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The use of cucurbitaceae fruits and seeds : research synthesis

Ouattara Howélé[1*], Touré Abdoulaye[1], Koné Vazoumana[2], Kati-coulibaly Séraphin[3]

[1]*Training and Research Unity of Biological Sciences, Peleforo Gon Coulibaly University, Korhogo, Côte d'Ivoire*

[2]*Unity of Biological Sciences, Peleforo Gon Coulibaly University, Korhogo, Côte d'Ivoire*

[3]*Laboratory of Nutrition and Pharmacology, University of Félix Houphouët Boigny, Abidjan, Côte d'Ivoire*

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Abstract

This review aim to show to population the importance for good health of the three Curbitaceae, [*C. lanatus* (Thunb), *L. siceraria* (Molina) and *C. mannii* (Naudin)], fruits, seeds and by-products consumption. Then, all article talking about the Cucurbitaceae have been downloaded. The juice, extracted from the pulp of *C. lanatus* and *L. siceraria* fruits consumption bring proteins, lipids, minerals and vitamin for the organism. The three Cucurbitaceae seeds are nutritiously rich because they contain carbohydrates, proteins, lipids, minerals, fiber, vitamin and antioxidant. The lipids extracted from the three Cucubitaceae seeds are sources of polyunsaturated fatty acids. The seeds are also rich in proteins which can be used for food forification in developing countries. The consumption of juices extracted from the fruits, seeds and its by-products protect against diabetes, hyperlipidaemia, cancer, the devasting action of free radicals, bacterial disease, inflammatories reactions, cardiovascular desesaes, depression, can modulate immune action and reinforce eye slight. The consumption of Cucurbitaceae pulp juice, seeds and its by-products must be recommend in developing countries where malnutrition is a recurrent phenomena. Research in order to improve food fortification with some products derived from Cucurbitaceae seeds must be intensify.

* **Corresponding Author:** Ouattara Howélé ✉ ouattarahowele@gmail.com

Introduction

Curbitaceae are a family of Plant which belong to the order of Cucurbitales. Most of the Plants of this family are originated from tropical and subtropical regions. This family of Plant contain 825 species devided into 118 genuses (Rahman *et al.,* 2003).These Plants are found in all countries, specially in Africa and in Latin America even if some wild species are shown in temperate area (Spichiger *et al.,* 2000). Five species of Cucurbitaceae, improperly call according to Zoro Bi *et al.* (2003) « pistaches » in French or « pistachio » in English, are found in Côte d'Ivoire.These species are *Lagenaria siceraria* (Molina), *Citrullus lanatus* (Thunb), *Cucubita moschata* (Duchesne), *Cucumeropsis mannii* (Naudin) and *Curcumis melo* (Subsp). Among them, the most important, because of it economic role, are *Citrullus lanatus* (Thunb), *Lagenaria siceraria* (Molina) and *Cucumeropsis mannii* (Naudin). The seeds of the three species, which are well consumed into sauce, are sold (Zoro Bi *et al.,* 2006). The juice extracted from the fruits of *Lagenaria siceraria* (Molina) and *Citrullus lanatus* are consumed but that of *Cucumeropsismannii* is bitter. The studies of Zoro Bi *et al.* (2003 ; 2006) permited to improve the production of the Cucurbitaceae which are consumed in Côte d'Ivoire. Also, several scientific works shown the nutritious component and explained the nutritional value of the three Cucurbitaceae species. In fact, there is a wealth of literarure on this subject. Nevertheless, few of synthesis updated review of the literature on the best properties of Cucurbitaceae seeds or fruits and its by-products are available for the public.

This updated review of the literature is made in order to promote the use of Cucurbitaceae seeds or fruits and its by-products in human diets because of the several benefits for health.

Distinction criteria between C. lanatus (Thunb), L. siceraria (Molina) and C. mannii (Naudin) seeds

Roots, spalings and leaves of Cucurbitaceae Plant have certainly some similarities but fruits and seeds give better distinctive identity (Oyolu, 1977 ; Fursa, 1981 ; Maynard, 2001 ; Walter *et al.,* 2002 ; Grubben& Denton, 2004 ; Shah *et al.,* 2010). In fact, *C. lanatus* fruits are round (Fursa, 1981) while that of *L. siceraria* can be oblong, spherical or on bottle shape and that of *C. mannii* vary exclusively between the oblong form and the spherical form (Treas*et al.,* 2002). *C. lanatus* and *C. mannii* fruits are well-developed than that of *L. siceraria*. The pulp of *C. lanatus* fruit is yellowish or reddish where as that of *C. manniii*and *L. siceraria* are whitish (Erhirhie*et al.,* 2003). The fruit of *L. siceraria* is more voluminous following respectively by the fruit of *C. lanatus* and that of *C. mannii*(Kokate *et al.,* 1999 ; Laghetti *et al.,* 2007; Mabberley, 2008).

C. lanatus seeds are oval and their edge are flat and rough (Fursa, 1981 ; Van der Vossen *et al.,* 2004). That of *L. siceraria* are flat with a thickening on an extremity but that of *C. mannii* can be flat, smooth and shrink on an extremity (Decker-walters *et al.,*1988 ; Cowan, *et al.,* 1993).*C. lanatus* seeds are yellowish, that of *L. siceraria*are also yellowish but sometimes can be brownish while that of *C. mannii* are always whitish (Staub *et al.,* 1988 ; Wehner *et al.,* 1988). *L. siceraria* seeds are the most voluminous following respectively by that of *C. lanatus* seeds and that of *C. mannii* (Staub *et al.,*1988 ; Shah *et al.,* 2010). The Fig. 1show the different form of the three Cucurbitaceae seeds.

Nutritious component of fruits and seeds of C. lanatus (Thunb), L. siceraria (Molina) AND C. mannii (Naudin)

Studies made on Cucurbitaceae fruits are mainly concerned *C. lanatus* (Thunb) and *L. siceraria* (Molina) because both fruits are more used in food. On the hand, studies made on the seeds are concerned the three species because the third seeds are consumed.

Nutritious component of *C. lanatu s*and *L. siceraria* fruits.

Proximate composition

Proximate composition of 100 g of *C. lanatus* fruits

are 91.45 g, 0.61 g, 0.15 g, 7.5 g and 0.4 g for moisture, protein, lipids, carboxydrate and fiber respectively (USDA, 2006). Concerning *L. siceraria*, the proximate composition per 100 g of fruits are 96.3 g, 0.62 g, 0.02 g, 3.39 g and 0.6 g for moisture, protein, lipids, carboxydrate and fiber respectively (USDA, 2002).

Minerals content

The main minerals component in 100 g of *C. lanatus* fruits are calcium (7 mg), phosphorus (11mg), iron (0.24 mg), magnesium (10 mg), potassium (112 mg) and sodium (0.1 mg). As for *L. siceraria*, it minerals content in 100 g of fruits are 26 mg for calcium, 13 mg for phosphorus, 0.20 mg for iron, 11 mg for magnesium, 150 mg for potassium, 2 mg for sodium, 0.70 mg for zinc, 0.026 mg for copper, 0.066 mg for manganese and 0.2 mcg for selenium (USDA, 2002 ; 2006). We can notice that the two species have high content in potassium.

Vitamin content

Vitamin found in 100 g of *C. lanatus* fruits are vitamin B1 (0.033 mg), vitamin B6 (0.045mg), vitamin A (569 UI) ; de riboflavin (0.021mg), niacin (0.178 mg), vitamin C (8.1 mg) and pantothenic acid (0 .221 mg). That found in 100 g of *L. siceraria*fruits are vitamin C (10.1 mg), thiamin (10.029 mg), riboflavin (0.022 mg), niacin (0.320 mg), pantothenic acid (0.152 mg), vitamin B6 (0.04 mg), total folic acid (6 mcg) and 6 UI of vitamin A (USDA, 2002 ; 2006).

Lipids component

Lipid fraction of *C. lanatus* fruits contain 0.016 g of Saturated Fatty Acid (SFA), 0.037 g of Mono Unsaturated Fatty Acid (MUFA), 303 Mcg of betacarotene, 78 Mcg of betacryptoxanthin and 4532 Mcg of lycopen which may be according to Mandel *et al.* (2005), responsible of fruit pulp coloration.

Against, we can notice in *C. lanatus* fruits citrillune which is important for cellular division, for healing and for ammoniac elimination in the people living (Mandel *et al.,* 2005).

In the lipid fraction of *L. siceraria* fruits, Researchers found 0.002 g of SFA and some Poly Unsaturated Fatty Acids (PUFA) which are constituted by 0.004 g of oleic acid and 0.009 g of linolenic acid (USDA, 2002 ; 2006).

Amino-acids content

The amino acids content of *L. siceraria* fruits are leucine (0.036 g), phenylalanine (0.015 g), valine (0.027 g), threonine (0.018 g), arginine (0.014 g), histidine (0.004 g), methionine (0.004 g), lysine (0.021g), isoleucine (0.033 g) and 0.003 g of tryptophan (USDA, 2002).

Nutritious component of *C. lanatus*, *L. siceraria* and *C. mannii* seeds.

Main component

The seeds of the three Cucurbitaceae are marvels of nutritious components. In fact, the main components of 100 g of dry seeds of *C. lanatus* are in decreasing order lipids (45.89 g), proteins (23.37 g), carboxydrate (23.06 g), moisture (3.85 g), ash (2.50 g) and fiber (2.33 g) respectively (Fila *et al.,* 2013). That of *L. siceraria* seeds are lipids (45.85 g), proteins (24.85 g), moisture (17.81 g), ash (5.12 g), fiber (3.90 g) and moisture, 2.47 g (USDA, 2002) and that of *C. mannii* are lipids (52 g), fiber (15,5 g), proteins (10,3 g), carboxydrate (8,2 g), ash (3,6 g) and moisture, 3.3 g (Omafuvbe *et al.,* 2004).Table 1 is shown the quantity of the main components found in the three Cucurbitaceae seeds.

Lipids content

Lipids extracted in the seeds of *C. lanatus* contain 82. 25 % of Unsaturated Fatty Acids (USFA) and 17.75 % of SFA. The USFA is constituted by 14.69 % of oleic acid and 67.56 % of linoleic acid and that of SFA is constituted by 9.97 % of palmitic acid and 7.78 % of stearic acid (Ziyada *et al.,* 2008).

The seeds of *L. siceraria* are containing 78.7 % USFA and 21.3 % of SFA. The USFA of this oil are palmitoleic acid (0.1 %), oleic acid (9 %), linoleic acid (69.5 %) and linolenic acid (0.1 %).

Table 1. Proximate composition of *Citrullus lanatus*, *Lagenaria siceraria* and *Cucumeropsis mannii* seeds.

Main constituents (100%)	*Citrullus lanatus*	*Lagenaria siceraria*	*Cucumeropsis mannii*
Moisture	3.85	2.47	3.3
Lipids	45.89	45.85	52
Protein	23.37	24.85	10.3
Fiber	2.33	3.90	15.5
Carboxydrate	23.06	17.81	8.2
Ash	2.50	5.12	3.6

Adapted from USDA (2002 :2006), Omafuvbe (2004) and Fila *et al.* (2013).

The SFA of this oil are lauric acid (0.1 %), myristic acid (0.02 %), palmitic acid (13 %) and stearic acid, 8.18 % (Fokou *et al.,* 2009).

The USFA of *C. manni*iseeds oil contain 69.5 % in which there are 0.3 % of palmitoleic acid, 13.6 % of oleic acid, 55.3 % of linoleic acid and 0.3 % of linolenic acid. The SFA percentage of this oil is 30.5 % with 0.3 % of lauric acid, 0.9 % of myristic acid, 17.8 % of palmitic acid and 11.4 % of stearic acid (Fokou *et al.,* 2009).

Table 2 is shown the different kind of fatty acids found in *C. lanatus*, *L. siceraria*and *C. mannii* seeds oils.

Table 2. Lipids contain in *Citrullus lanatus*, *Lagenaria siceraria* and *Cucumeropsis mannii* seeds.

Lipids (100 %)	*Citrullus lanatus*	*Lagenaria siceraria.*	*Cucumeropsis mannii*
Total USFA	82.25	78.7	69.5
Palmitoleic acid	0	0.1	0.3
Oleic acid	14.69	9	13.6
Linoleic acid	67.56	69.5	55.3
Linolenic acid	---	0.1	0.3
Total SFA	17.75	21.3	30.5
Lauric acid	0	0.1	0.3
Myristic acid	0	0.02	0.9
Palmitic acid	9.97	13	17.8
Stearic acid	7.78	8.18	11.4

USFA : Unsaturated Fatty Acid

SFA: Saturated Fatty Acid

Adapted from Ziyada*et al.* (2008) and Fokou*et al.* (2009).

Amino-acids content

The amino-acids found in 1 gram of proteins extracted from *C. lanatus* seeds are aspartic acid (104.61 mg), threonine (41.31 mg), serine (46.45 mg), glutaminic acid (209.94 mg), glycine (66.44 mg), alanine (47.04 mg), cysteine (2.5 mg), valine (71.31 mg), methionine (4.0 mg), isoleucine (23.09 mg), leucine (39.62 mg), tyrosine (34.97 mg), phenylalanine (32.38 mg), lysine (33.04 mg), histidine (29.33 mg) and arginine, 122.81 mg (Ogunyinka, 2012).

That found in 1 gram of *L. siceraria* seeds proteins part are 2.079 mg of leucine, 1.222 mg of phenylalanine, 1.972 mg of valine, 0.903 mg of threonine, 4 .033 mg of arginine, 0.681 mg of histidine, 0 .551 mg of methionine, 1.833 mg of lysine, 1.264 mg of isoleucine, 0.431 mg of tryptophan, 0.301 mg of cystine, 1.019 mg of tyrosine, 1.158 mg of alanine, 1.796 mg of glycine, 1 mg of

proline, 1.480 mg of serine, 2.477 mg of aspartic acid and 4.315 mg of glutamic acid (USDA, 2002).

1 gram of *C. mannii* seeds proteins are constituted by glycine (2.346 mg), alanine (5.739 mg), serine (2.258 mg), proline (3.356 mg), valine (1.373 mg), threonine (3.419 mg), leucine (4.293 mg), isoleucine (4.857 mg), lysine (4.122 mg), aspartic acid (16.252 mg), glutamic acid (16.817 mg), phenylalanine (3.481 mg), methionine (3.267 mg), arginine (9.193 mg), histidine (2.117 mg), cystine (1.168 mg) and tyrosine, 2.369 mg (Ibironke *et al.,* 2013).

Table 3. Differents amino-acids (mg), contain in 1 g of *Citrulluslanatus*, *Lagenaria siceraria* and *Cucumeropsis mannii* seeds.

Amino-acids	*Citrullus lanatus*	*Lagenaria siceraria*	*Cucumeropsis mannii*
Essentials amino-acids			
Methionine	4.0	0.551	3.267
Cysteine	2.5	0.301	1.168
Tryptophane	ND	0.431	ND
Lysine	33.04	1.833	4.122
Threonine	41.31	0.903	3.419
Phenylalanine	32.38	1.222	3.481
Isoleucine	23.09	1.264	4.857
Leucine	39.62	2.079	4.293
Histidine	29.33	0.681	2.117
Valine	71.31	1.972	1.373
Tyrosine	34.97	1.019	2.369
Non essentials amino-acids			
Alanine	47.04	1.158	5.739
Serine	46.45	1.48	2.258
Glutaminic acid	209.94	4.315	16.817
Aspartic acid	104.61	2.477	16.252
Glycine	66.44	1.796	2.346
Proline	ND	1.0	3.356
Arginine	122.81	4.033	9.193

ND :undeterminate

Adapted from USDA (2002), Ogunyinka (2012) and Ibironke*et al.* (2013).

Table 3is shown the differents amino-acids contain in the proteins part of *C. lanatus*, *L. siceraria*and *C. mannii* seeds.

Minerals content

The seeds of these three Cucurbitaceae are very rich in minerals. In fact, minerals content in 100 g of*C. lanatus* seeds are magnesium (7.00 ppm), calcium (9.00 ppm), iron (0.65 ppm), zinc (0.41 ppm), nickel (0.01 ppm), copper (0.21 ppm), manganese (0.16 ppm) and cobalt, 3.05 ppm (Ziyada *et al.,* 2008).That of *L. siceraria* are containing 43 mg of calcium, 1174 mg of phosphorus, 14.97 mg of iron, 535 mg of magnesium, 807 mg of potassium, 18 mg of sodium, 7.46 mg of zinc, 1.387 mg of cuivre, 3 .02 mg of manganese and 5.60 mcg of selenium (USDA, 2002).In *C. mannii* seeds, minerals found are sodium (2.50 mg), potassium (198.50 mg), calcium (9.30 mg), iron (5.50 mg), copper (1.70 mg), magnesium (28.40 mg), manganese (1.70 mg), phosphorus (2.40 mg), silver (0.03 mg), aluminium (0.01mg) and nickel, 30 mg (Eunice *et al.,* 2012). Table 4 is shown the different minerals found in the three cucurbitaceae seeds.

Table 4. Main minerals found in 100 g *Citrullus lanatus*, *Lagenaria siceraria* and *Cucumeropsis mannii* seeds.

Minerals Symbols	*Citrullus lanatus* (ppm)	*Lagenaria siceraria* (mg)	*Cucumeropsis mannii* (mg)
Ca	9	43	5.50
P		1174	2.40
K		807	198.50
Na		18	
Fe	0.65	14.97	5.50
Mg	7	535	28.40
Mn	0.16	3.02	1.70
Zn	0.41	7.46	
Co	3.05		
Ar			0.03
Cu	0.21	1.387	1.70
Al			0.01
Ni	0.01		30
Se		5.60 mcg	

Adapted from USDA (2002), Ziyada*et al.* (2008) and Eunice *et al.* (2012).

Vitamin content

The three Cucurbitaceae seeds contain vitamin A, vitamin C and E but *L. siceraria* and *C. mannii* seeds are more rich in vitamin E than *L. siceraria* seeds (Samuel *et al.,* 2011). It can also be found in *L. siceraria* seeds, niacin, folic acid and riboflavin (Byrd-B *et al.,*2007 ;Amit *et al.,* 2012 ; Aruna *et al.,* 2014 ; Umar, 2015).

Other component

The three Cucurbitaceae seeds are rich in antioxidants such as betacarotene, polyphenol and flavonoid (Byrd-B *et al.,* 2007 ; Amit *et al.,* 2012 ; Eunice *et al.,* 2012 ; Aruna*et al.,* 2014 ; Umar, 2015). There are also in the three Cucurbitaceae seeds alkaloids, steroids, terpenoids and un-nutritional substances such as tannins, saponines, lectines and phytates (Byrd-B *et al.,* 2007 ; Méité *et al.* 2008 ; Amit *et al.,* 2012 ; Aruna *et al.,* 2014 ; Umar, 2015). The un-nutritional substances can limit the nutritional qualities of the seeds.

Comparative studies of the different constituents of the seeds.

Global comparison

C. lanatus, *L. siceraria* and *C. mannii* seeds are rich in lipids, protein but they have few fiber and carbohydrate. Netherveless, *Cucumeropsis mannii* seeds are more rich in lipids and fiber than *Citrullus lanatus* and *Lagenaria siceraria* seeds: then fiber of *Cucumeropsis mannii* seeds, more abundant, will be more benefic for human diet than the others seeds because fiber enhance satiety phenomena and make easier digestion. But, in term of proteins and carbohydrate content, there are in high quantity in *Lagenaria siceraria* and *Citrullus lanatus* seeds than that found in *Cucumeropsis mannii* seeds suggesting that *Lagenaria siceraria* and *Citrullus lanatus* seeds can be recommend for people which suffer from deficiency of protein and from energizing a phenomena often observed in Côte d'Ivoire regions where Cucurbitaceae are cultivated. Then, a study made by Meité *et al.* (2008) demonstrated that defatted cake of *Citrullus lanatus* seeds can be used for bread fortification in order to avoid malnutrition due to insufficiency of protein and energizing in developing countries.

Lipids constituent comparison

Lipids studies of the three Cucurbitaceae reveal that they are rich in Polyunsaturated Fatty Acid (PUFA). However, *C. lanatus* seeds are rich in PUFA than *L. siceraria* seeds which are more rich than *C. mannii* seeds. Linolenic acids are the highest followed by oleic acids. Palmetoleic acids are present in trace. SFA

are not abundant in Cucurbitaceae seeds oils. However, among the three Cucurbitaceae, *C. mannii* seeds oils have the highest MUFA content followed respectively by *L. siceraria* seeds oils and *C. lanatus* seeds oils. Among the SFA component found in Cucurbitaceae seeds, palmitic acid is the more abundant followed by stearic acid, myristic acid and lauric acid respectively.

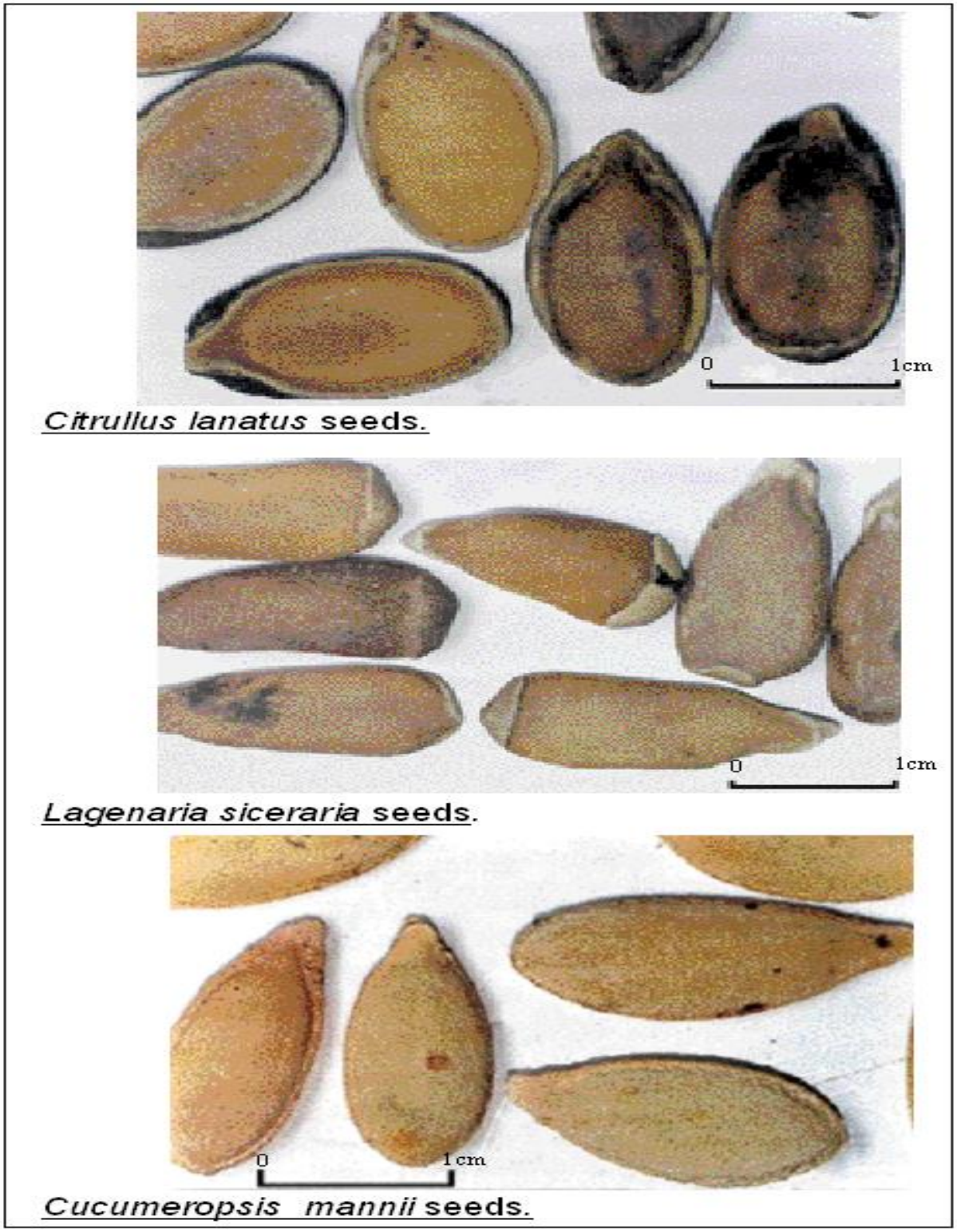

Fig. 1. On this picture it is shown respectively *Citrullus lanatus* seeds, *Lagenaria siceraria* seeds and *Cucumeropsis mannii* seeds according to Zoro Bi *et al.* (2003).

Amino-acids content comparison

The essential amino-acids found in the three Cucurbitaceae seeds are methionine, cysteine, lysine, threonine, phenylalanine, isoleucine, leucine, histidine, valine and tyrosine.The different part of proteins extracted from the three Cucurbitaceae seeds contain the non essential amino-acids such as alanine, serine, glycine, arginine, aspartic acid and glutaminic acid. Tryptophan an essential amino-acid is only found in *L. siceraria* seeds and proline a non essential amino-acid is found in *L. siceraria* and *C. mannii* seeds. Among the three Cucurbitaceae, only *L. siceraria* seeds contain all the amino-acids, *C. mannii* seeds do not contain tryptophan and in *C. lanatus* seeds, it misses two amino-acids which are tryptophan and proline.

Minerals content comparison

Minerals content of the three Cucurbitaceae are very diversified. *C. lanatus*, *L. siceraria* and *C. mannii* seeds contain calcium, iron, magnesium, copper and manganese. Nickel is present in *C. lanatus* and *C. mannii* seeds. Phosphorus and potassium are in high proportion in*L. siceraria* seeds and *C. mannii* seeds. Cobalt is found in *C. lanatus* seeds, selenium and sodium in *L. siceraria* seeds and silver, aluminium in *C. mannii* seeds.

Other component comparison

C. lanatus, *L. siceraria* and *C. mannii* seeds are also sources of various substances. In fact, they contain vitamins A and C, alkaloids, tannin, flavonoids, steroids, terpenes, saponines and polyphenols (antioxidants). Only *C. lanatus* seeds contain pantothenic acid, betacarotene, betacryptoxanthine, lectines and anthraquinones. *L. siceraria* and *C. mannii* seeds are both rich in vitamin E.

Nutritional value of C. lanatus, L. siceraria and C. mannii Fruits and seeds

Effect of C. lanatus seeds and fruits consumed on health

The red colour of the pulp fruit is due to the presence of lycopen which is very important for eye slight and has efficacy on cancer (Mandel *et al.,* 2005). The antioxidant found in *C. lanatus* fruits and seeds such as vitamin C, phenol and flavonoid have protective effects on the organism against free radicals (Johnson, 2001).

The fact that there is citrullin in *C. lanatus* seeds permitted to the organism which consumed sauce made to synthetize arginine an essential amino-acid.

Citrullin is important for cell division, for healing and for ammoniac elimination (Collins *et al.,* 2007). Essential amino-acids, trace element and fatty acids found in the seeds have protective effects on prostate (Ojeih *et al.*, 2008).

According to Francis *et al.* (2013), juice extracted from the fruits have protective effects on gastric injuries. In fact, when it is give to Albinos rat's which get gastric lesion, after 30 days, it is observed curing. This juice also release constipation on rats (Swapnil *et al.,* 2011).

According to Madhavi *et al.* (2012), *C. lanatus* seeds oil has protective activities on rat's (Madhavi *et al.* ,2012) and anti-inflammatories effects (Erhirhie *et al.,* 2013).

Seeds components extracted with methanol are endowed with analgesic activities (Rahman *et al.,* 2008).

Fruits and seeds components extracted with methanol are effectiveness on some bacteria such as *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa, Bacillus substimis* and *Candida albicans* (Rahman *et al.,* 2008).

According to several studies, the fruit is refreshing, aphrodisiac, astringent for intestine, diuretic, good for stomac, purify blood, energizing and is good for eyes (Rahman *et al.,* 2008).

It has protective effects against hiperlipidaemia (Aruna *et al.,* 2013) and it is fight against ulcer (Alok *et al.,* 2012 ;Okunrobo *et al.,* 2012).

Effects of Lagenaria siceraria (Molina) fruits and seeds consumption

Traditionally fruits, seeds and lipids of *L. siceraria* are used in the treatment of diabetes, ulcer, colon inflammation, hypertension, cardiac disease and skin illnesses.

The fruits are also used as emetic, sedative, diuretic, antibiotic and the seeds as vermifuge (Duke *et al.,* 1985 ;Rahman, 2003 ; Kirtikar *et al.,* 2005).

According to Lakshmi *et al.* (2011), the fruits exctract obtained with ethanol has protective effects on liver against carbon tetrachloride (CCl4).

The acetone extract of the pulp of the fruit reduce the devastation cause by DPPH (1 ,1-diphenyl-2-picryl hydrazyl) in deed this extract could be endowed with free radicals activities (Deshpande *et al.,* 2007).

The extract of *L. siceraria* fruit, when consumed, prevent endogenous alteration and lipid peroxydation on heart. This extract reduce toxicity marker (creatine kinase and lactate déshydrogénase) induce by doxorubicin. *L. siceraria* fruit powder has protective effect against change of encephalogramm (ECG) due to doxorubicin (Fard *et al.,* 2008).

The diuretic, anti-inflammatory, analgesic and anti-depression activities have been proved by the methanol extract of *L. siceraria* fruit (Ghule *et al.,*2007 ; Shah *et al.,* 2010 ; Prajapati *et al.,* 2011). Also, it has been proved that the methanol extract reduce blood pression due to Dexamethasone, can eliminate some microbes such as *Pseudomonas aeruginosa* and *Streptococcus pyogène*and has an anti-hyperlipdaemia action because it reduces weight gain of rat's caused by atorvastatine administration (Ghule *et al.,* 2009 ; Mali *et al.,* 2010). Concerning the fruit extract obtained with ethanol, when applied to albinos rat's which are swam, it reduces their stresses suggesting that it is endowed with adaptation properties (Lakshmi *et al.,* 2009). Chen *et al.* (2008) have demonstrated that triterpene extracted from the fruit have cytotoxic effects.

Effects of C. mannii seeds consumption

Compare to *C. lanatus* and *L. siceraria* seeds which are been subjected of many nutritional studies, particularly experimental studies made with rat's, few data are concerned the seeds of *C. mannii*. However, three main results can be noticed:

A study made by Ibironke and Adegboye (2013) shown that when a part of nuts pasta is substituted by a pasta of *C. mannii* seeds in rat's diet, as haematological parameters and organ suh as heart, liver, kidneys, lung, intestine, spleen and brain are not the cause of abnormalities whatever the degree of substitution;

Achu*et al.* (2008) compared in a study the atheroma induce of *C. mannii* seeds oil to that of maize oil and palm oil. They are shown that *C. mannii* seeds oil do not increase significantly gain weight, tryglyceride, total cholesterol, LDL cholesterol, HDL cholesterol and atherogenicity index than the two oils used as references suggesting that *C. mannii* seeds oil is potentially good for human feed;

The protein extracted from *C. mannii* seeds have practically according to Claudilde *et al.* (2013) the same effects on blood glucose level with the protein extract of *Citrullus lanatus* and *Lagenaria siceraria* seeds when used in rat's diet.

Conclusion

Finally, it is demonstrated by scientific research that The three Cucurbitaceae (*Citrullus lanatus*, *Lagenaria siceraria* and *Cucumeropsis mannii*) fruits, seeds and by-products are endowed with high nutritional values. So, their use in human diets must be encouraged because they can contribute to ensure alimentary security especially in developing countries. The proteins and lipids obtained from the seeds can be utilized to fortify food and then avoid malnutrition.

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