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Effects of Khaya Tea on Reduction of Obesity and Some Biochemical Parameters of Obeses Rats

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Abstract

Actually, many tea extracts are prepared and used to promote weight loss. The rationale for this usage includes reports that khaya extract inhibit the digestion/absorption of carbohydrate and fat into gastrointestinals tube of rats, then suggest that khaya tea could be a potentially therapeutic alternative in the prevention of obesity caused by a HFD. The investigators in this study tested the potential of increasing doses of three extracts concentrations (3.3mg/Kg, 6.6mg/Kg, and 9.9mg/Kg of khaya tea) to induce weight loss, steatorrhea, and blood lipid alterations in obeses rats ingesting a high-fat diet. After the 90 days on the HFD, the animals were treated with 3.3mg/Kg, 6.6mg/Kg and 9.9mg/Kg of body weight of khaya tea. The time course of the body weight and obesity-related biochemical parameters were evaluated. The animals were fed with a standard diet (SD, n= 6) or high-fat diet (HFD, n= 6) for 90 days. After 90 days of treatment with 3.3mg/Kg, 6.6mg/Kg and 9.9mg/Kg of body weight, Khaya tea decreased average 68.4% of the changes in body weight (expressed as % of initial body weight) ($P< 0.05$). In the blood, Khaya tea decreased ($p <0.05$) 9% of total cholestérol with a efficace dose of 6.6 mg / kg, and 26.30% of LDL-cholestérol. While it increased ($p <0.05$) 33% of HDL-cholestérol with efficace dose of 9.9 mg / kg. Then Khaya tea decreased the triglycerides serum of 34.78% (3.3 mg / kg), 11.60% (6.6 mg / kg) and 7.24% (9. 9 mg / kg) with efficace dose of 3.3 mg / kg. Khaya tea reduice significately average of 18% the risk of myocardial infarctus, and of 36.61% the risk of coronary heart disease with efficace dose of 6.6 mg / kg of khaya tea.These results confirmed that: khaya tea could be a therapeutic alternative in the treatment of obesity caused by a HFD.

Keywords: KHAYA Senegalensis; Khaya Tea; Obesity; Weight Loss; Biochemical Parameters; Bioactives components; Obeses Rats

Abbreviations: HFD: High Fat Diet; SD: Standard Deviation; KT: Khaya Tea; BMI: Body Mass Index; ASAT: ALAT, CT, c-LDL, c-HDL, TAG, GPT, GOT

Introduction

The treatment of obesity advocates regime change as the first approach to therapy; it clearly recommends the introduction of a lipid-lowering agent (synthetic or natural) in therapy [1]. Catechins found mainly in green tea stimulate the catabolism of lipids in the liver [2]. According to [3] catechin supplementation with green tea reduces body weight, fat tissue, liver lipids, hyperglycemia and hyperleptinemia in mice. At the same time [4] report that Stachytarpheta cayennensis tea has a ($p<0. 05$) hypocholesterolemic and hypoponderal effect in rabbits. However, given the new trend of modern and African societies to feed and treat themselves using natural products known as "organic" with low toxicity, we are witnessing the emergence of so-called "functional" foods (teas for example), several studies of which in many countries have demonstrated their beneficial performance in dietary interventions [5]. This is the case in Cameroon, where following a population survey, several plants have the potential to be used in obesity management; this is the case *Khaya senegalensis*.

Commonly known as Dry-zone mahogany, Senegal mahogany, Gambia mahogany, *K. senegalensis* is an important multipurpose tree particularly value for timber [6]. It is naturally distributed from West to East Africa and cultivated as ornamental, roadside or timber tree in many countries out of its natural area including Egypt, Astral African countries, Madagascar, India, Indonesia, Vietnam, Sri Lanka and Australia [7]. It is commonly used by traditional healers in West and Central Africa to treat several diseases of which malaria, tumor, chronic wound, hookworms, syphilis, headache and stomach upset [6,8]. It is also used by traditional practitioners and populations as a slimming tea [9].

Extracts of this plant exhibit antioxidant, antifungy and antimicrobial activities [8,10]. They content several bioactive compounds extract of seed oil content alkaloids, tannins, flavonoids, saponins, phytates and oxalates with lacking of glycosides [8]. The stem bark contains, phenolic compounds, Sulfurous acid, decylpentyl ester, n-Hexadecanoic acid, 1-Pentadecanol, 13,16-Octadecadienoic acid, methyl ester , Oleic acid, Octadecanoic acid, Dodecanoyl chloride and cis-11-hexadecenal [11]. These compounds and others can justify the medicinal potential of *K. senegalensis*. According to literature, these extracts inhibit the activity α-amylase, decrease bowel motility in some blood and serum enzyme (Aspartate transferase, Alanine transferase and Alkaline phosphatase) that can justify their uses against diabetes [12]. This predicts that Medium-term consumption of Khaya tea can reduces obesity, without effect on the liver and kidneys. It is then interesting to evaluate *in vivo* the antidiabetic and antiobesity potential of *K. senegalensis* obtained *in vitro*. The objective of the present study is to evaluate the impact of the medium-term consumption of Khaya tea on the evolution of obesity and some markers of harmfulness in obese male rats.

Methods and Procedures

Khaya Tea Preparation and Administered Doses

The extract of Khaya tea has been prepared [9]. The administered doses refitting on results of [13] which stipule that for 28 days, for the exctract bark's concentration of *Khaya senegalensis* inferior than 10 mg (KT)/ kg of body weight, there isn't sub-chronictoxicity (ASAT, ALAT, creatinin). Therefore, the animals were treated with 3.3mg/Kg, 6.6mg/Kg and 9.9mg/Kg of body weight of khaya tea in later on [14].

Preparation of Orlistat Solution

The orlistat pill (10 mg/kg) has been bought at the pharmacy and has been administrated to animals by dissolution of one pill of atorvastatin in 10 ml distilled water.

Animals and Diets

Thirty-six male 90-day-old Swiss strain rats (Sw/Uni) (240±40g), free of specific pathogens, were obtained from laboratory of Biophysic, Alimentary Biochemistry and Nutrition (ENSAI) of NGAOUNDERE UNIVERSITY-CAMEROON. The animals were maintained on a 12:12 h artificial light–dark cycle and housed in individual cages. After a random selection, the rats were introduced to the standard diet A0 (SD, n= 6) or HFD (n= 30) for 90 gays. The compositions of the experimental diets are shown in Table 1 on (15). Before the 90 days of the HFD, the animals were randomly divided into five subgroups according to the intervention: C0: (group 1 ; n= 6 ; control group) received HFD plus pure water (by gavage), D1 (group 2 ; n= 6) received HFD plus orlistat (10mg/kg; by gavage), D2 (group 3 ; n= 6) received HFD plus an aqueous extract of khaya tea (3.3 mg/kg ; by gavage), D3 (group 4 ; n=6) received HFD plus an aqueous extract of khaya tea (6.6 mg/kg ; by gavage) and D4 (group 5 ; n=6) received HFD plus an aqueous extract of khaya tea (9.9 mg/kg ; by gavage).

All the groups were treated for 90 days and the solutions were administered by intra-gastric gavage. The total food intake by each group was recorded at least three days, and the body weight of each rat was recorded at least three days. At the end of the experiment, the rats have eaten nothing 17 hours before and were deeply anaesthetized by oil's ether and sacrificed. After dissection, the blood were analysed immediatly then, tissues were collected and stored at −80 °C on Pl analyzed. The experiments were performed in accordance with the principles outlined by the Brazilian College for Animal Experimentation. The compositions of the modified experimental diets during induction of obesity in rats or before gavage by khaya tea is contain in a Table 1 shows in [14].

The induction criteria for obesity in male rats as part of this work is based on the work of [15] which states that obesity is directly related to the BMI of adult male Wistar rats the body mass index (BMI) is equal to the ratio of the weight of the rats in grams on the square of the length in centimeters squared rats:

Body mass index rats (BMI) = weight in rats (g) / (Length of rats) 2 (cm^2)

For Index rats body mass index (BMI) of between 0 45 to 0.68 g / cm^2, rats exhibit a normal weight mass while for a higher Body mass index 0.68 g / cm^2, rats are considered obese. The experiment was done on rats for four months, weighing between 350- 400 g. It is very important to remember that for this test particularity lies in the fact that the administration of fat diet with 30% fat is three months and the feeding rats Khaya tea is successively after for three months like showed Table 1 below.

Nutrients	C0: Negative Control	D0: positive control	D1: 10mg / Kg (Orlistat)	D2: 3,3mg / Kg (KT)	D3: 6,6mg / Kg (KT)	D4: 9,9mg / Kg (KT)
	Food Standard (g / kg)	Food Standard (g / kg)	Food Standard (g / kg)	Food Standard (g / kg)	Food Standard (g / kg)	Food Standard (g / kg)
corn starch	397.5	397.5	397.5	397.5	397.5	397.5
dry fish meal (casein)	200	200	200	200	200	200
sucrose	100	100	100	100	100	100
Dextrin	132	132	132	132	132	132

Nutrients	C0: Negative Control	D0: positive control	D1: 10mg / Kg (Orlistat)	D2: 3,3mg / Kg (KT)	D3: 6,6mg / Kg (KT)	D4: 9,9mg / Kg (KT)
palm oil (lard)	-	-	-	-	-	-
Soya oil	70	70	70	70	70	70
Cellulose	50	50	50	50	50	50
Mineral Complex	35	35	35	35	35	35
Vitamins Complex	10	10	10	10	10	10
L-cystine	3	3	3	3	3	3
choline	2.5	2.5	2.5	2.5	2.5	2.5
Feature	-	Gavage H2O	-	-	-	-
Total (g / kg)	1000	1000	1000	1000	1000	1000
Khaya Tea (mg / kg)	0	0	0	3.3	6.6	9.9

Table 1: Khaya tea administration modified protocol after induction of obesity in rats (17)

Biochemical Analysis and Measurements

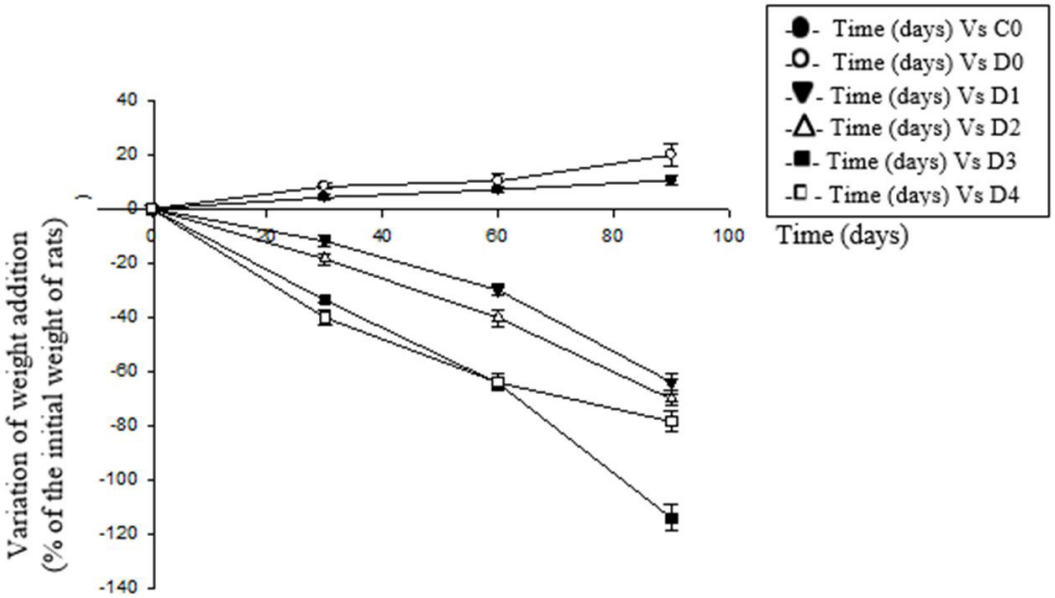
The serum was obtained by centrifugation of the blood at 800 g for 10 min and ALT, AST, creatinine, the total cholesterol, triglyceride, and high-density lipoprotein-cholesterol concentrations were immediately determined using an automatic analyzer (COBAS-MIRA System of Roche Diagnostics, Indianapolis, IN). Low-density lipoprotein (LDL)-cholesterol was calculated from the formula. Food intake was assessed daily and individual body weights were obtained at least three days. Fecal fat was measured at least three days by weighing the rats on scales [16].

Statistical Analysis

The data were expressed as the mean ± s.e.m. Comparisons among the groups of data were carried out using the one-way ANOVA followed by the Dunnett multiple Comparisons test. The statistical significance for the expression of the analysis was also assessed by ANOVA and the differences identified were pinpointed by an unpaired Student's t-test. An associated probability (P value) of <5% was considered significant.

Results and Discussion

Effects of Khaya Tea on Weight Gain



Identification of groups: C0: 5% lipids; D0: 5% fat + placebo; D1: 5% fat + 10 g / Kg of Orlistat; D2: 5% fat + 3.3 mg / kg khaya tea; D3: 5% fat + 6.6 mg / kg khaya tea; D4: 5% fat 9.9 mg / ml of tea khaya

Figure 1: Variation rate of weigth gain during experiment time (90 days)

Figure 1 shows a non-significant increase (P >0. 05) in the weights of groups of rats fattened without extract compared to the group subjected to the normal diet (5% lipids) without extract. The saturated fats contained in the palm oil we used would have contributed to the increase in weight. This confirms that the diet promotes hyperlipidemia, a factor triggering cardiovascular disease by decreasing C - HDL and increasing C – LD L [17]. [18] observed similar results with 8-month-old rats consuming oil

proportions ranging from 5 to 20% for two months. For rats treated with Khaya tea, there was a significant decrease (P < 0. 05) (0-90 days) of 67. 74% (D2: 3. 3 mg /kg khaya tea); 68. 25% (D3 : 6. 6 mg /kg khaya tea); and 69. 23% (D4 : 9. 9 mg /kg khaya tea) respectively of the weight acquired during obesity induction compared to rats not receiving aqueous extract. The negative sign indicates that the animal lost weight during treatment, following the change in hyperlipidic diet on the one hand and on the other hand the effect induced by the aqueous extract of khaya tea following inhibition of dietary cholesterol absorption. This finding was demonstrated by [19] on the mechanism of lipid digestion in pigs.

This decrease in weight is due to the action of catechins which inhibit AG-synthase and reduce visceral lipid deposition and consequently weight according to [2]. But also, this decrease in weight would be also the consequence of the action of inhibitors contained in khaya tea (tannins, saponins) which act on intestinal lipases and glucidases, which supports the inhibition of digestion and absorption of the little lipids and carbohydrates (which will ferment to give fatty acids) contained in food which were found in large quantities in the faeces of rats. These results are consistent with those obtained by [20] on aqueous acacia extract for the same substrates.

Effect of Khaya Tea in Body Mass Index (BMI) of Rats

The following Table 2 provides information on the variation rate of body mass index (BMI) at the beginning and end of the experiment in rats Khaya tea.

BMI rats (g / cm²)	C0	D0	D1	D2	D3	D4
Initial IMI (Day 1)	0.69	0.71	0.98	0.97	1	1.15
Final BMI (90 days)	0.87	0.95	0.68	0.69	0.7	0.76
BMI variation	0.18	0.24	-0.3	-0.28	-0.3	-0.39
reduction rate (%)	/	0	20	14.28	20	38.5

-: represents the decline and rise +

Identification of groups: C0: 5% lipids; D0: 5% fat + placebo; D1: 5% fat + 10 g / Kg of Orlistat; D2: 5% fat + 3.3 mg / kg khaya tea; D3: 5% fat + 6.6 mg / kg khaya tea; D4: 5% fat 9.9 mg / ml khaya tea.

Table 2: Change in Body Mass Index (BMI) rats at the beginning and end of the experiment at Khaya tea

This Table shows that at the beginning of the experiment, the Body Mass Indices of rats ranged from 0. 69 to 1. 15 g/cm². These values are greater than 0. 68 g/cm² which is the threshold value above which rats are considered obese [15]. However, at the end of the experiment, i. e. after 90 days, the BMI of rats receiving increasing concentrations of khaya tea decreased from 14. 28 to 38. 5%, or an average of 24. 26% decrease in BMI in rats. This decrease in BMI is linked to the same phenomena responsible for the weight loss mentioned above.

Effects of Khaya Tea on Serum Parameters, and Abdominal Lipids

Effects of khaya Tea on Plasma Cholesterol (Total, LDL and HDL) (Table 3)

Parameters	C0	D0	D1	D2	D3	D4	Rate (%)
CT (mg /dL)	51 ± 3^{a}	55 ± 5^{b}	48 ± 3^{a}	52 ± 3^{a}	48 ± 3^{a}	57 ± 3^{b}	9
C-LDL (g / L)	$0,25\pm0,01^{b}$	$0,27\pm0,02^{c}$	$0,20\pm0,01^{a}$	$0,21\pm0,02^{a}$	$0,19\pm0,02^{a}$	$0,20\pm0,02^{a}$	26
C-HDL (g /L)	$0,28\pm0,01^{c}$	$0,20\pm0,01^{a}$	$0,27\pm0,01^{b}$	$0,29\pm0,02^{b}$	$0,30\pm0,02^{b}$	$0,31\pm0,03^{b}$	33

Table 3: Change in plasma cholesterol levels in different rat groups

Effects of Khaya Tea on Plasma Triglyceride (Blood Serum) Levels

The following Table 4 shows the plasma triglyceride reduction rate in rats that received Khaya tea.

Rats groups	C0	D0	D1	D2	D3	D4
T. A. G (mg /dL)	46 ± 3^{a}	69 ± 1^{c}	53 ± 4^{a}	45±4=	61 ± 3^{b}	64 ± 2^{b}
Reduction rate(%)	/	0	23,18	34,78	11,60	7,24

-: represents the decrease and + the increase

Table 4: Change in plasma triglyceride levels in different rat groups

There was a significant decrease (p<0. 05) in blood triglycerides in the groups of rats that received aqueous extract at different blood concentrations of 34. 78% (D2 : 45 mg/dL), 11. 60% (D3 :61 mg/dL), and 7. 24% (D4 :64 mg/dL), respectively, and an effective dose of 3. 3 mg/kg khaya tea compared to their control who did not receive khaya tea extract D0 (69 mg/dL). On the inhibition of Gras synthase Acid and visceral lipid deposition, we can also look at the work of [3] who showed that tea catechins reduce visceral fat deposition by mitochondrial B-oxidation of GA in 11-month-old rats receiving a fatty diet. These results lead us to believe that Khaya tea catechins would reduce visceral lipid deposition by B-oxidation and/or inhibition of AG synthease.

Effect of Khaya Tea on the Risk of Coronary Heart Disease and Atherogenicity

a. Effect of Khaya Tea on Coronary Heart Disease Risk

The following Table 5 shows the rate of reduction in the cardiovascular disease risk index in rats that received Khaya tea.

Rat groups	C0	D0	D1	D2	D3	D4
C.T/HDL	1,82±0,03[b]	2,75±0,05[c]	1,78±0,03[b]	1,79±0,03[b]	1,60±0,02[a]	1,84±0,04[b]
Reduction rate(%)	/	0	35,27	34,90	41,82	33,10

-: represents the decrease and + the increase

Table 5: Rate of change in cardiovascular disease risk index (C.T/ HDL) in different groups of rats (T. H)

The averages on the same line followed by the same letter are not significantly different at the p<0. 05 threshold for all parameters. Identification of groups C0: 5% lipids; D0: 5% lipids + placebo ; D1: 5% lipids + 10 g /Kg Orlistat ; D2: 5% lipids + 3. 3 mg /kg khaya tea ;D3: 5% lipids + 6. 6 mg /kg khaya tea ; D4: 5% lipids + 9. 9 mg /ml khaya tea.

Table 5 presents the experimental results of the total cholesterol to HDL ratio. These values range from 1. 60 to 2. 75 for the test. However, all concentrations of ingested extracts not only significantly reduced (p<0. 05) this ratio in hyperlipidemia compared to the D0 control groups, but also kept it below 5 and consequently reduced the risk of coronary heart disease, because according to [21], the smaller (<5) this ratio, the lower the risk of coronary heart disease. We can therefore deduce that khaya tea extract can reduce the risk of coronary heart disease from 33. 10 to 41. 82% with an effective dose of 6. 6mg /Kg khaya tea.

b. Effect of Khaya Tea on the Atherogenic Index (LDL/HDL) of Male Rats

The following Table 6 shows the rate of reduction of the atherogenic index in rats that received Khaya tea.

Rat groups	C0	D0	D1	D2	D3	D4
LDL/HDL	0,89±0,02[a]	1,35±0,02[b]	0,95±0,01[a]	1,40±0,02[b]	1,36±0,02[b]	1,17±0,03[a]
Reduction rate(%)	/	0	29,63	0	0	13,34

Table 6: Rate of change in atherogenic index of different groups of rats

The averages on the same line followed by the same letter are not significantly different at the p<0. 05 threshold for all parameters. Identification of groups C0: 5% lipids; D0: 5% lipids + placebo ; D1: 5% lipids + 10 g /Kg Orlistat ; D2: 5% lipids + 3. 3 mg /kg khaya tea ;D3: 5% lipids + 6. 6 mg /kg khaya tea ; D4: 5% lipids + 9. 9 mg /ml khaya tea.

Table 6 shows the indexes of the groups of rats treated with Khaya tea extract vary almost not significantly (p<0. 05) (D2 (1. 40) ;D3 (1. 36) ; D4 (1. 17)) compared to the untreated control groups D0 (1. 35). All these values are below the threshold value of 3. 5 (critical point of the atherogenic index). Thus, groups with low atherogenic ratios are less exposed to CVD. According to (23), the LDL/HDL ratio correlates directly with the risk of CVD because an increase in the ratio is directly proportional to an increase in risk. The 13. 34% reduction obtained are similar to those of (24) who affirm that when the total cholesterol /HDL or LDL/HDL ratio is favorable (<3. 5), the level of lipids which compose this ratio is without influence on the risks of coronary heart disease.

Effect of Khaya Tea on Blood Sugar in Male Rats

Table 7 shows the rate of blood glucose reduction in rats that received Khaya tea.

Test sampling time (min)	C0	D0	D1	D2	D3	D4
0	0	0	0	0	0	0
30	56±5	67±3	61±4	46±5	69±3	79±4
60	47±2	72±3	60±4	37± 5	49±4	53±3
120	37±2	62±4	52±2	39±4	35±3	39±2
Reduction rate(%)	/	0	16,12	37	43,54	37,10

-: represents the decrease and + the increase

Table 7: Changes in blood glucose levels (mg/dL) in rats over time

The averages on the same line followed by the same letter are not significantly different at the p<0. 05 threshold for all parameters. Identification of groups C0: 5% lipids; D0: 5% lipids + placebo ; D1: 5% lipids + 10 g /Kg Orlistat ; D2: 5% lipids + 3. 3 mg /kg khaya tea; D3: 5% lipids + 6. 6 mg /kg khaya tea ; D4: 5% lipids + 9. 9 mg /ml khaya tea.

Table 7 above shows that there is a significant reduction (p<0. 05) in blood glucose levels in rats treated with khaya tea extract between 60 and 120 minutes ranging from 37% (D2 : 3. 3 mg /kg khaya tea), 43. 54% (D3 : 6. 6 mg /kg khaya tea), and 37. 10%

(D4 : 9. 9 mg /kg khaya tea) respectively compared to the group of untreated rats. This leads us to believe that the extract could be used to prevent or even fight type 2 diabetes; this reduction could be linked to the antioxidant effect of flavonoids and polyphenols of the aqueous extract of khaya tea on liver fat which will release glucose cell receptors and therefore lead to the consumption of lower blood glucose as stipulated by [24].

Effects of Khaya Tea on Rat Creatinine

The following Table 8 shows the creatinine level. This rate provides information on the kidney health of rats that received Khaya tea.

Parameter	C0	D0	D1	D2	D3	D4
Creatinine (mg/L)	7,80±0,35[a]	8,53±0,25[a]	8,05±0,31[a]	7,20±0,10[a]	7,50±0,40[a]	7,80±0,70[a]

Table 8: Creatinine levels of different rat groups

The averages on the same line followed by the same letter are not significantly different at the p<0. 05 threshold for all parameters. Identification of groups C0: 5% lipids; D0: 5% lipids + placebo ; D1: 5% lipids + 10 g /Kg Orlistat ; D2: 5% lipids + 3. 3 mg /kg khaya tea ;D3: 5% lipids + 6. 6 mg /kg khaya tea ; D4: 5% lipids + 9. 9 mg /ml khaya tea.

The treated groups D2 (7. 20 mg/L), D3 (7. 50 mg/L), D4 (7. 80 mg/L), as well as their standard group D1(8. 05mg/L), have a creatinine level that is not significantly different (p>0. 05) compared to their untreated control D0(8. 53 mg/L). The aqueous extract of Khaya tea at different doses administered (3. 3 ; 6. 6 ; 9 ,9 mg/kg) limits the elevation of creatinine levels in treated rat groups. This explains the antioxidant effect of the aqueous extract of Khaya tea on kidney function at doses administered. These results are consistent with those of [17], who showed a reduction in plasma creatinine levels in rats with oral diabetes for 28 days.

Effects of Khaya Tea on Markers of Harmfulness (Alat, Asat) in Rat Liver

The following Table 9 shows transaminase levels (ALAT, ASAT). These rates provide information on the liver health status of rats that received Khaya tea.

Parameters	C0	D0	D1	D2	D3	D4
ALAT/GPT (U/L)	76±3[a]	78±2[a]	71±2[b]	62±4[b]	66±11[b]	42±4[b]
ASAT/GOT (U/L)	87±2[a]	78±5[a]	67±3[b]	66±4[b]	63±8[b]	60±8[b]

Table 9: ASAT and ALAT levels of different rat groups

The averages on the same line followed by the same letter are not significantly different at the p<0. 05 threshold for all parameters. Identification of groups C0: 5% lipids; D0: 5% lipids + placebo ; D1: 5% lipids + 10 g /Kg Orlistat ; D2: 5% lipids + 3. 3 mg /kg khaya tea ;D3: 5% lipids + 6. 6 mg /kg khaya tea ; D4: 5% lipids + 9. 9 mg /ml khaya tea.

In the previous table, there was a significant decrease (p<0. 05) in ASAT levels between the D2 treated groups (3. 3 mg /kg khaya tea) ;D3 (6. 6 mg /kg khaya tea) ; D4 (9. 9 mg /ml khaya tea) and their standard D1 group compared to their untreated control D0. For ALT, there was a significant decrease (p<0. 05) in ALT levels between the D2, D3, D4 treated groups compared to their untreated D0 control group.

The decrease in ALAT and ASAT levels in the groups treated with aqueous extract compared to the untreated group indicates that at these doses, aqueous tea khaya extract has no toxic effect. This finding is justified by the effect of Portulaca oleraceae on liver function in cholesterol-lowering rats obtained by [25].

Conclusion

At the end of this work, whose objective was to evaluate the impact of the medium-term consumption of Khaya tea on the reduction of obesity and some markers of harmfulness in obese male rats, it emerges in summary that, the medium-term consumption of Khaya tea by obese adult rats, significantly reduced (P<0. 05), the weight of abdominal fat, and increased excretion of fecal lipids on the one hand. And on the other hand, reduced blood lipids (TG), reduced bad cholesterol (TC, LDL-C), and increased good cholesterol (HDL-C). Finally, this product is not harmful to the kidneys and liver of rat organs treated with the doses administered in this study. Brief khaya tea effectively reduces obesity in obese male rats and does not show signs of toxicity to their bodies.

The present study demonstrate that medium-term consumption of Khaya tea significantly reduce (P<0. 05), obesity throughout weight of abdominal fat, and increase dexcretion of fecal lipids. It also help to reduced blood lipids (TG), reduced bad cholesterol (TC, LDL-C), and increased good cholesterol (HDL-C). In addition, this product is not harmful to the kidneys and liver of rat organs treated with the doses administered in this study. Brief khaya tea effectively reduces obesity in obese male rats and does not show signs of toxicity to their bodies and could have the same effects to the person.

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References

1. Tcheriatchoukine Dimitri (2010) Obesity: recent discoveries relating to the molecular mechanisms behind new therapeutic strategies: These, Presented and supported to obtain the State Diploma of Doctor of Pharmacy. Henry Poincare-Nancy-1 University. (L'obésité: découvertes récentes relatives aux mécanismes moléculaires à l'origine de nouvelles stratégies thérapeutiques: These, Présentée et soutenue pour obtenir le Diplôme d'Etat de Docteur en Pharmacie. Universite Henry Poincare-Nancy-1).

2. Wang TD, Chen WJ, Chien KL, Su S SY, Hsu HC, et al. (2001) Efficacy of cholesterol levels and ratios in cholesterol fed rats. J Ethnopharmacy 101: 277-82.

3. Murase T, A Nagasawa, J Suzuki, T Hase, I Tokimitsu (2002) Beneficial effects of tea catechins on diet-induced obesity: stimulation of lipid catabolism in the liver. Int J Obesity Relat Metab Disord 26: 1459-64.

4. Chigozie IK, Eloghosa OB, Augusta O (2008) The Hypocholesterolemic Effect of Stachytarpheta cayennensis Tea :Implications for the Management of Obesity and Hypertension. Asian J Biochem 3: 267-70.

5. Kishimoto Y, Tani M, Kondo K (2013) Pleiotropic preventive effects of dietary polyphenols in cardiovascular diseases. Eur J Clin Nutr 67: 532-5.

6. Arnold R (2004) Khaya senegalensis: current use from its natural range and its potential in Sri Lanka and elsewhere in Asia.

7. Poyodi Kola, Kossi Metowogo, Yendubé T Kantati, Povi Lawson-Evi, Mabozou Kpemissi, et al. (2020) Ethnopharmacological Survey on Medicinal Plants Used by Traditional Healers in Central and Kara Regions of Togo for Antitumor and Chronic Wound Healing Effects. Evidence Based Complementary Altern Med.

8. MacDonald Idu, Joseph Omorogiuwa Erhabor, Ovuakporie Uvo Oghale, Nosa Omoregbe Obayagbona (2014) Antimicrobial qualities, phytochemistry and micro-nutritional content of Khaya senegalensis (Desr.) A. Juss seed oil. J Phytopharmacol 3: 95-101.

9. Mache André Gilles, Guiama Valentin Désiré , F Mbofung Carl Moses (2015) Optimization of total polyphenols and tannins content during extraction of Khaya tea (Khaya senegalensis): Effect of water volume, temperature and infusion time. Int J Innovation Appl Stud.

10. Lompo Marius, Traoré Rakiatou, Ouédraogo Noufou, Kini Félix, Tibiri André, et al. (2016) In vitro antioxidant activity and phenolic contents of different fractions of ethanolic extract from Khaya senegalensis A. Juss. (Meliaceae) stem barks. Afr J Pharm Pharmacol 10: 501-7.

11. Blessing Ikoojo Omotoyinbo, Ayoola Ebenezer Afe, Olawale Solomon Kolapo, Oluseyi Valerie Alagbe (2018) Bioactive Constituents of Essential Oil from Khaya senegalensis (Desr.) Bark Extracts. Am J Chem Biochem Eng 2: 50-4.

12. Marcellin Cokou Takin, Sabbas Attindehou, Alphonse Sezan, Sèlidji Eugène Attakpa, Lamine Baba-Moussa (2013) Bioactivity, therapeutic utility and toxicological risks of Khaya senegalensis. Indian J Pharm Biol Res 1: 122-9.

13. Abubakar MG, Lawal A, Usman MR (2010) Hepatotoxicity studies of sub-chronic administration of aqueous stem bark of KHAYA senegalensisin albino rats. Bayero J Pure Appl Sci 3: 26-8.

14. André Gilles Mache, Valentin Désiré Guiama, Carl Moses F Mbofung (2015)Anti-hyperlipidemic and anti-weight gain effects of khayatea on high-fat-diet rats. Int J Innovation Scie 18: 224-31.

15. Novelli LB, YS Diniz, CM Galhardi, GMX Ebaid, HG Rodrigues, et al. (2007) Anthropometrical parameters and markers of obesity in rats. Lab Anim 41: 111.

16. Fernanda Martins, Tatiana M Noso, Viviane B Porto, Alline Curiel, Alessandra Gambero, et al. (2009) Maté Tea inhibits in vitro pancreatique lipase Activity and Hashypolipidemic. Effect on High-fat Diet-induced Obese Mice. Integrative physiology 18: 42-7.

17. Hamlat. N, Neggazi S, Benazzoug Y, Kacimi G, Chaib S, et al. (2008) Hyperlipid diet and atherosclerotic process in Rattus Norvegecus. Science and Technology. (Regime hyperlipidique et processus atherosclérose chez Rattus Norvegecus. Science et technologie.N°27) pp. 49-56.

18. Ghomdim Nzali, C Tchiegang, E Mignolet, C Turu, Y Larondelle , et al. (2012) Study of Bioconversion of Conjugated Linolenic Acid (CLNA) of Ricinodendronheudelotii (Bail.) Seed in Male Rats into Conjugated Linoleic Acid (CLA) Using UV-Vis Spectrometry and Gas Chromatography. Asian J Biochem 7: 194-205.

19. Corring T, Juste C, Simoes Nunes C, Bourdon D (1979) Effect of bile secretion on digestion in pigs. Ann Bio Anim Bioch Biophys. (Effet de la secretion biliaire sur la digestion chez le porc.Ann.Bio.anim. Bioch. Biophys) 19: 1123-30.

20. Waheeb A Daka helallah Mohammand Alharbi, Aisha Azmat (2011) Hypoglycemic and hypocholestérole miceffts of acacia tortilis (Fabaceae) Growing in Makkah. Pak J Pharmacol 28: 1-8.

21. Anderson TJ, IT Meredith, AC Yeung (1995) The effect of cholesterol-lowering and antioxidant therapy on endothelium-dependent coronary vasomotion. N Engl J Med 332: 488-93.

22. Vasu VT, Hiren M, Jyoti TV, Saripta G (2005) Hypolipidaemic and antioxidant effect of EnicostemmaLittorale Blume aqueous extract in cholestrol fed rats. J Etnopharmacol 101: 277-82.

23. Nam BHN, Kannel WB, Dagostino RB (2006) Search for an optimal athorogeniclipid riskprofil: From the Framingham Study. Am J Cardiol 97: 372-5.

24. Protus Arrey Tarkang CJ, Ofogba Lat (2012) Evaluation of hypoglycemic activity and safety of Momordicacharantia(Cucurbitaceae). Afr J Pharm Sci Pharm 3: 2152-7849.

25. Al Hoziriny S. (2008) Protective effect of pursalane on rat lever injury induced by carbon tetrachloride. J Pharmacol 16: 239-45.