a pure oil, stable at room temperature, and non-drying [3, 4]. It is composed of 73.5% unsaturated fatty acids and 26.75% saturated fatty acids. Unsaturated fatty acids are predominantly linoleic, with an average content of 44.23%, followed by linolenic acid (22.23%) and oleic acid (4.76%) [5]. Saturated fatty acids are mainly represented by lauric acid (17.27%) and stearic acid (6.53%) [6]. This oil therefore has good nutritional quality and could be combined

*Corresponding author: millierobet@gmail.com (Robet Emilie Jocelyne)

Received: 27 August 2025; **Accepted:** 8 September 2025; **Published:** 26 September 2025

with the main vegetable oils for consumption, such as palm oil, cottonseed oil, peanut oil, and shea oil [7].

However, the physicochemical characteristics and fatty acid profile are not sufficient to ensure the safety of *Citrullus lunatus* (Cucurbitaceae) seed oil before its prescription [8]. Further study of nutritional and physiological parameters for growth is necessary to measure the nutritional impact and explore the metabolism of the nutrients that make up this oil. This study was undertaken within this framework.

The objective of this work is to promote dietary diversification through the consumption of local food products. To achieve this goal, the nutritional parameters, serum metabolites, and biometrics of the nutritional regulatory organs of a diet formulated with *Citrullus lanatus* (Cucurbitaceae) oil in Wistar rats will be evaluated.

2. Materials and Methods

2.1. Materials

The materials used consisted of plant material and technical equipment.

2.1.1. Plant Material

Whole and hulled seeds of Citrullus lanatus (Cucurbitaceae) were purchased from the Gouro market in Adjamé (Abidjan District, Ivory Coast). This market is known to be the major supply area for Citrullus lanatus (Cucurbitaceae) in Ivory Coast.

2.1.2. Animal Material

The animals used for the animal experiment were male albino rats (Rattus norvegicus, Muridae, L., 1753), of the Wistar strain. These were 12 growing rats weighing between 60 g and 65 g and aged between 7 and 8 weeks. These animals were obtained from the Nutrition, Pharmacology, and Toxicology Laboratory of the Biosciences Training and Research Unit (UFR) at Felix Houphouët-Boigny University, Abidjan, Côte d'Ivoire.

2.1.3. Technical Equipment

The technical equipment consisted of an oven (MEMMERT, 854 Schwabach, Germany) for food dehydration. A NASCO blender (BL1008AK-CB) was used for seed grinding. A Soxhlet (DÜSSELDORF, Germany) was used for fat extraction. A Büchi ROTAVAPOR R-3 (Switzerland) was used for hexane removal. An extraction flask containing hexane was used to collect the fat. A precision balance (1/100) (DENVER INSTRUMENT, Germany) was used to weigh the rats and food. A dissection kit was used for organ collection and hemolysis tubes were used to collect blood. A refrigerated centrifuge (Alresa Orto, Spain) and a Mindray autoanalyzer (China) were used for blood analyses, and finally, an HP laptop was used for data processing.

2.2. Methods

The methods used relate to oil extraction and animal testing.

2.2.1. Oil Extraction from *Citrullus Lanatus* (Cucurbitaceae)

The seeds were cleaned and then ground in a blender at the Nutrition, Pharmacology, and Toxicology Laboratory. The resulting paste was then introduced into the Whatman cartridge, along with 10 g of the sample. A cotton ball was placed over the cartridge to prevent it from rising during heating. 150 mL of hexane was added to this mixture, and the mixture was connected to the flask and the extractor for 6 hours. The hexane-oil mixture is collected and the solvent is removed by rotary evaporation. The oil is extracted and stored in a cold room. The oil content is given by the following formula:

$$\text{Huile } (\%) = 100 \times \frac{m^2}{m^1} \tag{1}$$

m_1: 10 g of sample
m_2: mass of extracted oil

2.2.2. Animal Experimentation

Experimental Conditions

The experiments were conducted on Wistar rats from the UFR Biosciences animal facility. The temperature in the animal facility was 25℃ to 27℃, and the humidity level in the room was between 70% and 80%, with 12 hours of light and 12 hours of darkness. Before the experiment, the animals were fed pellets manufactured by an Ivorian company after weaning. At the start of the experiment, the animals were between 7 and 8 weeks old. They were divided into groups of six in cages with individual metabolisms. These rats received ad libitum a semi-synthetic mixed formula diet with 12% protein and tap water. Five days before the experiments, they were fed a diet based on Citrullus lanatus (Cucurbitaceae) oil to accustom them to the experimental semi-synthetic formulated diets [9].

Table 1. *Composition of foods formulated with Citrullus lanatus oil (Cucurbitaceae).*

INGREDIENTS	RHCL	RHT
Herring fish powder (g)	19.57	19.57
Citrullus lanatus oil (mL)	5	-

INGREDIENTS	RHCL	RHT
Sunflower oil (mL)	-	5
Cornstarch	60	60
Sucrose (g)	14.095	14.095
Premix (AMIN'TOTAL) (g)	1.33	1.33
Water (L)	1.33	1.33
Total dry matter of foods (g)	1000	1000
Total energy (Kcal/Kg of food)	4190.06	4190.06

Calculated value: Crude fat, 5%; Protein 12% and 40% carbohydrates. RHCL: food formulated with *Citrullus lanatus* (Cucurbitaceae) oil; RHT: food formulated with Sunflower oil. Premix: mixture of vitamins and minerals (AMIN'TOTAL, Laboratoire Boivé; France)

Diet composition

These are two [2] isoprotein diets prepared according to [9], with modifications (Table 1). These are one diet formulated with *Citrullus lanatus* (Cucurbitaceae) oil (RHCL) and one diet formulated with Sunflower oil (RHT), taken as a reference. Indeed, these diets were formulated to contain 5% lipids, 12% proteins, and 40% starch. The protein content is provided by fish powder (12%) and the carbohydrates by corn flour. Micronutrients came from a vitamin and mineral blend (AMIN'TOTAL, Laboratoire Boivé; France). The premix, a vitamin and mineral blend, was incorporated into the feed at a rate of 10 g per 5 kg of feed. Distilled water was added for feed preparation. The levels of the various nutrients were set to meet the minimum needs of rats [10, 11].

Growth Experiment

The growth experiment lasted 21 days [9].

Growth Study

The animals are housed in individual metabolism cages. There are 12 growing rats, with 6 rats per formulated diet. Every morning, between 7:00 and 8:00 a.m., the rats are fed and the water in the bottles is renewed. The feed allocated to each treatment is weighed and given to the rats per group. The next day, the leftovers are weighed to determine the amount of feed ingested. Every three days, the animals are weighed to assess changes in their body weight for up to 21 days.

Expression of Nutritional Parameters

Body Weight Gain (BWG)

Body weight gain (BWG) is determined over a period of 21 days. It is the difference between the final weight and the initial weight.

$$\mathrm{BWG}\left(\frac{\mathrm{g}}{\mathrm{j}}\right) = \frac{Pf(g) - Pi(g)}{21} \tag{2}$$

Pf = Final weight

Pi = Initial weight

Number of days = 21

Dry matter intake (DMI)

The amount of total dry matter intake (DMTI) (g/day) represents the total amount of food ingested in the form of dry matter by the animal during the duration of the experiment.

$$\mathrm{DMTI}\left(\frac{\mathrm{g}}{\mathrm{J}}\right) = \frac{\mathrm{AI\ (g)} - \%\ \mathrm{AR\ (g)}}{21} \tag{3}$$

AI = Food Intake

AR = Food Rejected

Number of days = 21

Total Fat Intake (TLI)

This is the amount of fat derived from the total dry matter ingested and the percentage of fat in the diet.

$$\mathrm{TLI}\left(\frac{\mathrm{g}}{\mathrm{L}}\right) = \mathrm{DMTI} \times \text{Percentage of lipids} \tag{4}$$

Feed Efficiency Ratio (FER)

FER reflects the efficiency with which food is assimilated. In other words, it is the weight gain obtained by ingesting 1 g of food. It is calculated by dividing the weight gain (BWG) (g) by the amount of DMTI (g).

$$\mathrm{FER} = \frac{\mathrm{BWG(g)}}{\mathrm{DMTI(g)}} \tag{5}$$

Lipid Efficiency Ratio (LER)

LER is the efficiency of fat utilization. It is calculated by dividing weight gain (BWG) by total fat (TLI).

$$\mathrm{LER} = \frac{\mathrm{BWG(g)}}{\mathrm{TLI(g)}} \tag{6}$$

Study of the Physiological Effects of Consumption of Formulated Diets

Blood Sample Collection

At the end of the 21-day growth experiment, the rats were fasted for 16 hours. The next day at 8 a.m., they were weighed and then sacrificed by decapitation after ethyl urethane anesthesia. Approximately 5 mL of blood was collected in tubes from the carotid artery. Two types of test tubes were used for the collection. These were purple tubes containing EDTA (ethylenediamine tetraacetate), an anticoagulant for CBC

(Complete Blood Count), and orange tubes containing no anticoagulant for biochemical analyses. This other blood sample was centrifuged at 3000 rpm for 10 minutes for serum metabolite and electrolyte analyses [9].

Organ harvesting and weighing

The animals were sacrificed and their blood was collected. A longitudinal laparotomy (surgical opening of the abdomen) was then performed to isolate the heart, liver, spleen, both kidneys, and abdominal fat. These organs were weighed and stored in dishes containing 10-fold formalin. The organ weights were adjusted to the percentage of the animal's weight obtained during the last weighing of the rats (Meité et al., 2008). The relative weight of the organs (PO) was determined using the following formula:

$$\text{PO}\ (\%) = \frac{\text{Organe weight (g)}}{\text{Animal weight (g)}} \times 100 \qquad (7)$$

Determination of mean serum metabolite values

Serum metabolite assays are based on the blood lipid profile. These include triglycerides, total cholesterol, HDL cholesterol, and LDL cholesterol. Creatinine levels, protein levels, blood urea, and the atherogenic index were also determined. These metabolites were determined using a HITACHI 902 autoanalyzer from Roche, Japan. This device consists of a reagent compartment and a sample, control, and calibrator compartment. The reagent compartment is permanently refrigerated thanks to the permanent power source. The determination of the various elements can be performed kinetically, colorimetrically, or using the ISE (Flame Photometric Option). The analysis device uses standard techniques for determining blood parameters [12].

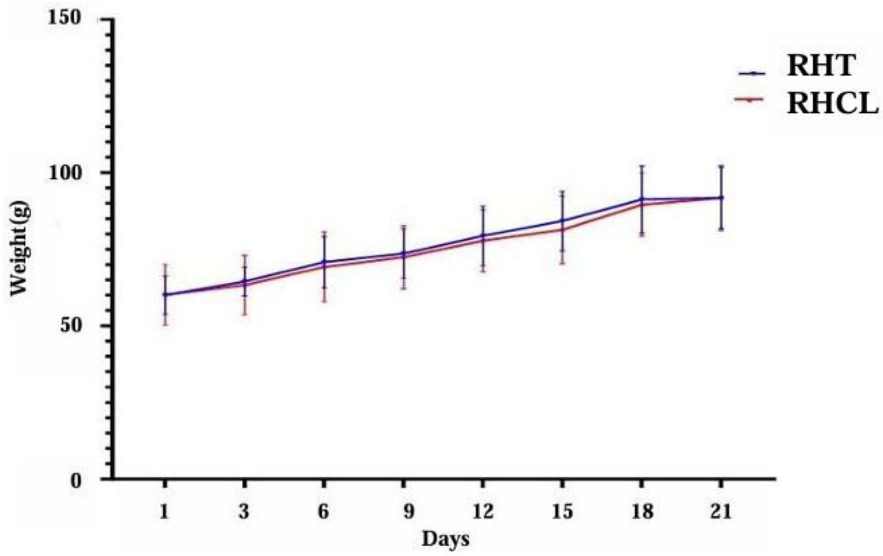
Statistical Analysis

The results presented in this document are in the form of tables and figures. Graph Pad Prism 8 software was used for statistical analyses and to calculate means and standard deviations. Analysis of variance (ANOVA) followed by the Newman-Keuls multiple comparison test of means was used to rank and compare means. Means are always followed by their standard deviations. Two means are significantly different if the probability resulting from the statistical tests is less than or equal to 0.05 ($P \leq 0.05$). The letters a and b in superscript follow the means resulting from the Newman-Keuls test in tables and figures. Means followed by different letters in the same row or column are significantly different.

3. Results

3.1. Growth of Rats Fed Diets Formulated with *Citrullus Lanatus* (Cucurbitaceae) Oil and Sunflower Oil

The rat growth curves show the weight gain of rats fed diets formulated with Citrullus *lanatus* (Cucurbitaceae) and Sunflower oil. These curves show steady growth over the 21 days of the experiment. However, the growth of rats fed diets formulated with both types of oils is virtually similar. Indeed, the weight gain that highlights this growth shows no significant difference (1.49 ± 0.17 g/day; 1.65 ± 0.19 g/day; *Citrullus lanatus* (Cucurbitaceae) and Sunflower oil, respectively) ($P > 0.05$) (Figure 1) (Table 2).



RHCL: food formulated with Citrullus lanatus (Curcubitaceae) oil; RHT: food formulated with sunflower oil. (n=6).

Figure 1. *Evolution of body weight of rats after consumption of the two foods formulated with Citrullus lanatus (Cucurbitaceae) oil and Sunflower oil.*

Table 2. *Mean values of the nutritional characteristics of rats after consumption of food formulated with Citrullus lanatus oil (Cucurbitaceae) and Sunflower oil.*

Parameters	Formulated Food	
	RHCL (n=6)	RHT (n=6)
Body weight gain (BWG) (g/day)	1.49 ±0.17 [a]	1.53 ±0.19 [a]
Dry matter intake (DMI) (g)	6.97 ±0.47 [a]	7.02 ±0.36 [a]
Feed efficiency ratio (FER)	0.22 ± 0.02 [a]	0.21 ± 0.02 [a]
Lipid Efficiency Ratio (LER)	0.51 ± 0.01 [a]	0.52 ± 0.02 [a]

n: Number of rats per treatment. Analysis of variances followed by the Newman-Keuls multiple comparison test at the 5% threshold. On the same line, the means followed by the letters a are significantly identical ($p \leq 0.05$). RHCL: food formulated with Citrullus lanatus (Cucurbitaceae) oil; RHT: food formulated with Sunflower oil.

3.2. Mean Value of Nutritional Characteristics

The mean values of dry matter intake (DMI) (6.97 ±0.47 g; 7.02 ±0.36 g), feed efficiency ratio (FER) (0.22 ±0.02; 0.21 ± 0.02), and fat efficiency ratio (LER) (0.52 ±0.01; 0.49 ±0.02) were statistically identical for feeds formulated with *Citrullus lanatus* (Cucurbitaceae) oil and sunflower oil, respectively ($P > 0.05$) (Table 2).

3.3. Mean Values of Serum Metabolites in Rats Fed Diets Formulated with *Citrullus Lanatus* (Cucurbitaceae) Oil

Table 3. *Mean value of serum metabolites of rats.*

Parameters	Formulated Food	
	RHCL (n=6)	RHT (n=6)
Protein g/L	65.33 ± 3.47 [a]	60.33 ± 4.99 [b]
Bun g/L	5.10 ± 0.02 [a]	5.01 ± 0.04 [a]
Creatinine mg/L	48.7 ± 0.47 [a]	49.4 ± 0.47 [a]
Total Cholesterol g/L	0.98 ± 0.02 [a]	0.97 ± 0.06 [a]
HDL Cholesterol g/L	0.27 ± 0.04 [a]	0.29 ± 0.03 [a]
LDL Cholesterol g/L	0.45 ± 0.05 [a]	0.56 ± 0.05 [a]
Glucose g/L	5.6 ± 0.30 [a]	5.4 ± 0.34 [a]
Triglycerides g/L	0.95 ± 0.34 [a]	0.98 ± 0.19 [a]

n: Number of rats per treatment. Analysis of variances followed by the Newman-Keuls multiple comparison test at the 5% threshold. On the same line, the means followed by the letters a are significantly identical ($p \leq 0.05$). RHCL: food formulated with *Citrullus lanatus* (Cucurbitaceae) oil; RHT: food formulated with Sunflower oil.

The values of blood urea (5.10 ±0.02; 5.01 ±0.04 g/L), blood creatinine (48.7 ±0.47; 49.4 ±0.47 mg/L), blood glucose (5.6 ±0.32 g/L; 5.4 ±0.16 g/L), total cholesterol (0.98 ± 0.02 g/L; 0.97 ±0.06 g/L), HDL cholesterol (0.27 ±0.04; 0.29 ±0.03 g/L), LDL cholesterol (0.45 ±0.05g/L; 0.56 ±0.05g/L), and triglycerides (0.95 ± 0.34g/L; 0.98 ± 0.19g/L) of rats having consumed respectively the diet formulated with *Citrullus lanatus* (Cucurbitaceae) oil (RHCL) and the diet formulated with Sunflower oil (RHT) did not show any significant difference ($P \geq 0.05$) between them. However, proteinemia of rats fed with diet formulated with *Citrullus lanatus* (Cucurbitaceae) oil (RHCL) (65.33 ±3.47 g/L) is higher than that obtained in rats fed with diet formulated with Sunflower oil (RHT) (60.33 ± 4.99 g/L) (P ≤ 0.05) (Table 3).

3.4. Organ Biometrics of Rats Fed Formulated Diets

The results indicate that the mean weight of the heart (0.45 ± 0.05%; 0.44 ± 0.01%), liver (3.98 ± 0.39%; 3.92 ± 0.09%), kidney (0.73 ± 0.05%; 0.74 ± 0.09%), spleen (0.58 ± 0.17%; 0.56 ± 0.03%) and abdominal fat (0.71 ± 0.44%; 0.78 ± 0.46%) of rats fed diets formulated with *Citrullus lanatus* (Cucurbitaceae) oil (RHCL) and diets formulated with Sunflower oil (RHT), respectively, are not not statistically different (P ≥ 0.05) from each other (Table 4).

Table 4. *Mean organ weight of rats after consumption of the two formulated diets.*

Organs (% of body weight)	Formulated foods	
	RHCL (n=6)	RHT (n=6)
Heart	0.45± 0.05 [a]	0.44 ± 0.01 [a]
Liver	3.98 ± 0.39 [a]	3.82 ± 0.09 [a]
Kidneys	0.73± 0.05 [a]	0.74 ± 0.09 [a]
Spleen	0.58 ± 0.17 [a]	0.56 ± 0.03 [a]
Abdominal Fat	0.71 ± 0.44 [a]	0.78 ± 0.46 [a]

n: Number of rats per treatment. Analysis of variances followed by the Newman-Keuls multiple comparison test at the 5% threshold. On the same line, the means followed by the letters a are significantly identical (p ≤ 0.05). RHCL: food formulated with *Citrullus lanatus* (Cucurbitaceae) oil; RHT: food formulated with Sunflower oil.

4. Discussion

Nutritional growth parameters were conducted to measure the nutritional impact of the diet formulated with *Citrullus lanatus* (Cucurbitaceae) oil, compared to that formulated with Sunflower oil, on rat growth. The study of physiological parameters allows for the exploration of nutrient metabolism. It consists of an indirect study of the so-called metabolic regulatory organs. Indeed, excess or deficient production of a substance synthesized by an organ, after the consumption of a food, is indicative of a dysfunction of that organ [12].

During animal experiments, the feed formulated with *Citrullus lanatus* (Cucurbitaceae) oil induced a positive effect on the growth of rats. This benefit is observable through the daily weight gains of the animals having consumed the formulated feed. And this growth is comparable to that induced by Sunflower oil. The weight gains obtained (1.49 ±0.17 g/day; 1.55 ± 0.19 g/day; respectively for the feed formulated with *Citrullus lanatus* oil (Cucurbitaceae) and Sunflower oil) are higher than those reported by [9] (0.97 ± 0.32 g/day; 1.03 ± 0.09 g/day) for cereals consumed in Ivory Coast. Such observed values esult from an optimum concentration of proteins in formulated foods, which are capable of ensuring satisfactory energy coverage [9].

The consumption level recorded in this study, that is, the total dry matter ingested (6.97 ± 0.47 g and 7.02 ± 0.36 g); respectively for the food formulated with *Citrullus lanatus* oil and Sunflower oil) are comparable. These results are higher than those revealed by [7] 0.6 ± 0.16 g to 1.18 ± 0.03 g for Cucurbitaceae consumed in Ivory Coast. However, they are lower than those reported for roots and tubers (8.18 ±1.09 g to 22.18 ± 4.72 g) [13]. These results could be explained by the specific characteristics of the foods used. Aroma, flavor, and chemical composition, in particular, significantly influence the consumption of foods [7].

Feed and fat efficiency coefficients, established from weight gains and feed consumption, allow for a better assessment of the efficiency of using the food intake of formulated foods. In this study, the feed efficiency coefficients obtained with foods formulated with *Citrullus lanatus* (Cucurbitaceae) oil and sunflower oil are comparable (0.22 ± 0.02 to 0.21 ± 0.02). These values are higher than those given by [8] in their work on composite bread made with 95% wheat flour and 5% defatted *Citrullus lanatus* (Cucurbitaceae) seed flour (0.11 ± 0.01). These values suggest that, like Sunflower oil, *Citrullus lanatus* (Cucurbitaceae) oil, combined with carbohydrates, is capable of providing satisfactory energy coverage, allowing for optimum protein concentration in formulated foods [14, 15]. In addition, the high values of the lipid efficiency coefficients of foods formulated with *Citrullus lanatus* (Cucurbitaceae) oil

(0.51 ± 0.01), show that this oil, composed of 44.23% linoleic acid, 22.23% linolenic acid and 4.76% acid, improves the efficiency of these foods [6].

The study of physiological effects revealed that the uremia of the diet formulated with *Citrullus lanatus* oil (Cucurbitaceae) (5.10 ± 0.02 g/L) is comparable to that of Sunflower oil (5.01 ± 0.04 g/L) and are within the standards (5.5 ± 1.0 g/L to 5.2 ± 0.7 g/L) set for Wistar strain rats by [17]. The values obtained for uremia suggest that the diet formulated with *Citrullus lanatus* oil (Cucurbitaceae), do not appear to cause renal disorders [9].

The creatinine values recorded in this study are lower than those recorded by [12] (0.70 ± 0.15 g/L to 0.86 ± 0.1 g/L) obtained for cassava-based meals (attieke, attoukpou, and alacali) in Wistar rats. Creatinine is a constituent of muscle protein, eliminated only by the kidneys, and, like blood urea, is used for routine assessment of renal function. The values obtained in this study indicate that creatinine production is relatively constant and very little affected by dietary or tissue protein catabolism. These results thus confirm that formulated diets do not induce any imbalance in renal function [16].

The blood glucose values of rats fed diets formulated with *Citrullus lanatus* (Cucurbitaceae) oil and those formulated with sunflower oil are comparable. These values are within the established standards (5.4 ± 0.8 g/L to 6.0 ± 0.9 g/L) for Wistar rats by [17]. These diets therefore do not cause any major disruption of carbohydrate metabolism. In addition, [18] seed extracts have been shown to exert hypoglycemic properties.

The mean triglyceride values obtained are comparable for the two oils (0.95 ± 0.34 and 0.98 ± 0.19 g/L) studied. These results are close to those obtained by [9] (0.87 ± 0.08 g/L) with yellow corn consumed by populations in Côte d'Ivoire and suggest the absence of a negative impact of the formulated feed studied on lipid metabolism. Furthermore, the values of total cholesterol, LDL and HDL cholesterol are consistent with those revealed by [19] in their work on composite bread made with 95% wheat flour and 5% defatted Citrullus lanatus (Cucurbitaceae) seed flour. Such values are considered low and suggest that these diets do not cause major disruptions in cholesterol metabolism [20, 21]. Furthermore, the cholesterol levels obtained in this study could be due to the presence of linolenic and oleic acids, which act in cholesterol regulation. This fatty acid is involved in the prevention of certain pathologies, notably metabolic syndromes such as type 2 diabetes [9].

The rats that consumed the diet formulated with *Citrullus lanatus* (Cucurbitaceae) oil studied had a liver whose mass (3.98 ± 0.39%) was comparable to that obtained in those fed the diet formulated with Sunflower oil (3.92 ± 0.09%). These values are comparable to those obtained by [9] (3.15 ± 0.47% to 3.51 ± 0.37%) and [24] (3.01 ± 0.57% to 3.37 ± 0.72%). According to them, this is a liver hypertrophy without revealing an anomaly or pathology. Liver enlargement or increased liver weight following overweight are not always pathological [22].

The kidneys of rats fed diet formulated with *Citrullus lanatus* (Cucurbitaceae) oil (0.73 ± 0.05%) and those of rats fed diet formulated with Sunflower oil are comparable (0.74 ± 0.09%). Similar kidney weight values were also found in rats fed millet and rice-based diets consumed in Côte d'Ivoire [23]. These data do not reveal any dysfunction. However, these changes in kidney weight could be attributed to increased activity due to antinutrients that are difficult to metabolize [10].

Rats consuming diets formulated with *Citrullus lanatus* (Cucurbitaceae) oil had spleen weight values (0.58 ± 0.17%) similar to those of rats fed diets formulated with sunflower oil (0.56 ± 0.03%). These values were higher than those of cassava-based diets (0.28 ± 0.01% to 0.28 ± 0.07%) [12]. These results are thought to be the result of hyperactivity of the spleen. The spleen plays a role in immune defenses and is involved in certain metabolisms [9].

Rats fed high-calorie diets formulated with *Citrullus lanatus* (Cucurbitaceae) and Sunflower oil have high adipose tissue accumulations (0.71 ± 0.44%; 0.78 ± 0.46%, respectively). Indeed, a high-calorie diet promotes an increase in body fat, while a low-energy diet prevents the accumulation of abdominal fat. However, the values obtained are not alarming because lipids represent only 5% of the diet. Their presence is therefore less adipogenic [24].

5. Conclusion and Outlook

The evaluation of the nutritional and physiological impacts of *Citrullus lanatus* (Cucurbitaceae) oil in Wistar rats showed that, first, *Citrullus lanatus* (Cucurbitaceae) oil induces a positive effect on rat growth. Second, when combined with carbohydrates, this oil is capable of providing satisfactory energy coverage, allowing for optimal protein concentration in the formulated feed, thus improving its effectiveness. Finally, the consumption of *Citrullus lanatus* (Cucurbitaceae) oil does not cause any metabolic disturbances or hypertrophy of the nutritional regulatory organs. Ultimately, *Citrullus lanatus* (Cucurbitaceae) oil is a healthy oil, which, like sunflower oil, could be recommended in the diet of populations in Côte d'Ivoire. However, it would be interesting to expand this study by evaluating the organoleptic and sensory properties of *Citrullus Lanatus* (Cucurbitaceae) oil in consumers.

Abbreviations

RHCL	Food Formulated with *Citrullus lanatus* (Cucurbitaceae) Oil
RHT	Food Formulated with Sunflower Oil
BWG	Body Weight Gain
DMI	Dry Matter Intake
FER	Feed Efficiency Ratio

LER	Lipid Efficiency Ratio
N	Number of rats per treatment
Pf	Final weight
Pi	Initial weight
AI	Food Intake
TLI	Total Fat Intake
PO	Relative Weight of the Organs

Acknowledgments

I would like to thank the Director of the Biology and Health Laboratory, Mr. YAPI Ahoua, and Mr. Ernest AMOIKON Kouakou, Full Professors at the Biology and Health Laboratory of the Biosciences Department at Félix Houphouët-Boigny University, for supervising this work.

Author Contributions

Robet Emilie Jocelyne conceptualized and wrote the original version of the work.

Nagalo Ousmane contributed to the methodology.

Abale Louise Christelle Akouasso performed the formal analysis.

Meite Alassane provided supervision and validation and provided the necessary resources to complete the work.

Amoikon Kouakou Ernest performed the visualization and writing (review and editing).

Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] Boujemaa, I., El Bernoussi, S., Harhar, H. and Tabyaoui, M. The influence of the species on the quality, chemical composition and antioxidant activity of pumpkin seed oil. Oilseeds and fats, Crops and Lipids. 2020, 27(40), 2-7. https://doi.org/10.1051/ocl/2020031

[2] Bourlieu-Lacanal, C. (2022) Les huiles végétales alimentaires, Journée scientifique Perception sensorielle des lipides et comportements alimentaires, 1-18.

[3] Tay, B. Y. P., Anishas, I. and Zulina, A. M. Oxidative Stability of Refined Red Palm Olein under two Malaysian Storage Conditions. 2020. Journal of Oleo Science. 2020, 69(10), 1209-1218. https://doi.org/10.5650/jos.ess20045

[4] Eze, S. O., Orji, J. N., Okechukwu, V. U., Omokpariola, D. O., Umeh, T. C. and Oze, N. R. Effect of processing method on carotenoid profiles of oils from three varieties of Nigerian palm oil (elaise guinensis). Journal of Biophysical Chemestry. 2021, 12(03), 23-31. https://doi.org/10.4236/jbpc.2021.123003

[5] Robet, E. J., Nagalo, O., Yéboue, K. H., Meité, A., Amoikon, K. E. Nutritional Value of *Citrullus lanatus* (Cucurbitaceae) Seed Oil, Consumed in Côte D'ivoire. American Journal of Food Sciences and Techonology. 2025, 13(4), 100-104. https://doi.org/10.12691/ajfst-13-4-3

[6] Ouattara, H., Atsamo, D. A., Ouattara, B., Kone, V. and Kati-Coulibaly, S. Comparison of the Effects of Cucurbitaceae Seeds Oils and Refined Palm Oil in the Prevention of Cardiovascular Disease Risk. Journal of Nutrition Health Food Sciences. 2022, 10(1), 1-13. https://doi.org/10.15226/jnhfs.2021.001187

[7] Ouattara, H., Atsamo, D. A., Ouattara, B., Kone, V. and Kati-Coulibaly, S. Consumption of Cucurbitaceae Seeds Oils is Better in Risk of Cardiovasular Disease Prevention on Rats Than The Consumption of Re ned Palm Oil, Resarch Square. 2021, 1-15. https://doi.org/10.21203/rs.3.rs-443011/v1

[8] Meité A., Kouamé, K. G., KatiI-Coulibaly, S., Offoumou, A. M. Étude de la valeur nutritionnelle du pain normal et des pains composites contenant de la farine de graines délipidées de *Citrullus lanatus* (Cucurbitacées). Bulletin de la Société Royale des Sciences de Liège. 2028, 77: 80-103. https://popups.uliege.be/0037-9565/index.php?id=595

[9] Robet, E. J. Étude comparée de la composition physico-chimique, des paramètres glycémiques, des effets nutritionnels et physiologiques, chez le rat Wistar, de quelques céréales (blé, maïs, sorgho, mil et fonio) consommées en côte d'ivoire. Ph. D. Thesis, Université Felix Houphouët Boigny, Abidjan Côte d'Ivoire, 2022.

[10] Adrian, J., Rahache, M. and Fragne, R. (1991) Technique d'analyse nutritionnelle. In: principes des techniques d'analyses. Paris, France, Edition Lavoisier TEC et Doc; 1991, 451-478.

[11] Séa, T. B. Rougbo N. P., Kouadio N. J. Envrin B. J. A., Soro Y. R. and Kouamé L. P. Composite Flour Formulated from Roasted Cereal and Leguminous: Effects on Well-being of Young Rats. American Journal of Food and Nutrition. 2020, 8(1), 6-11. https://doi.org/10.12691/ajfn-8-1-2

[12] Yéboué, K. H. Evaluation nutritionnelle, physiologique, et bilan digestif de trois mets à base de manioc (attieke, attoukpou et palacali) chez le rat Wistar. Ph. D. Thesis, Université Felix Houphouët Boigny, Abidjan Côte d'Ivoire, 2018.

[13] Koffi, K. P., Robet, E. J., Yao, A. R., Kouadio, A. P. and Amoikon, K. E. (2020) Comparative study of the nutritional potential of some starchy food (potato, yam, cassava, sweet potato and taro) in rats. International. International Journal of Developement and Research, 10(05), 36108-36112. https://doi.org/10.37118/ijdr.18839.05.2020

[14] Bouafou, K. G. M. Etude de la production d'asticots à partir d'ordures ménagères et de la valeur nutritionnelle de la farine d'asticots séchés (F. A. S.) chez le rat en croissance.. Ph. D. Thesis, Université Felix Houphouët Boigny, Abidjan Côte d'Ivoire, 2007.

[15] Faust, M. I., Johnson, R. P., Stern, S. J. and Hirsch, J. Diet-induced adipocyte number increase in adult rats: a new model of obesity. American Journal of Physiology. 2007, 235(3), 279-286. https://doi.org/10.1152/ajpendo.1978.235.3.E279

[16] Silué, F. E., Ouattara, A., Yéboué, K. H., Ouattara, K., Kati-Coulibay, S. Effect of Cashew Kernel Meal on Blood Biochemical Parameters and Biometry of Organs Regulating Nutritional Metabolism in Laying Hens. American Journal of Food Sciences and Technology. 2023, 11(4), 150-155. https://doi.org/10.12691/ajfst-11-4-4

[17] Janvier L. 2019. Rat Wistar. Consulté le 18 Avril 2025, sur https://janvier-labs.com

[18] Patel, S. and Rauf A. Edible seeds from Cucurbitaceae family as potential functional foods: Immense promises, few concerns. Biomedicine and pharmacotherapy, 2017, 91, 330-337. https://doi.org/10.1016/j. biopha.2017.04.090

[19] Meité, A., Dally, T., Ouattara, H., Bouafou, K. G. M., Kouamé, K. G., and Kati-Coulibaly. S. Paramètres biochimiques sanguins et biométrie des organes des rats soumis aux pains fortifies avec la farine de graines non délipidées de *Citrullus lanatus* (Cucurbitacées). International Journal of Innovative Research and Scientific, 2017, 20(2), 560-567. http://www.issr-journals.org/links/papers.php?

[20] Brennan, M. A., Menard, C., Roudaut, G. and Brennan, C. S. Amaranth, millet and buckwheat flours affect the physical properties of extruded breakfast cereals and modulate their potential glycaemic impact. Starch-Starke, 2012, 64: 8-392. https://doi.org/10.1002/star.201100150

[21] Seyrek, K., Yenisey, C., Serter, M., Kargin-Kiral, F., Ulutas, P. A. and Bardakcioglu, H. E. (2004) Effects of dietary vitamin C supplementation on some serum biochemical parameters of laying Japanese quails exposed to heat stress (34.8℃). Revue de Médecine Veterinaire. 155(6): 339-342. https://www.researchgate.net/publication/289454430

[22] Gorpinath, C. and Mowat, V. Atlas of toxicological pathology. New York, USA, Springer Science+Business Media; 2014, pp. 47-76.

[23] Dally, T. Analyse de trois aliments de base des régions Nord, Centre et ouest de la Côte d'ivoire; influence sur la croissance et le maintien chez le rat (Wistar). Ph. D. Thesis, Université Felix Houphouët Boigny, Abidjan Côte d'Ivoire, 2013.

[24] Kouamé, A. C. Approche nutritionnelle à l'amélioration de la prise en charge des diabétiques: composition physico-chimique, index glycémique et charge glycémique des principaux mets traditionnels de Côte d'Ivoire. Ph. D. Thesis, Université Nangui Abrogoua, Abidjan, Côte d'Ivoire, 2015.

Biography

Robet Emilie Jocelyne is a Lecturer-Researcher at the Alassane Ouattara University in Bouaké (Ivory Coast), in the Science and Technology Training and Research Unit. She specializes in Nutrition, Pharmacology, and Toxicology. Her writings aim to promote local foods and natural pharmacological substances.

Research Field

Robet Emilie Jocelyne: Animal Physiology, Nutrition, Pharmacology, Toxicology

Nagalo Ousmane: Animal Physiology, Pharmacology Toxicology

Abale Louise Christelle Akouasso: Animal Physiology, Biology of Reproduction and Animal Development

Meite Alassane: Animal Physiology

Amoikon Kouakou Ernest: Animal Physiology