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Anti-oxidative activity of fruit extracts of some medicinal plants used against chronic diseases (diabetes, hypertension) in Kankan, Guinea

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Abstract: Ethnobotanical surveys in Kankan (Guinea) led to an inventory of 78 plants used in the treatment of hypertension and diabetes. Among them, 31 plants producing edible fruits were selected. From these, 16 were anti- hypertensive, 8 anti-diabetic and 7 were used to treat hypertension as well as diabetes. The strongest anti-oxydative activity was observed in the hydro alcoholic fruit extracts of Tamarindus indica L. (116.75 %), Diospyros mespiliformis Hochst. ex A. DC. (111.75 %), Strychnos spinosa Lam. (111.71 %) and Aframomum melegueta (111.12 %). The alcoholic extracts of Cissus aralioides (Welw. Ex Bak.), Cola cordifolia (Cav.) R. Br., Gardenia ternifolia, Syzygium guineense (Willd.) DC were devoid of any antioxidant activity.

Keywords: Guinea, Medicinal Plants, Fruit Extracts, Antioxydant, Chronic Diseases

1. Introduction

Several experimental, epidemiological and clinical studies support the hypothesis that dietary habits are likely to be involved in the development of pathological processes against cancer or cardio -vascular diseases. The attraction for antioxidants began after several epidemiological studies which had shown that the rate of cancer was low among people who eat a lot of fruits and vegetables rich in antioxidants [1]. In Africa, research on wild fruits and other wild edible plants is also intended to promote the preservation of these species, presently under threat by human activities. In fruits, vitamins C, A and E, and polyphenols are known to be responsible for such antioxidant activity, with polyphenols being the most active. A number of studies have reported the content of some essential nutrients in wild edible fruits from western Africa [2]. It is now established that the consumption of food with antioxidants such as vitamins C, E, carotenoids and the polyphenols helps to limit the oxidative stress and to reduce the risks of cancer, cardiovascular disease, osteoporosis, inflammatory diseases [3]. Some theories of cellular aging are based on the nutritional deficiency in these compounds [4; 5]. In addition to their nutritional value, the preservation of these fruits also has economical advantages, as there is a significant trade in some if these wild edible fruits [2].

For the cultivated plant species, the nature and antioxidant levels are closely dependent on the variety, cultivation methods and methods of food processing [6].

By now, there is no reliable data on the antioxidative activity of the fruits of the Guinean native flora, especially those used against diabetes and hypertension. The valuation of the fruits of native flora that are supposed to be important sources of these vitamins and other antioxidants could be an interesting alternative to reduce the public health spending and to improve the health of populations.

The overall objective of this study is to contribute to the development of the local resources in the management of chronic diseases such as diabetes and arterial hypertension.

2. Materials and Methods

2.1. Study Area

Located in the eastern part of the country, Kankan Prefecture extends on average between 9 ° 40 ' and 10 ° 45' north latitude and 8 ° 18 ' and 9 ° 45' west longitude. In the overall, the landscape is monotonous, consisting mainly of plains, except in some places where plateaus, lowlands and hills that interrupt the monotony encountered. The altitude varies from 400 to 650 m above the level of the sea. Located in the humid tropics, the Prefecture Kankan has a continental climate trend, mainly influenced by the harmattan blowing from north-east to south-east from November to March. Two alternated seasons: the dry season (November-April) and the rainy season (May to October). Rainfall varies between 800 and 1500 mm per year.

The edible fruits of the native flora are encountered during the two seasons of the year. Climatic factors of the area offer favorable conditions for the development and sufficient fruiting native plants including species with edible fruits. The main plant formations encountered are: grassy plain, shrub savanna, savannah, woodland, woodland, gallery forest.

The population of Kankan is about 327210 (census updated in 2004) with a population density of 28.29 inhabitants / km2. It is composed mainly of the Malinke ethnic group. More than 60% of the population live in rural areas and are interested in forest resources. People practicing agro -forestry- pastoral activities and trade to meet their basic needs (health and nutrition) [7].

On the occasion of holding weekly markets in each sub-Prefecture and in some large villages, the products reach the city center via traders. But the remoteness and isolation of some communities remain a real obstacle to the exploitation of the fruits of native flora.

2.2. Investigations Ethnobotanical

To get data related to the census and the use of plants with edible fruit used against diabetes and hypertension, we have done investigation according to the method developed by Adjanohoun [8]. Information is collected on standardized forms. Samples indicated that some fruits were harvested for determination (herbarium). Scientific names have been checked primarily in the following books: Illustrated flora of Senegal [9], Flora of Guinea [10].

2.3. Evaluation of Antioxidative Activity of Fruits

We have selected fruits to be analyzed from wild plants used in local traditional medicine against hypertension and diabetes mellitus.

- Extraction:

We performed extractions in different solvents (water, alcohol, methanol, ethyl acetate) in the laboratory of Cell Biology at the University of Kankan [11]. We adopted the method of DPPH because the extracts containing antioxidants could be evaluated based on their ability to clean the radical 1,1- diphenyl- 2 -picrylhydrazyl (DPPH) [12].

- Screening TLC for the detection of active extracts:

Spots of different dilutions of extracts of fruits and quercetin are placed on plates of silica gel (GF254) and developed in a mobile phase toluene -ethyl acetate (97: 3 v / v). Revelation is made by means of a stable solution diphenylpicryl - hydrazyl radical (DPPH) at 0.2% for the detection of the standard and potentials of the antioxidants. Persistent yellow spots have antioxidant activity [12].

- Test DPPH :

50 µL of dilutions of various fruit extracts are quercetin and mixed with 2.5 ml of a methanolic solution diphenylpicryl hydrazyl - 0.004%. After an incubation period of 30 minutes in the dark, the absorbance of the extracts were read at UV-Visible spectrophotometer at 517 nm [12].

3. Results

3.1. Ethnobotanical Survey

One hundred and twenty eight (128) people participated in the survey from which thirty eight (38) women. 23/38 women were fruit traders. Farmers are the most important socio-professional group. All those surveyed belong to the Malinke ethnic group with 5 variants with the following numbers: Maninka : 98; Wassolon - Foulah : 10; Lele : 2; Kouranko : 14; Bassandö - Foulah ; 4.

Their ages range from 12 to 85 years. Among these, 34/128 (27%) are young and have less than 40 years of age. Most of the other informants are older than 40 years: 94/128 (73%).

Seventy-eight (78) plants are used in the treatment of hypertension and diabetes in Kankan among them 31are fruit plants (40%). These belong to 23 families, the most representative being Caesalpiniaceae (3/31), followed by Anacardiaceae, Annonaceae, Apocynaceae, Arecaceae, Euphorbiaceae, Rubiaceae (2/31, each).

The therapeutic uses of the inventoried plants are summarized as follows (Table 1):

- Seven (7) are used against hypertension and diabetes
- Sixteen (16) against hypertension
- Eight (8) against diabetes.

The leaf is the organ most used (21/38, 55%) followed by the fruits (7/38, 18%), bark (5/38, 13%), root (2/38) of the whole plant (2/38), of the seed (1/38). Decoction is the most common method of preparing recipes (32/38, 84%). Infused are often used (6/38, 16%).

Table 1. *Fruit species used against hypertension and diabetes.*

Species	Family	Name Maninka	Pathology	Organ	Preparation
Adansonia digitata L.	Bombacaceae	Seda	HTA	Leaf	Decoction
			Diabète	Bark	Decoction
Aframomum melegueta	Zingiberaceae	Yaya	HTA	Whole plant	Decoction
			Diabète	Seed	Decoction

Species	Family	Name Maninka	Pathology	Organ	Preparation
Antidesma venosum Tul.	Euphorbiaceae	Alkouranayiri	HTA	Leaf	Infused
Blighia sapida C. König	Sapindaceae	Finsan	Diabète	Leaf	Infused
Bridelia ferruginea Benth.	Euphorbiaceae	Dafinsagba	Diabète	Root	Decoction
Cissus aralioides (Welw. ex Bak.) Pla.	Vitaceae	Lassa	Diabète	Leaf	Infused
Cola cordifolia (Cav.) R. Br.	Sterculiaceae	Taba, Tabalen	HTA	Leaf	Decoction
Detarium senegalense J.F. Gmel.	Caesalpiniaceae	Bödö, Bötö, Börö	HTA	Bark	Decoction
Dialium guineense Willd.	Caesalpiniaceae	Köfina	HTA	Leaf	Decoction
Diospyros mespiliformis Hochst. ex DC.	Ebenaceae	Sounsounfin	HTA	Bark	Decoction
Ficus capensis Thunb.	Moraceae	Toro	HTA	Leaf	Decoction
Gardenia ternifolia	Rubiaceae	Bourenkèman	Diabète	Leaf	Decoction
Landolphia heudelotii A. DC	Apocynaceae	Gbayi	HTA	Fruit	Decoction
Lannea acida A. Rich.	Anacardiaceae	Bembémounkou	Diabète	Leaf	Decoction
Lannea velutina A. Rich.	Anacardiaceae	Bembéwagna	HTA	Leaf	Decoction
Nauclea latifolia Sm.	Rubiaceae	Badi, Bado	HTA	Root	Decoction
			Diabète	Leaf	Decoction
Nymphaea lotus L.	Nympheaceae	Kofidi, Kökoun	HTA	Whole plant	Decoction
Oncoba spinosa Forssk.	Flacourtiaceae	Gboro	HTA	Bark	Decoction
Parinari excelsa Sabine	Chrysobalanaceae	Koura	HTA	Leaf	Decoction
Parkia biglobosa (Jacq.) R. Br. . Don f	Mimosaceae	Nèdè, Nèrè	HTA	Leaf	Decoction
			Diabète	Leaf	Infused
Pterocarpus santalinoides DC.	Fabaceae	Djaoun	HTA	Leaf	Decoction
Raphia sudanica A. Chev.	Arecaceae	Ban	Diabète	Fruit	Infused
Raphiostylis beninensis (Hook. f. .) P.	Icacinaceae	Kourangbayi	HTA	Leaf	Decoction
Saba senegalensis (A. DC.) Pichon	Apocynaceae	Sagba	HTA	Fruit	Decoction
Spondias mombin L.	Anacardiaceae	Ninkon	Diabète	Bark	Infused
			HTA	Leaf	Decoction
Strychnos spinosa Lam.	Loganiaceae	Kounékouné	HTA	Fruit	Decoction
			Diabète	Leaf	Decoction
Syzygium guineense (Willd.) DC.	Myrtaceae	Kissan	Diabète	Leaf	Decoction
Tamarindus indica L.	Caesalpiniaceae	Tombé	Diabète	Leaf	Decoction
Uvaria chamae P. Beauv.	Annonaceae	Frignan	HTA	Leaf	Decoction
Vitex doniana Sweet	Verbenaceae	Kodoba	HTA	Fruit	Decoction
Xylopia aethiopica (Dunal) A. Rich.	Annonaceae	Kani	HTA	Fruit	Decoction
			Diabète	Fruit	Decoction

Table 2. *Antioxidant activity of extracts /quercetin.*

Plant	TLC	Moyx	Rap.	Abs 50%	%
Adansonia digitata L.	+	0,12035	100	0,1556	77,36
Aframomum melegueta	+++	0,40725	100	0,3665	111,12
Antidesma venosum Tul.	+	0,02115	100	0,2219	9,53
Blighia sapida C. König	+	0,08550	100	0,2219	38,54
Bridelia ferruginea Benth.	+	0,02950	100	0,2219	13,30
Detarium senegalense J.F. Gmel.	+++	0,34545	100	0,3665	94,26
Dialium guineense Willd.	+	0,12825	100	0,1556	82,44
Diospyros mespiliformis Hochst.	++	0,40955	100	0,3665	111,75
Ficus capensis Thunb.	+	0,02895	100	0,2219	13,05
Landolphia heudelotii A. DC.	+	0,01850	100	0,2219	8,34
Lannea acida A. Rich.	+	0,06605	100	0,2219	29,77
Lannea nigritana (Sc. Elliot) Keay	+	0,01670	100	0,2219	7,53
Nauclea latifolia Sm.	++	0,12385	100	0,1556	79,61
Nymphaea lotus L.	++	0,12910	100	0,1556	82,99
Oncoba spinosa Forssk.	++	0,03000	100	0,2219	13,52
Parinari excelsa Sabine	+	0,12060	100	0,1556	77,52
Parkia biglobosa (Jacq.) Benth.	++	0,33810	100	0,3665	92,25
Pterocarpus santalinoides DC.	+	0,01815	100	0,2219	8,18
Raphia sudanica A. Chev.	+++	0,34445	100	0,3665	93,98
Raphiostylis beninensis (Hook.f.) Planch	+	0,06740	100	0,1556	43,33
Spondias mombin L.	++	0,34390	100	0,3665	93,83
Strychnos spinosa Lam.	+++	0,40940	100	0,3665	111,71
Tamarindus indica L.	++	0,42790	100	0,3665	116,75
Uvaria chamae P. Beauv.	+	0,03000	100	0,2219	13,52
Vitex doniana Sweet	+	0,12910	100	0,1556	82,99
Xylopia aethiopica (Dunal) A. Rich.	+	0,03040	100	0,2219	13,70

3.2. Anti-Oxidative Activity

The TLC screening of 31 fruit extracts gave 27 (87%) positive samples (more or less yellow spots) and four negative *viz*. the alcoholic fruit extracts of *Cissus aralioides*, *Cola cordifolia* (Cav.) R. Br (Taba), *Gardenia ternifolia* (Welw ex Bak.), *Syzygium guineense* (Willd.) DC. Their antioxidant activities related to quercetin, reference product are shown in Table 2.

Fifteen alcoholic fruit extracts showed an (have superior) antioxidant potency 43% higher than the reference quercetin product. The highest activity was found in the extract of *Tamarindus indica* (116.75 %), *Diospyros mespiliformis* (111.75 %), *Strychnos spinosa* (111.71 %) and *Aframomum melegueta* (111.12 %). The lowest (<10%) anti oxidative activities were observed in extracts of fruit *Lannea nigritana*, *Pterocarpus santalinoides*, *Landolphia heudelotii*, *Antidesma venosum*.

4. Discussion and Conclusion

Fruits contribute significantly to the diets of many rural families in times of famine and they also provide some essential micronutrients. The results obtained in this study showed that fruits are valuable sources of antioxidants and if their consumption is promoted they will go a long way in addressing some problems of malnutrition bedeviling rural communities in Africa *[13*]. Over the world, the use of plants or herbs as antioxidants in processed foods is becoming of increasing importance in the food industry as an alternative to synthetic antioxidants [14]. Plant polyphenols are strongly correlated with antioxidant activity and are considered as dietary antioxydants in human health and disease [15]. These secondary metabolites along with high levels of ascorbic acid have been found in the fruit extracts of *Adansonia digitata* which were beneficial in reducing the glycemic response [16; 17] and showed a strong antioxidant activity with an IC_{50} of 8,15µL in DPPH [18]. Other p*revious investigations showed that the beverages of the fruits of Strychnos spinosa and Adansonia digitata were capable of acting as antioxidant sources as they displayed significant radical scavenging properties mainly due to their phenolic, ascorbic acid, proantocyanidin and flavonoid contents. Adansonia digitata had the highest and comparable antioxidant activities to Citrus sinensis (orange) [*13]. *T*he fruit of *Tamarindus indica* which was rich in phenolic components such as epicatechin, catechin and oligomeric proanthcyanidins may be an important source of cancer chemopreventive natural products in tropical regions [19 ; 20]. Significant amount of total phenolics has been found in the fruit of *Diospyros mespiliformis* [2] which had high DPPH radical-scavenging capacity [21]. A potent antioxidant activity was described for the seeds of *Aframomum melegueta* [22].

Wild fruits have attracted a great deal of public and scientific interest because of their potential health promoting effects as antioxidants. Because Polyphenols or polyphenol rich diets provide significant protection against the development and progression of many chronic pathological conditions including cancer, diabetes, cardio-vascular problems and aging, the present results support the wide use of most of the collected samples, in particular the fruits of *Tamarindus indica*, *Diospyros mespiliformis*, *Strychnos spinosa* and *Aframomum melegueta* .

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