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Evaluation Of The Biochemical Composition, Antioxydant Activity And Acute Toxicity Of Ripe Ficus Sycomorus Fruit Harvested In Cote D'ivoire

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Abstract

The objective of this study was to evaluate the nutritional profile and antioxidant activity of these fruits. As well as the pharmacological interest of their extracts. The aqueous and hydroethanolic extracts were obtained by maceration (homogenization) of the fruit puree. The triphytochemistry of Ficus sycomorus fruit extracts revealed the presence of polyphenols, sterols and poly terpenes, flavonoids, alkaloids, catechic tannins and quinone substances. In addition, our fruit extracts are safe for health as the LD50 of the extracts is higher than 5000 mg/kg. The hydroethanol extract of whole fruit had the best polyphenol and tannin contents (290.6±0.36; 215.5±0.54 mg/100g) and the best antioxidant activity. The percentage of free radical inhibition was 89.64% and a reducing power of 114.7 ± 7.36 µmol Trolox equivalent.

Regarding the biochemical composition of the fruits, variations were observed. These were 136 and 144 IU for vitamin A, 0.74 and 0.61 µg/100g for vitamin D, 2.47 and 1.35 mg/100g for vitamin B2, 12.7 and 6.7 µg/100g for vitamin B9. High levels of potassium (235.2 and 239.4 mg/100g) and calcium (32.31 and 38.78 mg/100g) were observed. Zinc and iron were lower in the fruits (0.09-0.1 mg/100g and 0.31-0.37 mg/100g). Values of 55.5 mg and 128.6 mg/100g of polyphenols, 12.03 and 27.6 mg/100g of flavonoids and 43.58 and 47.87 mg/100g of tannins were obtained. The levels of 5.67 and 26.92 mg/100g for phytates and 14.33-27.5 mg/100g of oxalates were obtained.

The results obtained show that the whole ripe fruits of Ficus sycomorus from Cote d'Ivoire have a nutritional and pharmacological importance to be exploited.

Key words*: Ficus sycomorus, fruits, antioxidant activity, biochemical composition, phytochemical.*

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I. Introduction

Health is a priority in the face of challenges such as food insecurity, climate change and biodiversity conservation (WHO, 2021)[1]. And for the prevention of pathologies and better management, nutritional management remains essential. Hence the WHO recommendation for regular consumption of fruit and vegetables. Indeed, the consumption of fruits and vegetables has a health benefit (Dreher, 2018)[2]. However, several fruits are neglected by communities as they are mostly wild.

Figs or fruits of Ficus sycomorus, a wild plant of the Moraceae family found in the northern regions of Cote d'Ivoire (Koné et al., 2005)[3] are an example. The leaves of this plant are used as fodder for ruminants and are widely traded for this purpose (Kassa et al., 2015)[4]. But the fruits are ignored even though they are consumed during famine by a minority.

These fruits are consumed in countries of the sub-region (Abdel-Aty et al., 2019)[5], are reportedly appreciated by the Egyptian population and used to make jam (Abd-el-Hak et al., 2016)[6]. Their consumption is beneficial to health due to their composition in nutrients and bioactive compounds such as antioxidants that help prevent chronic diseases (Akoue et al., 2019)[7]. These compounds would give fruits, pharmacological potentials (Acipa et al., 2013)[8]. Thus, a diet rich in fruits would reduce the risk of heart disease, diabetes and various types of cancer (Ano et al., 2018)[9].

The Ivorian flora contains them but their nutritional and pharmacological importance is not well known by the populations.

Could the ripe fruits of Ficus sycomorus in Côte d'Ivoire help to ensure food security?

The objective of this study was to evaluate the nutritional and pharmacological importance of the ripe fruits of Ficus sycomorus. The phytochemical composition of the fruit extracts, their antioxidant activities and acute toxicity were determined. But also, the biochemical composition and acceptability of these wild fruits whose consumption is unknown in Côte d'Ivoire.

II. Materials And Methods

1. Collection, identification and preparation of plant material

The plant material consisted of Ficus sycomorus fruits collected at maturity from wild plants in fields in Sinematiali in the Poro region of northern Cote d'Ivoire in February 2021. They were identified at the Centre National de Floristique (CNF) of the Université Félix Houphouët Boigny de Cocody with the herbarium number (UCJ012714). The fruits were washed and divided into two batches: one batch of peeled fruits and one batch of whole fruits.

2. Animal material

Nulliparous and non-pregnant female Wistar rats weighing between 109 and 121 g, from the animal house of the Ecole Normale Supérieure (ENS) in Abidjan (Côte d'Ivoire) were used for the acute oral toxicity tests. The ambient temperature was 26-30°C, humidity 40-60% and lighting 12 hours of light and 12 hours of darkness. The animals had free access to continuously available tap water in bottles and to food which is a formulation from bakery bread, corn, fish and soy).

3. Extraction

Preparation of the aqueous extract

The preparation of the total aqueous extract was carried out according to the modified method of Coulibaly et al, (2017)[10]. Five hundred grams (500g) of fruit puree was dissolved in one litre of distilled water. The mixture was then homogenised for 30 minutes using a Binatone brand blender. The homogenate obtained was wrung out in a cloth square and then filtered three times on cotton wool. The filtrate was evaporated at 50°C using a Venticell® type oven. The powder obtained is the total aqueous extract coded AFrE.

Preparation of the hydroethanol extract

The preparation of the total hydroethanolic extract was done under the same conditions as the aqueous extract except that the powder was dissolved in ethanol (70%). The powder obtained is the total ethanolic extract coded EfrE.

4. Phytochemical screening

Phytochemical screening was carried out according to the method used by Mangambu et al. (2014)[11].

Table no1: Phytochemical screening method

Chemical groups	Reagents	Reactions
Alkaloids	Dragendorff Bouchardat	Precipitate or orange coloration Reddish brown precipitate
Polyphénols	Ferric chloride	Blackish blue colouring
Flavonoids	Cyanidin	Pink-orange precipitation
Sterols et les poly terpenes	Liebermann	Green ring
Tannins	Stiasny	Precipitate of flakes
Quinonics	Borntraegen	Red or purple colouring
Saponins	Agitation	Persistent moss

5. Polyphenol and tannin composition of fruit extracts

Determination of polyphenols

The method used is that of Singleton et al (1999)[12]. It consists of weighing 1 g of sample, homogenising it in 10 ml of 70% methanol and centrifuging at 1000 rpm for 10 min. The pellet was recovered in 10 ml of 70% methanol and centrifuged again. The supernatants were then collected in a 50 ml flask and made up with distilled water. 1 ml of methanolic extract is taken and placed in a tube to which is added I ml of Folin-Ciocalteu reagent and the tube is left to stand for 3 min and I ml of 20% sodium carbonate solution is added. The volume was adjusted to 10 ml with distilled water and the tube was placed in the dark for 30 min and the OD was read on a spectrophotometer at 725 nm against the blank. A calibration range was performed using a standard solution of gallic acid at I mg/ml.

Determination of tannins

The method used is that of Bainbridge et al (1996)[13]. It consists of taking 1 ml of supernatant from the extraction of polyphenols and adding 5 ml of vanillin reagent (0.1 mg/ml vanillin in 70% (v/v) sulphuric acid), then leaving the tubes to stand for 20 min in the dark. The absorbance on the spectrophotometer at 500 nm was read against the blank. Finally, a calibration range was carried out using a standard solution of 0.1 mg/ml tannic acid.

6. In vitro antioxidant activities of the extracts

The measurement of the in vitro antiradical activity of the extracts was carried out by the 2,2'-diphenyl-1-picrylhydrazyl (DPPH) test according to the method of Parejo et al. (2000)[14] with some modifications and the FRAP (Iron Reducing Power) test carried out according to the method described by Pulido et al. (2000)[15].

7. Biochemical analyses

Each batch of ripe fruit was chopped using a Sonashi® type chopper and the resulting mash was used for biochemical testing using the modified method of Soro et al. (2018)[16].

Dry matter content

The dry matter content was determined according to the AOAC method (1990)[17]. The samples were weighed (5 g) and dried at 105 °C for 24 h. They were then cooled in a desiccator and weighed. The weight loss was expressed as a percentage of the initial sample weights.

Ash content

The ash content was determined by incineration at 550°C for 6 h according to the AOAC (1990)[17] method. The sample (5 g) was weighed in crucibles previously dried, weighed and placed in a muffle furnace at 550°C for 6 h. After cooling in the desiccator, the whole (crucible and sample) was weighed. The weight of ash was expressed as a percentage of the initial sample weight.

Crude fibre content

According to the AOAC (1990)[17] method, the fruit samples were weighed (2 mg) and 50 ml of sulphuric acid (0.25 N) was added. The resulting solution was homogenised and boiled for 30 min at reflux. 50 ml of sodium hydroxide (0.31 N) was then added and heated to boiling for 30 min at reflux. The extract obtained was filtered through Whatman filter paper and the residue was washed several times with hot water and dried in an oven at 105°C for 8 h. The dry extract was cooled in a desiccator, weighed and incinerated in an oven at 550°C for 3 h. Cooled in a desiccator and the ash was weighed.

Protein content

The protein content of the fruits was determined by determination of total nitrogen according to the AOAC method (1990)[17]. Fruit samples (1g) were mineralized in the presence of 20ml of concentrated sulfuric acid. To the mineralized, distilled water was added. To 10 ml of the solution, 10 ml of 40% NaOH solution was added. Distilled for 10 min in a flask containing 20 ml of boric acid (2%). Titrate the resulting distillate with a 0.01 N sulfuric acid solution until it turns orange. The percentage of total nitrogen and crude protein was calculated using a conversion factor of 6.25.

Digestible carbohydrate

The digestible carbohydrate content is determined by calculation (FAO, 1998) [18].

Energy content

The energy value was determined from the fat, carbohydrate and protein content and protein content of the composite flours using Atwater's conversion factors conversion factors; 4 Kcal/g for protein, 9 Kcal/g for fat and 4 Kcal/ g for carbohydrates as described by Loba et al. (2019) [19].

Total sugar content

Total sugars were determined according to the method described by Zhang et al., (2019)[20].

To 1 ml of aqueous sample was added 1 ml of 5% (v/v) phenol solution and then stirred before adding 5.0 ml of concentrated sulfuric acid. The homogenized solution was placed ten minutes later in a water bath at 30° C. for 30 minutes. The blank was prepared in the same way however, 1 ml of phosphate buffer replaced the sample solution. After homogenization of the reaction medium, the optical density is determined with a spectrophotometer (GENESYS 5) at 490 nm against a control containing no sugar extract. The optical densities are converted into the amount of total sugars using a calibration line obtained from a glucose solution (1mg/ml).

Reducing sugar content

Reducing sugars according to the method described by Coulibaly et al. (2020)[21].

A volume of 1ml of each preparation was brought into contact with 1ml of DNS reagent. The tubes were shaken and brought to a water bath at 100° C. for 5 min. After cooling, 3.5 ml of distilled water were added to the reaction medium. The optical density was read using a spectrophotometer (GENESYS 5) at 540 nm against white. This value is converted into mg of reducing sugars using a calibration curve obtained from a 1 mg/ml glucose solution.

PH

The pH was determined according to the AOAC (1990) [17] principle, using the potentiometric method, using the electrode of a pH meter.

Titratable acidity

The titratable acidity was assessed according to the method described by Dossou et al. (2007) [22] method, titrating with NaOH solution (0.1 N) in the presence of phenolphthalein until the colour turns pink.

Fat-soluble vitamins (A, D, E and K)

They were assessed by HPLC coupled to a fluorimetric detection according to the method described by Arvapally et al., (2020)[23].

To 1.0 g of the sample was added 10 mL of a 10% KOH solution in methanol-water (1:1, v/v).

The fluorimetric detection was made at 455 nm for vitamin A, at 245 nm for vitamin D, at 295 nm for vitamin E and at 312 nm for vitamin K.

Vitamins B1-B2-B3, B5, B6, B9

The method is based on the separation of the four vitamins by reverse phase HPLC using a C18 column and UV detection at 272 nm. The separation was previously optimized according to the polarity and the pH.

To carry out the various tests, 20 µl of solutions of the various vitamins were injected (Arvapally et al., 2020) [23].

Dosage of vitamins C

The method used for the assay is that described by Pongracz et al. (1971)[24]. Ten (10) grams of ground sample are mixed in 40 mL of metaphosphoric acid-acetic acid (2%: w/v), then the mixture is centrifuged at 3000 rpm for 20 min. The supernatant is adjusted to 50 mL with distilled water into a volumetric flask. 10 ml of the solution is titrated with 2,6-dichlorophenol indophenol (2,6-DCPIP) at 0.5 g/L until the color changes to persistent pink for 30 seconds. The 2,6-DCPIP solution is previously calibrated with a pure vitamin C solution at 0.5 g/L.

Minerals

The minerals (Ca, Mg, K, Na, Fe and Zn) were detremined by atomic absorption spectrophotometer according to the method described by Kouassi et al. (2013)[25].

One gram of sample was mineralised in a muffle furnace at 650°C and different sample solutions were prepared. The wavelengths of the elements to be analysed were first defined on the apparatus (424.7 nm for calcium, 248.3 nm for iron, 213.9 nm for zinc, 285.2 nm for magnesium, 766.5 nm for potassium and 589.0 nm for sodium). Then the absorbance of the solutions containing the ash is determined.

Determination of polyphenols

The method used is that of Singleton et al (1999)[12]. It consists of weighing 1 g of sample, homogenising it in 10 ml of 70% methanol and centrifuging at 1000 rpm for 10 min. The pellet was recovered in 10 ml of 70% methanol and centrifuged again. The supernatants were then collected in a 50 ml flask and made up with distilled water. 1 ml of methanolic extract is taken and placed in a tube to which is added I ml of Folin-Ciocalteu reagent and the tube is left to stand for 3 min and I ml of 20% sodium carbonate solution is added. The volume was adjusted to 10 ml with distilled water and the tube was placed in the dark for 30 min and the OD was read on a spectrophotometer at 725 nm against the blank. A calibration range was performed using a standard solution of gallic acid at I mg/ml.

Determination of tannins

The method used is that of Bainbridge et al (1996)[13]. It consists of taking 1 ml of supernatant from the extraction of polyphenols and adding 5 ml of vanillin reagent (0.1 mg/ml vanillin in 70% (v/v) sulphuric acid), then leaving the tubes to stand for 20 min in the dark. The absorbance on the spectrophotometer at 500 nm was read against the blank. Finally, a calibration range was carried out using a standard solution of 0.1 mg/ml tannic acid.

Dosage of oxalates

The method used is that of Odedeji et al. (2020)[26]. It consists of weighing 2 g of sample and homogenizing the sample in 25 ml of H2SO4 (3M) with magnetic stirring for one hour. The mixture is filtered with Whatman filter paper. Then, the filtrate is titrated with a solution of KMn04 (0.05 M) until it turn the color persistent pink.

Phytate assay

The method used is that described by Akpro et al. (2019)[27]. It consists of weighing 1 g of sample and homogenizing the sample in 20 ml of hydrogen chloride (HCL 0.65 N) under magnetic stirring for 12 hours. Then, the mixture was centrifuged at 12000 rpm for 40 minutes. 0.5 ml of the supernatant was removed, to which 3 ml of the Wade reagent was added. The mixture was allowed to stand for 15 minutes and the absorbance was read by using a spectrophotometer at a wave length of 490 nm against a control. A calibration range was made under the same conditions with sodium phytate at 10 µg / mL.

8. Acute oral toxicity

This study was conducted in accordance with OECD Guideline test 423 for the Testing of Chemicals (OECD, 2001)[28]. Two doses were used for this test (2000 and 5000 mg/kg body weight). For each extract, two batches of three female rats were formed. The rats in each batch were given a single oral dose of 2000 and 5000 mg/kg body weight. The controls were given distilled water. The animals were observed individually for the first 30 minutes after administration of the extracts and then regularly for 14 days. The weight of the animal was measured weekly for 14 days.

9. Sensory evaluation of Ficus sycomorus fruits

The ripe fruits of Ficus sycomorus were presented to a panel of 200 amateur students to assess their acceptability. Different sensory characteristics such as presentation, color, smell, taste, aroma, flavor of the fruit were given acceptability ratings according to Watts et al. (1991)[29]; Imane and Bouthaina (2020)[30].

10. Statistical analysis

Statistical tests and graphs were made with the software GraphPad.Prism.V 7.00 and SPSS V.20.0. The results were presented as mean ± errors on the mean. The data were evaluated by the one-way ANOVA method of analysis followed by the Bartlett multiple comparison test and the Chi-square at the 5% level to assess the significance of the observed differences. If $P<0.05$ the difference between the values is considered significant and if $P>0.05$ this difference is not significant.

III. Results

3.1. Phytochemical screening

The result of the phytochemical screening revealed the presence of polyphenols, flavonoids, sterols and poly terpenes in all the extracts. The alkaloids are also present in the extracts with the exception of the AFr extract. The gallic tannins were not revealed in the extracts but catechics are present in the hydroethanolic extracts. As for the quinone substances, they were only revealed in the whole fruit extracts (AFrE and EFrE) of Ficus sycomorus. This result is summarized in Table 2.

Table no2: Phytochemical composition of Ficus sycomorus fruit extracts

	Aqueous extract		hydroethanolic extract	
	AFr	AFrE	EFr	EFrE
Polyphenols	+	+	+	+
Flavonoids	+	+	+	+
Catechic tannins	-	-	+	+
Gall tannins	-	-	-	-
Alkaloids	-	+	+	+
Sterols and terpenes	+	+	+	+
Saponins	-	-	+	-
Quinonics	-	+	-	+

- : absent ; + : present ; AFr : aqueous extract of fruit peled ; AFrE : aqueous extract of whole fruit ; EFr : hydroethanolic extract of fruit peled ; EFrE : hydroethanolic extract of whole fruit

2. Composition of the extracts in polyphenols and tannins

The contents of the extracts in substances responsible for the antioxidant activity are mentioned in Table 3. The results show a significant difference in composition for the same parameter between the extracts of whole fruits and those of fruits peeled. Indeed, the content of total polyphenols and tannins of the different extracts vary respectively between 70.63 and 290.6 mg/100g and between 60.77 and 215.5 mg/100g of dry matter. The highest levels of total polyphenols and tannins were determined in the hydroethanolic extract of whole fruit and the lowest in the aqueous extract of peeled fruit.

Table no3: Composition of extracts in total polyphenols and tannins in mg/100g of dry matter

mg/100g	Total polyphenols	Tannins
AFr	70,63±0,26****	60,77±0,26****
AFrE	78,43±0,37****	67,13±0,67****
EFr	267,2±0,66****	200,8±0,21****
EFrE	290,6±0,36****	215,5±0,54****

Significance levels are expressed as : ****= $p<0,0001$; AFr : aqueous extract of fruit peled ; AFrE : aqueous extract of whole fruit ; EFr : hydroethanolic extract of fruit peled ; EFrE : hydroethanolic extract of whole fruit

3. In vitro antioxidant activities

The capacity of the extracts to inhibit DPPH free radicals, to chelate 50% of free radicals compared to vitamin C and their reducing power are represented by figures 1, 2 and 3 and summarized in table 4. Thus, it is observed that for the same concentration (200 ug/ml), the hydroethanolic extract, the aqueous extract of whole fruit and vitamin C inhibited respectively 89, 64%, 21.6% and 94.5% of the DPPH radicals. The inhibition concentration of the whole fruit hydroethanolic extract is close to that of vitamin C.

For the same concentration, the hydroethanolic extract, the aqueous extract of peeled fruit and vitamin C inhibited respectively 58.11%, 27.84% and 94.5%.

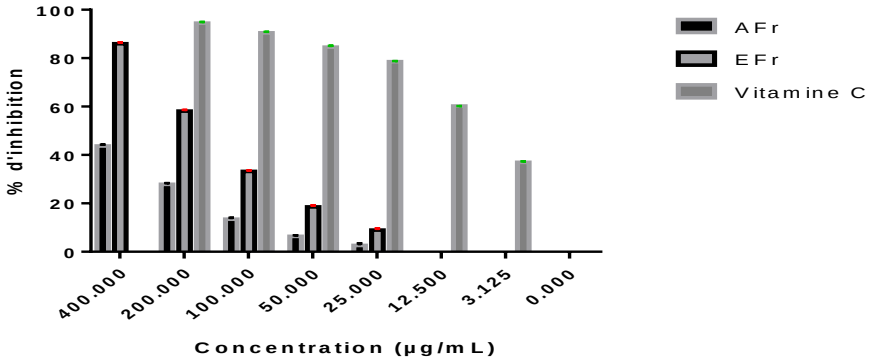

Figure 1 : Activities of peeled fruit extracts on free radicals

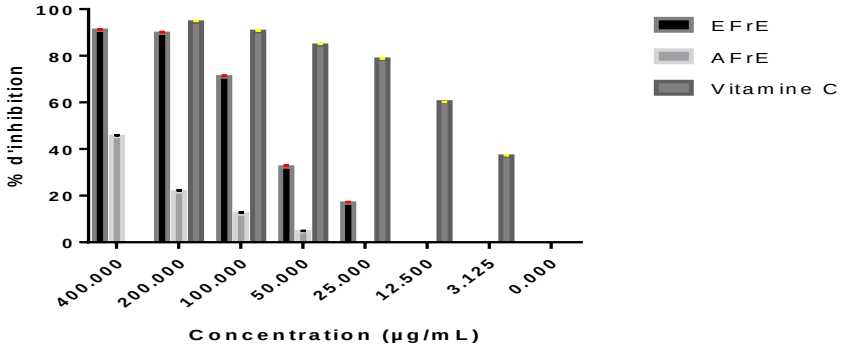

Figure 2 : Activities of whole fruit extracts on free radicals

It is observed in this table that only the hydroethanolic extracts have the ability to inhibit 50% of free radicals in the required doses. The lowest concentration to chelate 50% of DPPH free radicals is that of the hydroethanolic extract of whole fruit.

Table no4: Concentration of fruit extracts to inhibit 50% of free radicals

µg/ml	**AFr**	**EFr**	**EFrE**	**AFrE**
CI_{50}	-	118,6 ± 1,33	59,36 ± 0,53	-

AFr : aqueous extract of fruit peled ; AFrE : aqueous extract of whole fruit ; EFr : hydroethanolic extract of fruit peled ; EFrE : hydroethanolic extract of whole fruit

The hydroethanolic extracts have a high reducing power compared to aqueous extracts of Ficus sycomorus fruits. The hydroethanolic extract of whole fruits has the highest value.

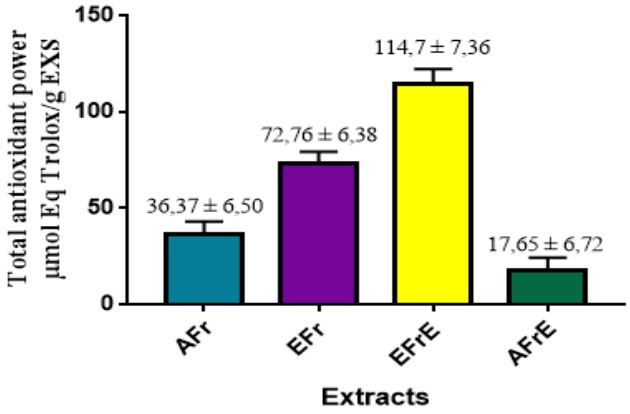

Figure 3 : Reducing power of Ficus sycomorus fruits extracts

4. Biochemical analysis

The biochemical composition of the fruits was assessed to nutritional value. The results are reported in Tables no5, 6, 7 and 8.

The results of macronutrient composition in Table no5 show that whole and peeled fruits have the same value. The difference is observed in the level of ash and fiber with a higher content in whole fruits.

Table no5: Biochemical composition of Ficus sycomorus fruits

	Whole fruit	Peled fruit
Dry matter (%)	90,3 ± 0,11	91,0 ± 0,02
Ash (%)	7,47 ± 0,06	6,67 ± 0,01*
Proteins(%)	3,5 ± 0,0	3,5 ± 0,0
Carbohydrates(%)	86,46 ± 0,0	88,04 ± 0,0
Total sugars (mg/100g)	80,2 ± 0,04	69,73 ± 0,08
Reducing sugars (mg/100g)	32,57 ± 0,05	35,6 ± 0,02
Fibre(%)	2,57 ± 0,02	1,79 ± 0,05*
PH	4,68	4,73
Titratable acidity (meq/100g)	7	9
Content energy (Kcal/100g)	359,84 ± 0,0	366,16 ± 0,0

Significance levels are expressed as : *= p<0,05

The vitamin contents of the fruits were reported in Table no6. The results show that the fruits of Ficus sycomorus contain all the groups of vitamins. However, whole fruits are richer than peeled ones.

Table no6: Vitamin composition of Ficus sycomorus fruits

	Whole fruit	Peled fruit
Vitamin A (UI)	144 ± 0,88	136 ± 0,58*
Vitamin D2 (µg/100g)	0,74 ± 0,02	0,61 ± 0,02*
Vitamine E (mg/100g)	0,09 ± 0,00	0,07 ± 0,01
Vitamin K1 (µg/100g)	3,93 ± 0,03	3,81 ± 0,03
Vitamin C (mg/100g)	2,63 0,24	2,3 ± 0,15
Vitamin B1 (mg/100g)	0,033 ± 0,01	0,013 ± 0,00
Vitamin B2 (mg/100g)	2,47 ± 0,02	1,35 ± 0,02****
Vitamin B9 (µg/100g)	12,7 0,11	6,7 ± 0,11****

Significance levels are expressed as : *= p< 0,05 ; ****= p<0,0001

The table no7 summarises the results of the mineral composition of the fruits. These results show that whole fruits have higher mineral contents than peeled fruits.

Table no7: Mineral composition of Ficus sycomorus fruits

	Whole fruit	Peled fruit
Ca (mg/100g)	38,78 ± 0,03	32,31 ± 0,1***
K (mg/100g)	239,4 ± 0,05	235,2 ± 0,1**
Mg (mg/100g)	16,14± 0,1	15,63 ± 0,05
Na (mg/100g)	0,78 ± 0,01	0,61 ± 0,02*
Ratio Na/K	$3{,}2.10^{-3}$± 0,2	$2{,}6.10^{-3}$± 0,2*
Fe (mg/100g)	0,37 ± 0,01	0,31 ± 0,03
Zn (mg/100g)	0,1 ± 0,01	0,09 ± 0,02

Significance levels are expressed as : *= p< 0,05 ; **= p< 0,01 ; ***= p< 0,001

The results of the phytochemical of the fruits are presented in Table no8. The contents of all the compounds are higher in the whole fruits.

Table no8: Phytonutrient composition of Ficus sycomorus fruits

	Whole fruit	Peled fruit
Polyphenols (mg/100g)	128,6 ± 0,33	55,5 ± 0,35****
Flavonoids (mg/100g)	27,6 ± 0,15	12,03 ± 0,07***
Tannins (mg/100g)	47,87 ± 0,2	43,58 ± 0,5*
Phytates (%)	26,92 ± 0,6	5,67 ± 0,67***

Oxalates (%)	27,5 ± 0,00	14,33 ± 0,44**

Significance levels are expressed as : *= p< 0,05 ; **= p< 0,01 ; ***= p< 0,001 ; ****= p< 0,001

5. Acute Oral Toxicity by OECD Method 423

Oral administration of Ficus sycomorus fruit extracts did not generate any sign of mortality during the 14-day test. Regarding weight gain, there was no difference compared to controls. The LD50 of Ficus sycomorus fruit extracts is therefore greater than 5000 mg/kg bw. According to the Globally Harmonized System of Classification (GHS), Ficus sycomorus fruit is non-toxic. The weight gain of the treated rats is presented in Figure 4.

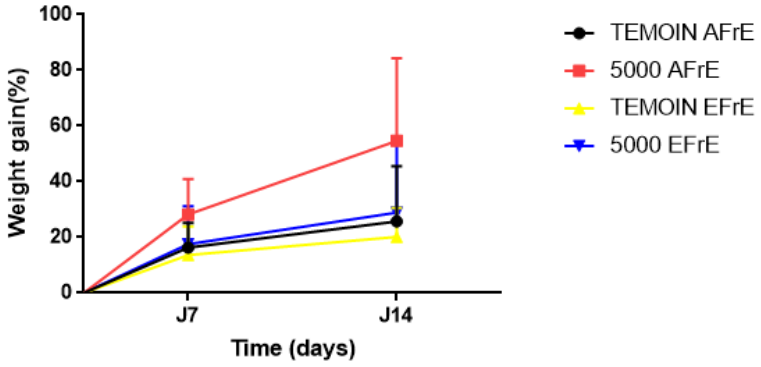

Figure 4 : Change in weight gain of female rats treated with AFrE and EFrE

6. Sensory evaluation of Ficus sycomorus fruits

The ripe fruits of Ficus sycomorus were presented to a panel of 200 inexperienced students for descriptive evaluation on criteria such as presentation, color, smell, taste, aroma, flavor in order to assess the acceptability of this fruit. The degrees of acceptability recorded and analyzed revealed that for all the criteria evaluated, the panelists fairly appreciated Ficus sycomorus fruit. Thus, all these variables had an influence on the appreciation of the fruit. Table no9 summarises the results of the sensory analysis.

Table no9: Sensory evaluation of ripe fruit of Ficus sycomorus

	Presentation (9)	Colour (9)	Smell (9)	Taste (9)	Aroma (9)	Flavour (9)	Appreciation (10)
Fruit	5,3 ±0,006	5,17±0,006	5,13±0,007	4,53±0,007	5,05±0,006	4,88±0,007	5,64±0,005

IV. Discussion

The wild fruits consumed are important both for health and nutrition. They provide the body with the essential elements for its proper functioning.

The triphytochemistry of Ficus sycomorus fruit extracts reveals the presence of polyphenols, sterols and poly terpenes and flavonoids. These compounds are thought to give the fruit extracts anti-inflammatory, antioxidant, anti-diabetic, anti-atherogenic, hepato-protective and cholesterol-lowering activities (Ngoumtsop et al. 2021[31]; Berger et al. 2004[32]). The alkaloids found would attribute hypotensive and vasodilatory properties to fruit extracts (Koné, 2009). Catechic tannins would give hydroethanolic extracts anti-inflammatory and anti-hypertensive activity (Dehou et al. 2018)[33]. This richness in phytochemical compounds of the extracts is similar to those of some aqueous extracts studied by N'guessan et al. (2009)[34] but different from those of Ficus sycomorus fruit extracts of Song et al. (2017)[35] and those of aqueous and organic extracts of Ficus carica dried figs studied by Benmaghnia et al. (2019)[36]. The phytochemical profile of our fruit extracts is believed to be responsible for their therapeutic benefits (Mathew and Negi, 2017)[37].

Polyphenols are thought to mitigate cellular damage associated with age and metabolic pathologies and protect the body from oxidative stress (Franscini and Palma, 2018)[38]. The total polyphenol and tannin contents of the obtained fruit extracts are lower than those of the Ficus sycomorus fruits of El-Beltagi et al. (2019)[39]. This difference would be due to the state of ripeness of the fruits and the place of harvest.

The antioxidant activity of fruit extracts confirmed that extracts with high polyphenol and tannin content have the best activity and strong reducing power. This assertion is confirmed by Ramde-Tiendrébéogo et al (2012)[40]. The percentage of inhibition and the 50% inhibition concentration of free radicals by the hydroethanol extract of whole fruits are better than those of Ficus carica dried figs by Benmaghnia et al. (2019)[36] for the same methods (DPPH, FRAP). This extract could help fight inflammation due to chronic diseases and degeneration of human cells (Merouane et al., 2014)[41].

Regarding the nutritional composition of ripe Ficus sycomorus fruit, the results showed that compared to the peeled fruit, the whole fruit is more nutritious. Indeed, whole fruit is richer in minerals such as calcium, potassium and sodium. These minerals are essential for cardiovascular health (Cappuccio, 2000)[42]. Thus, a high content of these compounds and a Na/K ratio of less than 1 would justify the use of whole fruits of Ficus sycomorus in the diet of people prone to heart disease. The contents of the different minerals obtained from Ficus sycomorus fruits are lower than those found by Okoronkwo et al. (2014)[43] in Ficus sycomorus fruits purchased in the local market of Nigeria (309.71 ± 0.023 mg / 100 g) and Pereira et al. (2017)[44] who obtained values, 2 to 3 times higher in the seven varieties of Ficus carica fruits harvested in Spain.

This difference could be due to the technological treatment of the fruits, the place of harvest and the state of ripeness of the fruits studied. The whole fruits also have a higher content of phytochemicals and vitamins A, D, B2, B9. The values of vitamins A and C of our fruits are higher than those of figs from Caliskan (2015)[45]. However, for all the vitamins present, our values are lower than those of dried figs studied by Russo et al. (2012)[46].

Regarding phytonutrients, polyphenols consisting of flavonoids, tannins, phenolic acids are beneficial to health (Okuda and Ito, 2011) [47]. When consumed, these compounds intervene by several mechanisms in cellular functions to prevent or reduce the risk of chronic diseases (Vauzour et al., 2010)[48].

Phytates and oxalates are anti-nutritional compounds. Indeed, phytates prevent the bioavailability of essential minerals such as zinc, calcium, iron, magnesium, potassium (Humer et al., 2014[49]). However, a daily intake of 1463 mg phytate/day would not affect mineral bioavailability but would be beneficial (Prieto et al., 2010[50]). According to these authors, this intake would prevent pathological calcifications, colorectal cancer and would reinforce the antioxidant action. As for oxalates, the consumption of a large quantity would be lethal and would favour calcium oxalate deposits in body tissues (Holmes and Kennedy, 2000[51]). A dietary intake of oxalate of 1.21 mg per day would be associated with a minor risk (Mitchell et al., 2019[52]). The phytate and oxalate contents of our Ficus sycomorus ripe fruits are higher than those of Musa et al. (2019[53]) (3.28; 59.54 mg/g) and Nigerian Ficus sycomorus fruits (1.98; 2.85%) respectively (Okoronkwo et al. 2014[43]). However, our values are lower than those determined by Ayosso (2015[54]) in sesame seeds (32.4 ± 0.6 mg/ 100g DM) and Akpro et al. (2019) [27] in fresh coconut products (27.30-36.67 mg/ 100g) respectively. Our fruits therefore contain tolerable amounts of toxic compounds.

The toxicological study through acute toxicity shows that the aqueous and hydroethanol extracts of Ficus sycomorus fruits have an LD50 greater than 5000 mg/kg body weight. Furthermore, no signs of toxicity and weight loss were observed. Extracts from Ficus sycomorus fruits are therefore not toxic at the dose of 5000 mg/kg body weight. This attests to the consumption of this fruit in various countries like China (Shi et al., 2018[55]), Egypt (Abd-el-hak et al., 2016[6]), Nigeria (Okoronkwo et al., 2014[43]).

V. Conclusion

The ripe fruits of Ficus sycomorus are rich in essential compounds for the body. They are good sources of vitamins, minerals and phytonutrients but also toxic compounds to the body. However, the levels of toxic compounds are not thought to have any harmful effects. Hydroethanol extracts of ripe fruit have a high antioxidant activity. This would justify their use in the pharmacopoeia to treat several pathologies. The ripe fruits of Ficus sycomorus could therefore help prevent and reduce the risks associated with chronic diseases.

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KOUADIO L. Adjoua, et. al. "Evaluation Of The Biochemical Composition, Antioxydant Activity And Acute Toxicity Of Ripe Ficus Sycomorus Fruit Harvested In Cote D'ivoire." *IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS)*, 17(2), (2022): pp. 36-46.