SABA SENEGALENSIS : A TROPICAL FRUIT WHICH COULD BE AN OUTSTANDING CONTRIBUTOR TO DIETARY VITAMINS IN WEST AFRICA

Yérim Mbagnick DIOP; Eric MARCHIONI**; Claude HASSELMANN**; Doudou BA**

**Laboratoire de Chimie Analytique, Faculté de Médecine et Pharmacie, Dakar (Sénégal)*
***Département des Sciences de l'Aliment - Faculté de Pharmacie, Université Louis Pasteur de Strasbourg, (France)*

(Reçu le 01-06-1999 - Révisé le 03-11-1999)

Résumé : La détermination des teneurs en vitamines de Saba senegalensis a montré que la pulpe de ce fruit tropical récolté en Afrique de l'Ouest contenait des teneurs exceptionnelles de vitamine B_2 (de 40 à 55 $\mu g.g^{-1}$ du fruit mûr). Les concentrations en vitamine B_6 et en α et β–carotènes n'étaient pas non plus négligeables (respectivement de 1,90 à 2,70 $\mu g.g^{-1}$ et de 1,(à 6,3 $\mu g.g^{-1}$ en équivalent rétinol).

La consommation de ce fruit pourrait donc contribuer largement à couvrir les besoins en riboflavine et à un degré moindre, ceux en vitamines A et B6 des populations de cette région d'Afrique.

Mots clés : Saba senegalensis, fruit tropical, propriétés nutritionnelles, vitamines.

I - INTRODUCTION

Saba senegalensis (common name : gumvine) is a tropical fruit borned by a thin liana (the root's diameter does not exceed 15 cm) that may reach a height of 30 m by fastening its tendrils onto the branches of the trees. The distribution area of this liana is limited to the Guinean region, including the south of Senegal (Casamance), Madagascar and the Comoro Islands. Only one cultivar (S. senegalensis senegalensis) exists in Senegal.

This ovoid fruit (6-10 cm long and 5-8 cm wide), with a brown-yellow mat skin (after ripening) enclosing a yellowish, sweet, fibrous and slightly acid pulp containing a large number of seeds, is simply collected from the wild, but could certainly be cultivated. It is harvested between June and September.

According to the FAO Table of Food Composition[1], this fruit is supposed to contain modest amounts of vitamin B_2 and niacin (respectively 0.30 $\mu g.g^{-1}$ and 5.0 $\mu g.g^{-1}$) and negligible amounts of -carotene. But L-ascorbic acid and vitamin B_1 are supposed to be present in noticeable amounts (respectively 480 $\mu g.g^{-1}$ and 1.5 $\mu g.g^{-1}$).

Since this fruit is produced in low tonnage and in a restricted area, it is not very surprising that very few researchers dealt with it in the last decades. Only Diop et al.[2] re-examined its vitamin C content and found values much lower than the value listed in the FAO Table (from 62 to 110 $\mu g.g^{-1}$ instead of 480 $ug.g^{-1}$), thus contributing to minimize the vitamin interest of this fruit still further.

However, in the course of a study carried out in the laboratory, dealing with the effect of an ionising radiation treatment on the vitamin content of tropical fruits, the analysis of the gumvine pulp provided quite different data from those of the FAO Table. Very high amounts vitamin B_2 and, to a lesser degree, of α- and β-carotenes were obtained [3].

As fresh fruits, which are practically the only foods eaten raw by the African population, are an important dietary source of vitamins, it seemed interesting to check these preliminary results by carrying out repeated (three years running) and extensive analysis of the gumvine pulp, in order to better estimate the possible nutritional interest of this fruit which currently contributes, during its harvesting period, to the diet of women and children who consume it with salt and pepper or macerated in sugar and water.

II - EXPERIMENTAL

Samples

Whole fruits at different stages of ripening (in order to study the evolution of vitamin B_2 content in relation to the fruit ripening) were purchased from a local market in Dakar (Senegal) and brought by air to the laboratory in Illkirch (France) the same day

Fresh pulp, used for all other analysis, was prepared three years running at the Institut de Technologie Alimentaire of Dakar (Senegal). Ripe and wholesome fruits (3-5 kg) were first washed and stoned. Pulp obtained after straining in order to eliminate fibres and debris, was put in 1kg polyethylene bags, frozen at -20°C and brought by air in an ice box to the laboratory in Illkirch (France) the same day. On arrival at the laboratory, the pulp was thawed out and immediately analysed.

Liquid chromatographic system

The chromatograph consisted of a Model 600 E pump, a 700 injector, a 991- arrays diode detector and a 470 fluorimetric detector (Waters Associated, Milford, USA).

Vitamin assays

Analysis of vitamins were carried out according to the HPLC methods described by Diop et al. [2] for L-ascorbic acid and vitamin C, Bergaentzlé et al. [4] for vitamin B_6 and Arella et al.[5] for vitamins B_1 et B_2. α-and β-carotenes were extracted from the samples according to the method of Reeder and Park[6]. Separation of the two carotenes was performed isocratically with a Lichrospher 100 RP18 column (Merck), using acetonitrile/methanol / dichloromethan (55 : 35 :10 v/v) at a flow rate of 1 ml min^{-1}. The absorbance was measured at 470 nm. For all vitamins, data were quantified using external calibration.

III - RESULTS AND DISCUSSION

The vitamin levels found in gumvine pulp are shown in Table 1.

TABLE 1 : *Vitamin contents[1] in samples of gumvine pulp harvested three years running*

Vitamins	Contents ($\mu g.g^{-1}$)					
	(1993)		(1994)		(1995)	
L-ascorbic acid	110	20	120	10		-
Total vitamin C	210	30	160	10		-
Vitamin B1	0.74	0.03	0.71	0.01	0.96	0.04
Vitamin B2	55.3	2.0	54.7	5.0	40.5	0.4
Vitamin B6	1.90	0.15	2.70	0.10	2.60	0.05
- carotene	18.8	1.2	4.6	0.7	5.60	0.1
- carotene	28.3	1.8	6.4	1.0	9.5	1.5

(1) Average of three measurements for each vitamin

Contents in vitamin C (close to the data of Diop et al.[2] and vitamin B_2 both fairly constant irrespective of the harvesting year, are lower than the data listed in the FAO Table of Food Composition[1]. On the other hand, provitamin A (carotene) and vitamin B_2 contents appear much higher than the data from this Table.

For many different reasons (climatic, geographical, etc), the vitamin levels of a fruit may change considerably. Since the data of the FAO Table of Food Composition were drawn up from a very small number of determination (one for β-carotene, two for the other vitamins) and carried out with analytical methods of questionable specificity, the discrepancy noted between the two sets of data for vitamin B_1 and vitamin C is not unexpected. This is not the case for provitamin A (carotene) and vitamin B_2 data. In fact, the amounts of α- and β-caro-

tenes found in the gumvine pulp, though fairly variable, are always far from being negligible. Expressed in retinol equivalent, they may compare with those of the mango pulp [from 1.0 to 4.0$\mu g.g^{-1}$, according to Souci et al.[7]. Much more surprisingly, the gumvine pulp contains very large amounts of vitamin B_2 (from 40 to 55 $\mu g\ g^{-1}$), more than 130 times higher than the amount given in the FAO Table of Food Composition. These amounts are not only much higher than those found in fruits reported to be rich in vitamin B_2 as sweet almonds (Amygdalus communis) (from 3.5 to 8.0 $\mu g.g^{-1}$) or durian (Durio zibethinus) (from 1.7 to 5.3 $\mu g.g^{-1}$) [7], but even also higher than those found in foodstuffs considered as major sources for vitamin B_2 as for example crude liver which contains approximately 30 $\mu g.g^{-1}$ vitamin B_2, according to Souci et al. [7]. Analogous amounts (in the order of 50 $\mu g.\ g^{-1}$) are only found in dried yeast [8,9]. This totally unexpected result, obtained three years running, was confirmed by analysis carried out in two other specialized laboratories. In other respects, the analysis of whole fruits, performed at different stage of maturity (unripe, slightly ripe, ripe), showed that the amount of vitamin B_2 already fairly high in the unripe fruit (from 10.9 to 13.4 $\mu g.g^{-1}$), increased regularly in the course of ripening (from 27.8 to 28.6 $\mu g\ g^{-1}$ in the slightly ripe fruit and 49.1 $\mu g\ g^{-1}$ in the ripe fruit). Gumvine seems also to be quite rich in vitamin B_6, but a comparison of its content with those of other tropical fruits cannot be seriously undertaken because of the lack of published data concerning this vitamin. According to Souci et al. [7], only avocado (5.3 $\mu g.g^{-1}$), banana (3.6 $\mu g.g^{-1}$) and peanut (from 3.0 to 5.8 $\mu g.g^{-1}$) would contain more vitamin B_6 than gumvine.

The recommended daily allowance for vitamin B_2 varies from 400 μg for an infant to 1800 μg for a lactating female (from 1100 to 1400 μg for an adult)[8]. On that account, the physiological needs of Senegalese inhabitants for this vitamin could be realized by a moderate consumption of fresh gumvine pulp (for example, 1400 μg of vitamin B_2 is supplied by 25-35 g of this pulp). Fresh gumvine pulp could also be an impor-

tant dietary source of vitamin A. For example even when the lowest provitamin A (carotene) contents are adopted, the consumption of 100 g of this pulp per day could meet 15-20% of the daily physiological needs of an adult, estimated at 1000 µg according to Olson[10]. Considering vitamin B_6 requirements, meats and whole grain cereals are generally considered as the most important dietary source for this vitamin. However, the prolonged cooking of these foods practised in Africa while fully justified for health reasons (i.e. microbiological considerations), is associated with a significant loss of vitamins. In these conditions, the contribution of a fruit like gumvine to the physiological needs in vitamin B_6 cannot be disregarded. In fact, the consumption of 100 g of gumvine pulp per day could meet 10 - 15% of the dailly allowance for an adult, estimated at 2.0 mg according to Driskell [11].

BIBLIOGRAPHIE

[1] - ANONYMOUS *Table de Composition des Aliments à l'Usage de l' Afrique*. FAO, Rome, (1970), pp 81-97.

[2] - DIOP P.A., FRANCK D., GRIMM P., HASSELMANN C., *High performance Liquid chromatographic determination of vitamin C in fresh fruits from West Africa*. J Food Comp Anal, (1988), 1, 265-269.

[3] - DIOP Y. M., *Intérêt des traitements ionisants pour la conservation des aliments dans les pays en développement. Cas du Sénégal.* Doctorat de l'Université Louis Pasteur (Strasbourg I), (1995), 158pp.

[4] - BERGAENTZLÉ M., ARELLA F., BOURGUIGNON J.B., HASSELMANN C *Determination of vitamin B_6 in foods by HPLC. A collaborative study.* Food Chem. (1995), 52, 81-86.

[5] - ARELLA F., LAHÉLY, S., BOURGUIGNON J.B., HASSELMANN C. *Liquid chromatographic determination of vitamins B_1 and B_2 in foods.* A collaborative study. Food Chem., (1996), 56, 81 -86.

[6] - REEDER S K, PARK G L, *A specific method for the determination of vitamin A in orange juice*. Journal of the AOAC, (1975), 58, 595-598.

[7] - SOUCI S.W., FACHMANNW, KRAUT H., *Food Composition and Nutrition Tables*, 5th ed MedPharma Scientific Publishers, (1994), Stuttgart, and CRC Press, Boca Raton.

[8] - COOPERMANN J.M., LOPEZ L., *Riboflavin. In Handbook of v'itamins*, ed Machlin L. J., M. Dekker Inc. New York and Basel, (1984), pp 299-327.

[9] - HASSELMANN C., FRANCK D., GRIMM P., DIOP P. A., SOULÈS C., *High performance liquid chromatographic analysis of thiamine and riboflavin in dietetic foods*. J. Micronutr. Anal., (1989), 5, 269-279.

[10] - OLSON J.A., *Vitamin A*. in Handbook of vitamins ed Machlin L

J, M Dekker Inc. New York and Basel, (1984), pp 1-43.

[11] - DRISKELL J. A., *Vitamin B_6*. In Handbook of vitamins, ed Machlin L J, M Dekker Inc. New York and Basel, (1984), pp 379-401.