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RESEARCH ARTICLE

NUTRIENTS AND PHYTOCHEMICAL COMPOUNDS OF TWO VARIETIES OF BUSH MANGO (IRVINGIAGABONENSIS) GROWN IN BENIN.

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Abstract

This study aim was to characterize *Irvingia gabonensis* pulp grown in Benin. Nutrient content results showed that the samples contained a large amount of sugar (9.54 -15.28%) and a very low protein content (1.20 - 2.21%) and ash (0.2 - 0.9). the water content and Brix degree was comparable to that of several fruits. pulp would be a good substrate for fruit production. Pulp contained several phytochemicals such as oxalates, phytates, tannins, saponins and flavonoids in the relatively high amount.

Introduction:-

Fruits and vegetables are generally the main sources of micronutrients for the dietary balance of populations. They play a complementary nutritional role by providing the body with vitamins, minerals, dietary fiber, and organic acids (Serville, 1984), essential elements for the good functioning of the body. However, the nutritional value of fruit is related to its composition, which depends on the species, the variety, the degree of maturity and the conditions of cultivation, storage and conservation (Sawadogo-Ligani et al., 2001). In Africa, non-timber forest products (NTFPs) play an important role in food and trade. These are wild or cultivated plants whose utility potential has been little exploited commercially. However, they constitute an opportunity of economic and food survival for the local populations (Gandari, 2008).

In particular, 80% of rural populations in sub-Saharan Africa depends on non-timber forest products (NTFPs) for their health needs (Kalaba et al., 2010). Their biochemical and nutritional contributions (proteins, fats, carbohydrates, minerals and vitamins and fiber (Augustino et al., 2011)) have demonstrated their potential to resolve food, nutrition and health crises in Africa (Okolo et al., 1995; et al., 2010; Ahenkan and Boon, 2011; Sossa-Vihotogbé et al., 2012). *Irvingia gabonensis* (bush mango) is one of NTFPs widespread in the Gulf of Guinea. It is among the species of priority food tree in traditional agroforestry systems and subject to domestication (Franzel et al., 1996). Fruits are economically very important in sub-Saharan Africa for local populations (Asaah et al., 2003, Leakey et al., 2003).

In Benin, *Irvingia gabonensis* is very abundant in the departments of Mono, Couffo and the dense forests of Pobè (Akouêhou, 2012). It is an important source of livelihood and income for many farmers. Indeed, some of these harvested products are intended for self-consumption and another for trade on local, national and regional markets. It is distinguished locally under two varieties («Ewoto» and «Eshito») in the national languages. This distinction has already been mentioned by Okafor (1975) in Nigeria. Thus, the aim of this work was to evaluate the physico-chemical characteristics and the antinutritional compounds of the varieties encountered in Benin.

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Material and Methods:-

Material

Bush mango samples consist of the two varieties identified by indigenous peoples in southern Benin. These are the varieties «Eshito» and «Ewoto». These two varieties were collected in eight township of Benin (Lalo, Tovikilin, Klwehanmè, Aplahoué, Kétou, Pobè, Ifangni, Adja-Ouèrè) and have been stored at 4-6°C before used.

Physicochemical analysis

pH and titratable acidity were determined according to the modified procedure of AACC 02-31.01. The pH was measured using a pH meter on a homogenized mixture of 10 g of pulp and 20 ml of distilled water. Titratable acidity is measured on a solution obtained with 10 g of pulp and 90 ml of distilled water. The solution obtained after filtration was titrated with magnetic stirring with sodium hydroxide (0.1 N) to the phenolphthalein end point.

Moisture content of samples was determined by oven methods (ISO 712: 1998). Soluble solids (Brix) was determined using a digital refractometer (ATAGO HSR-500). Protein was analyzed by the Microkjedhal nitrogen method, using a conversion factor of 6.25. Ash was determined according to the standard methods described by the Association of Official Analytical Chemists (AOAC, 1990). The total and reducing sugar contents were measured respectively by the colorimetric method developed by Dubois et al. (1959) and that described by Gonçalves et al. (1900). Ascorbic acid content was determined by dichlorophenolindophenol (Lees, 1975)

Phytochemical analysis

The Folin-Ciocalteu method (Singleton, Orthofer, and Lamuela-Raventos, 1999) was used to determine the phenolic content. The absorbance of the reaction mixture was measured at 760 nm on the spectrophotometer. Oxalates were assayed by the method of Day and Underwood (1986), phytates by the method of Reddy and Love (1999), saponins by the method of Hudson and El Difrawi (1979), flavonoids by the method of Arvouet-Grand et al (1994) and tannins by the method of Trease and Evans (1978).

Results and discussion:

Figures 1 and 2 show the pH, the titratable acidity and the Brix degree of the two varieties of *Irvingia gabonesis* studied. These results show that the pH of the samples varied from 4.4 to 6.1, for the variety «Ewoto» and from 5.3 to 6.1 for the variety «Eshito». For the titratable acidity, it varied from 0.03 to 0.06 for all varieties. As to Brix degree, it varied from 10.5 to 12 for the «Ewoto» variety and from 10.5 to 15.5 for variety «Eshito».The result shows that the Brix degree and the pH were varied significantly according to the variety and the production area. however, the «Ewoto» variety had the most acidic fruit so it is more stable to deterioration. Indeed, according to Bourgeois (1985), for pH below 4.5, fruit enjoy a microbiological stability and those with pH values close to neutrality would be susceptible to microbial growth. The results of Brix degree show that the variety ««Eshito» » have a significant concentration of soluble matter. These differences may be due to the maturity of the fruits. According to Mamiro et al. (2007) work on mangoes (*Mangifera indica L.*), Total soluble content increases with the ripening of the fruit. As for titratable acidity, although it seems to be influenced by maturation (Mamiro et al., 2007), there is no significant difference observed in our results.

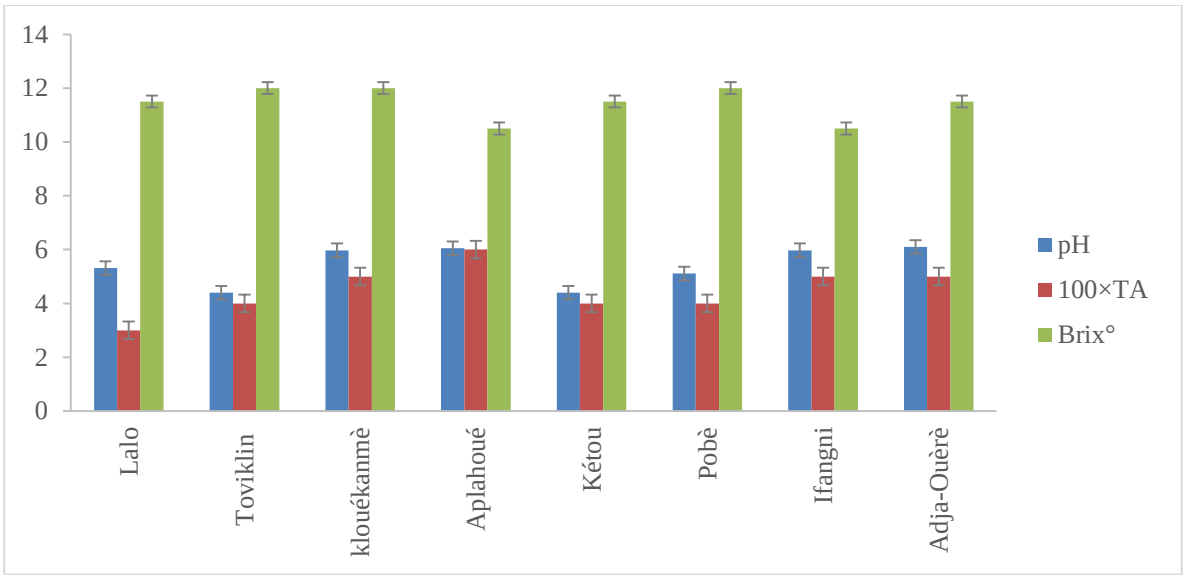

Figure 1:-pH, titratable acidity (TA) and Brix degree (Brix °) of «Ewoto» variety of *Irvengiagabonensis* from Benin

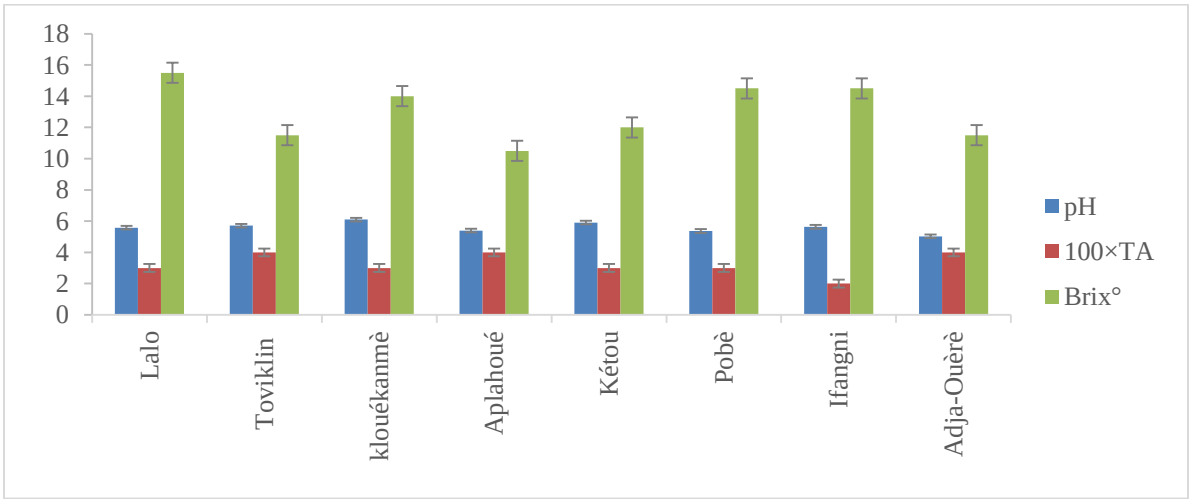

Figure 2:-pH, titratable acidity (TA) and Brix degree (Brix °) of ««Eshito» » variety*of Irvengia gabonensis* from Benin

Tableau I:-Nutrients of the pulp of the two varieties of *Irvingia gabonensis*
Values are Means ± SD of triplicate determinations

Variety	Township	Total sugar(%)	Reducing sugar(%)	Ascorbic acid (mg/100g)	Protein (%)	Dry matter (%)	Ash(%)
«Ewoto»	Lalo	14,57±0,04ij	8,22±0,01b	1,4±0,23h	1,54±0,05f	27,6±0,4h	0,33±0,01cd
	Tovikilin	14,04±0,11h	9,74±0,3e	1,04±0,04c	1,75±0,13i	26,06±0,4e	0,36±0,14c
	Klouékanmè	11,15±0,06d	10,29±0,02f	1,21±0,04hef	1,66±0,07h	26,76±3,1f	0,21±0,02b
	Aplahoué	10,39±0,03c	9,76±0,02de	0,96±0,11b	1,57±0,09g	25,57±2,5de	1,1±0,94f
	kétou	9,54±0,04a	7,9±0,07a	1,38±0,08g	1,5±0,01[e]	26,36±1,64de	0,36±0,14cd
	Pobè	12,86±0,15f	9,86±0,05e	0,87±0,1a	1,83±0,17j	25,5±0,18d	0,33±0,01c
	Ifangni	12,1±0,02e	10,23±0,02f	1,11±0,02d	1,4±0,05d	24,47±1,38bc	0,20±0,03b
	Adja-Ouèrè	10,19±0,07b	8,86±0,07c	1,08±0,06cd	1,2±0,09a	24,5±0,59c	0,38±0,06cd
««Eshito»»	Lalo	13,2±0,04g	10,95±0,09g	1,09±0,13cd	1,4±0,21d	36,69±0,3g	0,36±0,06cd
	Tovikilin	12,19±0,08e	9,47±1,10d	1,12±0,03d	2,1±0,18k	27,2±0,8fg	0,49±0,14e
	Klouékanmè	15,28±0,02k	9,98±0,04e	1,46±0,08h	1,31±0,07c	24,7±1,7c	0,37±0,06cd
	Aplahoué	14,45±0,08i	11,10±0,07h	1,25±0,02f	1,4±0,12d	23,9±1,8a	0,80±0,01a
	kétou	12,29±1,02e	10,90±0,01g	1,43±0,11h	1,66±0,01h	24,1±1,26ab	0,49± 0,14e
	Pobè	12,16±0,09e	9,73±0,02de	1,22±0,08e	1,75±0,25i	27,04±5,1fg	0,39± 0,05d
	Ifangni	14,89±0,01jk	12,97±0,09j	0,99±0,01b	1,22±0,07b	24,22±7,3abc	0,23 ±0,001b
	Adja-Ouèrè	14,89±0,08jk	11,6±0,01i	1,57±0,09i	1,91±0,07d	26,74±4,6f	0,89±0,05a

Mean with the same superscripts in the same column are not significantly different (P = 0.05).

The results of the physico-chemical composition are presented in Table 1. Results related to the pulp indicate that the dry matter for all sample varied from 23.90 to 36,69 %. The fruits were therefore susceptible to considerable alteration during storage (moisture greater than 60%) when they were not properly stored. This high-water content is comparable to that of fruit pulp such as mango, shea tree, *Borassus aethiopum*, *Vitex domania* sweet and Annona species (Folorunso et Modupe, 2007; Makalao et al., 2015). the combined results of water content and Brix degree may suggest the use of *Irvingia gabonensis* pulp for fruit juice production.

Total sugar and reducing sugar varied respectively between 9.54 and 15.28% and between 7.54 and 12.97. The lowest values were obtained for samples of the «Ewoto» variety and the highest values for the sample of the «Eshito» variety. These high values for the «Eshito» variety confirm the values obtained for Brix degrees. In fact, sugars constitute the majority of the total soluble compounds. protein content (1.2 - 2.21%) and ash (0.2 – 0.9) were low, although there is variability in the same variety, and variation from one variety to another, these values are similar to those obtained by Onimawo et al., (2003). However, the quality of the constituents of these two fractions could be an asset. Indeed, Onimawo et al., (2003) noted the presence of a high amount of calcium (262.3mg / 100g).

Ascorbic acid content (0.87 - 1.43 mg / 100g) is very low compared to that obtained by Onimawo et al., (2003) (66.7mg / 100mL) and Achinewhu (1983).

Table 2 presented oxalates, phytates, tannins, saponins and flavonoids content of the samples of *Irvingia gabonensis* studied. The presence of some of these compounds in fruits gives them well-known medicinal properties. Indeed, flavonoids, saponins and tannins have antimicrobial activity, as well as other physiological activities (Evans 2005). However, they constitute factors of non-absorption or mal-absorption of nutrients in the body.

The results in Table 2 show that the highest values for oxalates, phytates, tannins and saponins were 0.99, 0.91, 0.20 and 6.01%, respectively. These values for total phenols and flavonoids were 0.26 mg GA/100g and 1.06 mg CAT/100g of pulp. The high content of saponides (3.07 - 7.47%) were certainly responsible for the bitter aftertaste of the pulp of *Irvingia gabonesis*. The results do not reveal a significant difference between the values obtained for each parameter. The «Eshito» variety has the highest levels of oxalates, tannins, and flavonoids, while the highest levels of phenolics, phytates, and saponins are obtained from «Ewoto». These results can be explained by the variation of storage duration after harvest. Indeed, according to the work of Etubu (2012), while the content of flavonoids decreases those of saponins and tannins

Conclusion:-

The nutritional contribution of the two varieties of *Irvengia gabonensis* to the diet of indigenous populations in Benin remains important. These fruits can contribute to the diversification of food in the regions where they are found and constitute a very good source of nutrients for the population. The physico-chemical characteristics studied reveal no significant differences between the two varieties of Irvengia gabonensis. However, further studies will be needed to differentiate them.

Tableau II:-phytochemical compounds of the pulp of the two varieties of *Irvengia gabonensis*

Variety	Township	Total polyphenols (mg GA/100g)	Oxalates (%)	Phytates(%)	Tannins (%)	Saponins(%)	Flavonoids (mg CAT /100g)
«Ewoto»	Lalo	0,22±0,005bcd	0,98±0,09g	0,92±0,17cde	0,15±0,06abc	5,93±0,001bcd	1,01±0,009bc
	Tovikilin	0,26±0,006d	0,89±0,15f	0,88±0,11abc	0,16±0,01c	5,55±0,009abc	0,97±0,001bc
	Klouékanmè	0,17±0,002ab	0,60±0,11b	1,39±0,02e	0,13±0,07abc	6,86±0,002cd	1,03±0,001bc
	Aplahoué	0,21±0,08bcd	0,57±0,08b	1,00±0,06d	0,13±0,04abc	7,47±0,001d	0,78±0,001a
	kétou	0,25±0,001bcd	0,89±0,01b	0,85±0,21abcd	0,15±0,02a	4,63±0,01bcd	0,91±0,011a
	Pobè	0,21±0,0002abc	0,93±0,09e	0,89±0.11abc	0,13±0,09abc	5,08 ±0,0012a	0,95±0,03c
	Ifangni	0,12±0,0008bcd	0,85±0,11d	1,19±0,01ab	0,14±0,06c	4,80 ±0,001abc	0,92±0,06bc
	Adja-Ouèrè	0,24±0,005cd	0,96±0,27e	0,89±0,22cd	0,15± 0,03a	6,42± 0,001ab	0,82±0,02c
««Eshito» »	Lalo	0,21±0,01bcd	0,54±0,23a	0,90±0,01abc	0,19±0,01e	6,01±0,0027abc	0,93±0,004b
	Tovikilin	0,23±0,004bcd	0,67±0,21c	0,95±0.11cd	0,20±0,09f	5,45±0,019bcd	1,04±0,02c
	Klouékanmè	0,14±0,002a	0,99±0,09g	0,99±0,08d	0,13±0,08ab	3,07±0,008a	1,03±0,001bc
	Aplahoué	0,22±0,004bcd	0,71±0,12e	0,82±0,01a	0,15 ±0,05bc	6,86±0,001cd	0,82±0,001a
	kétou	0,22±0,002bcd	0,59±0,11b	0,91±0,11abcd	0,12±0,06a	5,94±0,006bcd	0,82±0,092a

	Pobè	0,17±0,0007abc	0,82±0,15e	0,89±0,04abc	0,15±0,01abc	3,77±0,009a	1,06±0,004c
	Ifangni	0,19±0,001bcd	0,73±0,09d	0,85±0,01ab	0,15±0,02a	5,50±0,001abc	0,98±0,099bc
	Adja-Ouèrè	0,24±0,01cd	0,76±0,21e	0,9±0,09cd	0,17±0,02a	5±0,008ab	1,03±0,05c

Values are Means ± SD of triplicate determinations
Mean with the same superscripts in the same column are not significantly different (P = 0.05).

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