



NUTRITIONAL COMPOSITION AND ACTIVE INGREDIENT PRINCIPLES OF N'SAFU (DACRYODES EDULIS) IN CITY OF LUBUMBASHI, UPPER KATANGA/DRC

²*M.J. Kahenga Mwana-Mwamba*, ¹*Kalaka M.Clovis*, ³*Kasongo Mulimbi .C*, ³*Kanyeba Mwakabubi S.*, ⁴*Kabwiz Kalamb C.*, ⁴*G. Ngoie Mfumwabana*

Address For correspondence:S

¹Food Science Department, Food Research Center (CRAA), Lubumbashi-DRC

²Department of Food Industry and Biotechnology, Food Research Center (CRAA), Lubumbashi-DRC

³Quality Control Department, Food Research Center (CRAA), Lubumbashi-DRC

⁴Food and Agriculture research Center (CRAA), Lubumbashi-Democratic Republic of Congo

Corresponding author:

Kalaka mayur clovis.

Food and Agriculture research Center (CRAA), **Lubumbashi-Democratic Republic of Congo**

E-mail:cloviskalaka@gmail.com

ABSTRACT: The fruit is locally called in the Democratic Republic of Congo, not in Kikongo of Bandundu and Central Congo. The fruit is a very important nutritional and socio-economic culture in Central Africa and in the riparian countries of the Gulf of Guinea.

The importance of this research is to contribute to the nutritional composition and active principles of n'safou fruit (*Dacryodes edulis*) and serve as a guide for consumers and the food industry to make biscuits and other uses. The aim of this research was to know the nutritional and phyto-chemical composition of the fruits of consumption in Lubumbashi.

Finally the results found in our research reveal that the fruits of n'safou (*Dacryodes edulis*) found in the city of Lubumbashi is endowed with antioxidant, antiseptic, antivenomous properties due to the presence of tannins in the latter; apart from its poverty in protein, the fruits *Dacryodes edulis* is very rich in moisture and fat. The fruits could be valued in the agro-food industries for the manufacture of biscuits.

KEYWORDS: Composition, Nutritional, Active Ingredients , n'safou

RÉSUMÉ: Le fruit est appelé localement en République Démocratique du Congo n'safou à Kikongo de Bandundu et du Congo Central. Le fruit est une culture nutritionnelle et socio-économique très importante en Afrique centrale et dans les pays riverains du golfe du Guinée.

L'importance de cette recherche est de contribuer à la composition nutritionnel et les principes actifs de fruit de n'safou (*Dacryodes edulis*) et servir de guide aux consommateurs et à l'industrie alimentaire pour en faire des biscuits et d'autres usages.

Le but de cette étude était de connaître la composition nutritionnelle et phyto-chimique des fruits de n'safou consommés à Lubumbashi. En fin les résultats trouvés dans notre recherche révèlent que les fruits de n'safou (*Dacryodes edulis*) trouvés dans la ville de Lubumbashi est dotée des propriétés anti oxydantes, antiseptiques, antivenimeuses suite à la présence des tanins dans ce dernier ; à part sa pauvreté en protéine, les fruits *Dacryodes edulis* est très riche en humidité et en matière grasse. Les fruits pourraient être valorisés dans les industries agroalimentaires pour la fabrication des biscuits.

Monts-clés : Composition, Nutritionnelles, Principes actifs, n'safou

1. INTRODUCTION

The fruit is locally called in the Democratic Republic of Congo, not in Kikongo of Bandundu and Central Congo. The fruit is a very important nutritional and socio-economic culture in Central Africa and in the riparian countries of the Gulf of Guinea. [1, 2, 3] hence the word safoutier to designate the tree that produces it and its scientific name is (*Dacryodes edulis*)

Dacryodes edulis (n'safou) is a fruit found in tropical and equatorial Africa. There are several kinds of varieties; the n'safou is distinguished by the variety of its colors from one fruit to another, navy blue, light pink through purple and sky blue. It consists of a nucleus. His flesh is often fat. N'safou is an important fruit at the national and international levels, has great nutritional values. [4]

In others, it is also rich in minerals: phosphorus, calcium, manganese, iron, copper, zinc, etc...

For some years, work has been carried out for the physico-chemical characterization of the fruits of the safoutier. [5, 6, 7, 8, 9, 10] The results obtained show that n'safou had nearly 50% lipids as an alternative source of oil for the populations.

Indeed, studies on chemistry *D.edulis* revealed that the fruit contains approximately 50% fat, 10% protein, 27% fiber and 10% sugars; certain varieties containing up to 70% of essential oils .[10, 11, 12, 13] Its pulp, the only edible part of the fruit, is rich in lipids, proteins, carbohydrates, minerals, vitamins and fibers [14, 15].

In addition the n'safou is very nutritious. It certainly does not have the sweet taste that is usually attributed to fruit. Just like the olive or avocado with which he has definitely some similarities, it is a fat fruit that contains little carbohydrates.

The safourist is a multipurpose tree although the most common use is fruit consumption [16] after softening in hot water, hot ash or even embers. The *Dacryodes edulis* is also eaten raw; it could also be used as butter to eat bread. [17] The importance of this study is to contribute to the nutritional composition and active ingredients of n'safou fruit (*Dacryodes edulis*) and serve as a guide for consumers and the food industry to make biscuits and other uses. The aim of this study was to know the nutritional and phyto-chemical composition of fruits of consumption in Lubumbashi.

2. MATERIAL AND METHOD

2.1. EQUIPMENT

2.1.1. Plant material

The study material is the fruits of n'safou (*Dacryodes edulis*). This fruit is saved in the Democratic Republic of the Congo, Congo Brazzaville, Cameroon, Guinea and Côte d'Ivoire...

2.1.2. Other analysis equipment

For the analyzes , we used these few materials:

- Oven
- HERAEUS - Muffle furnace brand prolabo
- ICP brand 8300
- Tamis
- Soxhlet
- Salvis bath brand

2.2. METHODS

2.2.1. Sampling method

We manually picked the ripe fruits of Nesafo (*Dacryodes edulis*) on the plant in the morning and ground them with a porcelain mortar; then screened using a sieve with a mesh size of 315 µm in order to obtain the fine powders which were stored at ambient temperature in clean and dry jars, well closed and on which the various analyzes were carried out.

2.2.2. Analytical methods

a) Identification of the active chemicals in the fruit of (*Dacryodes edulis*)

The methods used are based on the formation of a precipitate, the change of coloration or the formation of foam as described by Aebisch et al. [18], Wagner [19], Lumbu [20], Bruneton [21] who use the six reagents including Bragendorff, Hager, Mayer, Sunnenshein, Wagner and Bertrand [18]. The desired phytochemical groups are alkaloids, flavonoids, anthocyanins, quinones, steroids, terpenoids, saponins and tannins. The aqueous flavonoid extract gives, in the presence of concentrated acid and magnesium chips, a pink-orange and purplish red coloration in the supernatant layer of isoamyl alcohol. After heating in a water bath, without adding magnesium, the appearance of a red color indicates the presence of leuco anthocyanins.

Yellow picrosodium paper turns orange or red depending on the concentration of free hydrochloric acid in the aqueous vapor during the hot treatment of the drug.

The Quinones contained in an extract are detected by the change in color of the extract passing red in the presence of the base (NaOH) [18]; The detection of saponins is based on their foaming power: For a non-persistent foam, the filtrate is tested with an equal volume mixture of 1N sulfuric acid and green-dirty coloration or violet turning red [18].

The ethereal organic extract containing the steroids gives the green yellow stains in the presence of anhydrous acetic acid. By adding the HIRSHNON reagent (trichloroacetic acid), the yellow color turning red indicates the presence of terpenes [18].

In the presence of 1% ferric chloride, the aqueous extracts containing the tannins give various colors: blue-green, dark-blue or green or form precipitates (18).

b) Determination of the macroelement composition of safou fruits

Moisture determination was made by drying the samples in an oven set at 105 ° C until constant weight (22)

Total ash was determined by calcination at 550 ° C for 8 hours in a muffle furnace (method 923.03, AOAC 1990, (23).

To quantify the mineral elements, we used ICP 8300; crude protein was made by total nitrogen assay using the Kjeldhal method. (23) The crude protein content was determined using the following relationship: % PB = % N x 6.25 where % PB = grade in crude protein, % N = total nitrogen content of the sample and 6.25 = conversion factor of nitrogen content in protein. The lipids were extracted by soxhlet according to the Weiball method as reported by BUKATUKA (24).

The Determination of Glides Totals With Dubois and al. $\times 160 / 0,0072 \times 1000$ où Q.I = quantité de sucres dans l'échantillon en g / 100g, D.O. = la densité optique de l'échantillon (390nm).

3. PRESENTATION DES RESULTATS ET DISCUSSION

Tableau I. La composition en nutriments essentiels du fruit de n'afou (*Dacryodes edulis*)

Analysis	Nutritional Value (%)
Protein	9,8
Humidity	53
Ash	1
Fat	48,88
Carbohydrate	9

We find that the fruits *Dacryodes edulis* (n'safou) found in the city of Lubumbashi is quite low in protein [9, 8], although low, but will have

An important contribution to the diet to reduce protein malnutrition. But rich in fat and moisture. As confirmed [10, 11, 12] in their research. The present research reviews the phyto-chemical and nutritional aspects of *D.edulis* fruits.

Table II. Composition in mineral elements of the fruits of n'safou (*Dacryodes edulis*)

Analyzed elements in mg / Kg	Fruit of <i>Dacryodes edulis</i> (n'safou)
Al	129,8
Ca	1081
Cd	5,302
Cu	10,43
Fe	86,11
K	16690
Mg	1171
Mn	15,76
Na	246,9
Ni	27,81
Zn	16,16

With regard to the results of the mineral elements found in the table above and the results found by Tchiegang C. et al., Kapseu C. et al ... [4,5], it emerges as follows: apart from the content of cadmium, copper and manganese, we also observe differences between the elements analyzed in terms of content. In terms of nutritional plan, it may be noted that the fruits *Dacryodes edulis* commonly called "n'safou" would be an important source of potassium (16690mg / kg of fresh fruit and wall). We also observe that there is more magnesium, calcium, sodium, aluminum and iron.

Table III. Identification of the active chemical principles in Hazelnut (*Dacryodes edulis*) fruits

	Fruits
alkaloids	++
Flavonoids	++
Leucoanthocyanins	-
Saponins	+++
Stéroïds	-
Tanins	+++
Terpenoids	+
Quinones	-

Legend: - : absence
+ : presence
++ : Strong presence
+++ : Very strong presence

The identification analyzes of the active chemical principles reveal the presence of alkaloids, flavonoids, terpenoids, as well as a very strong presence of saponins and tannins in the fruits of *Dacryodes edulis*. This would give the fruit some therapeutic virtues (26, 27), including antivenoms, anti-hemorrhoids, antiseptics, anti-diarrhea, anti-oxidants and bactericidal following the strong presence of tannins.s

CONCLUSION

Finally the results found in our research reveal that the fruits of n'safou (*Dacryodes edulis*) found in the city of Lubumbashi are endowed with antioxidant, antiseptic, antivenomous properties due to the presence of tannins in the latter.

Apart from its poverty in protein, *Dacryodes edulis* fruits are very rich in moisture and fat.

The fruits could be valued in the food industries for the manufacture of biscuits. This would improve the organoleptic characteristics of some biscuits manufactured locally compared to reference products. The domestication of the N'safou (safoutier) plant in Lubumbashi is imperative.

REFERENCE

1. Kengue, J. (1990); Le safoutier (*Dacryodesedulis* (G Don) HJ Lam). Thèse Doctorat 3ième cycle, Université de Yaoundé, Cameroun.
2. Silou, Th., Rocquelin, Mouaragadja, I.,G. and Gallon, G., (2002); Contribution of the characterization of safous (*Dacryodes edulis*) of Central Africa III.Chemical composition and nutritional characteristics of safou of Cameroon, the Congo-Brazzaville, the Congo-Kinshasa and Gabon .Rivista Italiana Delle Sostanze Grasse, 79, 177-182.
3. Schreckenber, K., Degrande, A., Mbosso, C., BoliBaboulé, Z., Boyd, C., Enyong, L., Kanmegne, J. and Ngong, C., (2002), The social and economic importance of *Dacryodesedulis* (G. Don) H.J. Lam. In southern Cameroon. Forest Trees and Livelihoods, 12, 15-40.

4. Tchiegang C, Kapseu C, Parmentier M (1998). Chemical composition of oil from *Coula edulis* (Bail.) nuts. *J. Food Lipids* 5(2):103-111.
5. Kapseu C. & Tchiégang C.,(1996), Composition des fruits de deux cultivars de safou au Cameroun, *Fruits*, 51, 3, 1-7.
6. Kapseu C., Avouampo E. & Djeumako B.,(2002), Oil extraction from *Dacryodes edulis* (G. Don.) H.J. Lam fruit. *Forests, Tree and Livelihoods*,12, 97-104.
7. Kapseu C., Mapongmetsem P.M., Silou T. & Roques M., (1999), Physico-chimie des fruits du safoutier (*Dacryodes edulis*) camerounais, *Tropicultura*, 17, 1, 37-42.
8. Kenmegne Kamdem A.T., Ali A., Tchiégang C. & Kapseu C., (1997), Problématique de la production de l'huile de safou au Cameroun, *Fruits*, 52, 325-330.
9. Silou T., Goma Maniougui J., Boungou P. & Ouamba J. M., (1991), Etude du séchage de la pulpe de safou: résultats préliminaires, *Tropicultura*, 9, 2, 61-68.
10. Silou T., Rocquelin G., Gallon G. & Molagui T., (2000), Contribution à la caractérisation des safous (*Dacryodes edulis*) d'Afrique Centrale, Note II-Composition chimique et caractéristiques nutritionnelles des safous du district de Boko (Congo Brazzaville). Variation inter arbre. *Rivista Italiana Delle Sostanze Grasse*, 77, 85-89.
11. Kapseu, C., Mapongmetsem, P.M., Silou, Th, Roques, M.,(1988), Physicochimie des fruits du safoutier camerounais (*Dacryodes edulis*), *Tropicultura*, 16-17(1) : 7-42.
12. Kinkéla, T., Silou, T.,(2004), Composition en acides gras et en triacylglycérols de l'huile essentielle de la graine du safou. *J. Soc. Ouest-Afr. Chim.*, 017: 19-31.
13. Kinkéla T, Kama Niamayoua R, Mampouya D, Silou Th, (2006), Variation in morphological characteristics, lipid content and chemical composition of safou (*Dacryodes edulis*) according to fruit distribution. A case study. *African Journal of Biotechnology*, 5 (12): 1233-1238.
14. U. Omoti, and D.A. Okiy, (1987), Characteristics and composition of the pulp oil and cake of the African pear, *Dacryodes edulis* (G. Don) H.J. Lam, *Journal of the Science of Food and Agriculture* 38, 67-72.
15. E. Youmbi, M. Mbeuyo, N.D. Tchinda, and A. Amougou, (2010), Physico-chemical characterization and classification of fruits of *Dacryodes edulis* from the major agro-ecological zones of Cameroon. *Fruits* 66(6), 355-365.
16. Kengue J., (2002), Safou (*Dacryodes edulis* (G. Don) H. J. Lam), International centre for underutilised crops, Southampton, UK, 147 p.
17. Duru M, Amadi C, Ugbogu A, Eze A, Amadi B, (2012), Phytochemical, vitamin and proximate composition of *Dacryodes edulis* fruit at different stages of maturation. *Asian Journal of Plant Science and Research* 2(4): 437-441.
18. Aebisch E. et Reichstein T.,(1960), Orientierende chemische untersuchung einiger Apocynaceen, *Helvetica chimica acta*, Vol XLIII, Fase. VI(224): PP 1844 – 1861

19. Wagner H.,(1983), Drogen analyse, Dünschicht chromatographische Analyse von Arzneidrogen, Springer verlag, Berlin Heidelberg, 522p.
20. Lumbu S.,(1992), Buchnerdine et Buchneridine, nouveaux alcaloïdes dérivés de la spermine ; structure et systhèse total thèse doctorat en science chimiques, Université libre de Bruxelles.
21. Brumeton J.,(2009), Pharmacognosie : Phytochimie et plantes médicinales ,3^e éditions, TEC, Paris, pp 144-154 ; 196,274-388 ; 656,670-712, 783-1085,1191.
22. Dufey F., (1986) : Biologie cellulaire, Ed.CRP, Kinshasa, pp159.
23. Groegaert, (1958) : Recueil des modes opératoires en usages au laboratoire d'analyse de l'INEAC, Bruxelles.
24. Bukatuka F.C., Ngombe K.N., Mutwale K.P., Moni B.M., Makengo K.G., Pambu L.A., Bongo N.G., Mbombo M.P., Musuya M.D., Maloueki U., Ngbolua K.N., Mbemba F.T., Bioactivity and nutritional values of some Dioscorea species traditionally used as medecinal foods in Bandundu, D R. Congo, European journal of Medecinal plants, Vol 14, n° 1 , pp 1-11.
25. Dubois M., Gilles K.A., Hamilton P.A., Ruberg A., Smith F., (1956), Colorimetric method for determination of sugars and related substances, Analytical chemistry, pp 350 – 356.
26. Tina Cecchini, (1975) : Encyclopédie des plantes médicinales. Edition De Vecchi, Paris, pp 13-14,149-160
27. Arnaudinaud V., Mas T., Nay B., Vergé S., Soulet S., Castagnino C., Delaunay J.C., Chèze C., Vercauteren J., (1999) : Polyphenols du vin ; la chimie de la vie, actualité chimique, pp 29-32.