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Research Article

Study of the *Combretum micranthum* G Don Sector (Kinkeliba) in Senegal

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Abstract

Combretum micranthum (kinkeliba) is one of the most used medicinal plants in Senegal. However, its commercialization is poorly studied. The objective of this study is to analyze the commercialization of *Combretum micranthum* in Senegal. The study was carried out in two main regions of kinkeliba marketing in Senegal: Dakar, where kinkeliba is marketed; and Thies, where kinkeliba is produced and marketed.

Structured and unstructured surveys were administered to different categories of stakeholders: herbalists / traditional practitioners, collectors/ suppliers, retailers and consumers. Production sites that supply Dakar include the following: Diass, Sindia, Kiniabour, Pout, Thies Lalane.

The main sales points in Dakar are the Thiaroye and Grand Yoff markets. The kinkeliba marketing chain has short channels and women are the main stakeholders. Procurement is done by harvesting in the natural environment and by purchase for herbalists / traditional practitioners. The benefits and added value derived from the marketing of kinkeliba are positive and are increasingly evolving from producers to retailers. The kinkeliba chain, with its constraints and especially its strengths, requires better structuring and to be better known.

Keywords: *Combretum micranthum*, kinkeliba, commercialization, value chain, Senegal.

INTRODUCTION

In the countries of black Africa, health care on a modern basis, which is often expensive, pushes more than 80% of the population to resort to healers, one of the therapeutic arsenals of which consists of medicinal plants.¹ *Combretum micranthum*, commonly known as kinkeliba in Senegal, has a long history of use in many African countries. It has long been used in traditional medicine throughout West Africa for its cholagogue and diuretic properties². In Senegal, its leaves are very popular in both the therapeutic and food sectors.

Kinkeliba leaf extracts have been the subject of several chemical and pharmacological research studies. One can note among others, the study of the carbohydrate fraction³ which explains the action of the plant on digestive disorders and the hepatobiliary action, that of the unsaponifiable fraction of the lipid extract⁴ or the study on alkaloids⁵, which justifies the cholagogue activity and in part the lipotropic activity of the plant. Vitexin and isovitexin are considered to be the major leaf flavonoids⁶ linked to the hypotensive activity of the plant⁷. More recently Chika⁸ and Welch⁹ demonstrated the potential antidiabetic property of *Combretum micranthum* leaves.

The very rich chemical composition and the interesting pharmacological properties of this plant make it widely used

locally. This use involves flows that are organized in a sector, defined as the succession of actions carried out by actors to produce, transform, sell, and consume a product¹⁰. The objective of this study is to contribute to the knowledge and analysis of the kinkeliba sector. This specifically involves (1) identifying the actors in the sector, (2) analyzing its operation and (3) determining the financial benefits of the sector.

I. METHODOLOGY

I.1 Study area

Combretum micranthum, although widely consumed throughout Senegal, is more marketed in urban areas, particularly in the Thiès region which is the main production and marketing region of kinkeliba and the Dakar region also considered as a region of marketing (resale) and consumption of kinkeliba in Senegal. These are the regions that were targeted for this study. In Thiès, the targeted sales and production areas are the Diass, Sindia, Kiniabour and surroundings axis and the Pout, Thiès, Lalane axis (Figure 1). In Dakar, two flagship markets for the sale of kinkeliba were visited. These are the Grand Yoff market and the Thiaroye market

Figure 1: Distribution of respondents active in the marketing of kinkeliba in the areas surveyed

For consumers, we have chosen study areas recognized by the density and diversity of the population, which are: Grand Yoff, HLM Grand Yoff and Parcelles Assainies. The survey of these consumers made it possible, among other things, to get an idea of the diversity of the origin of the product and concerned 91 consumers distributed as follows: 31 in Grand Yoff, 46 in Parcelles Assainies, 14 in HLM Grand Yoff.

I.2 Data collection

It must be done on the basis of precise and detailed information for each stage of the sector considered. This information can come from different sources, the two main ones being bibliographic information and information obtained in the field¹⁰.

However, at the current state of knowledge, the Kinkeliba sector has never been the subject of a standard study. This is why the bibliographic data which should have been used as support at the level of the ministries concerned, the statistical organizations and the national customs, are very limited or almost non-existent. Thus, data collection has mainly focused on primary data obtained in the field.

The methods used in this present work are based on semi-structured and structured interviews which are carried out respectively by means of an interview guide and questionnaires, but also on observations made in the study areas. Semi-structured interviews concerned producers and consumers while questionnaires were administered to traders (resellers).

The themes and questions addressed during the surveys mainly relate to identification, socio-economic activities, organization of the activity, costs and profitability of the activity.

The observation consisted of going to the point of sale to see the interest that customers and traders have in the product. The purchase or haggling of the studied product made it possible to gain the confidence of the people to be investigated, to have the right information or to make price comparisons according to the weight and to observe the speed of flow of the goods.

The data obtained made it possible to carry out an analysis of the sector and an estimate of the benefits and costs incurred in marketing. The formulas below were used to determine average selling prices and value added.

$$PVMsc = (Psc / Pst) PVMst$$

PVMsc: Average selling price per bag; Psc: average weight per bag; Pst: Average weight per bag; PVMst: Average selling price per bag

$$\text{Profit (B)} = PVMsc - DT$$

PVMsc: Average selling price per bag; DT: Total expenditure

$$\text{Added value (VA)} = B + DPT$$

B: Profit; DPT = Staff expenditure + taxes

II. RESULTS AND DISCUSSION

II.1 The actors of the kinkeliba sector

The actors involved in the various links in the marketing chain perform various functions or roles. They are made up of collectors / suppliers, herbalists / traditional healers, retailers and consumers.

II.1.1 Collectors / suppliers

Collectors / suppliers are sellers commonly referred to as "bana bana", which can be considered at the same time as wholesalers. They ensure both the collection of plant material (kinkeliba leaves) at the level of production areas and wholesale.

These actors are predominantly older women (Figures 2 and 3). Their role in the sector is either to move from production areas to marketing areas to supply herbalists / traditional healers and retailers, or to stay in production areas and ensure the supply of certain retailers on site. They do the wholesale. They are responsible for drying (figure 4). After drying, the leaves are sorted (Figure 5) and packaged in plastic bags for wholesale (Figure 6).

Collectors can be classified into three categories according to the places where they carry out their activities:

- Those of the production zones in the Thiès region (Diass, Sindia, kiniabour and Lalane), these actresses only work on kinkeliba; they are specialized in picking and wholesaling as suppliers. They are not found in the markets, but in the houses where they set up a room to store the leaves already dried and sorted then packaged in bags;

- Those who move to the mainstream markets in Dakar;

- And finally those that directly supply neighborhood shops.

Alongside these women, there are actors who work in collaboration with herbalists under the support of ENDA SANTE. These are mainly men who were not met during our work.

II.1.2 Herbalists / traditional healers

According to the bill on traditional medicine and pharmacopoeia in Senegal, "is a herbalist, someone who knows the uses and sells medicinal plants". While a traditional healer, in addition to knowing the medicinal properties of plant species, generally has knowledge of other natural resources (animal skin, soil, etc.) that can provide treatment¹¹. These two categories of actors exercise an unconventional medical practice based on approaches presented as traditional in certain communities. Mystical practices and the use of plants are inseparable in their way of dealing. Secret rites are passed down from generation to

generation, from parents to descendants. At the level of this category of actors, kinkeliba is retained as a medicinal plant.

They are mostly male (Figure 1) and over 50 years old (Figure 2). They source by purchase from suppliers. Those surveyed are concentrated in the cities, in particular in Dakar, divided between the Thiaroye market and that of Grand Yoff. Those in the latter market form the most structured category, grouped together in the form of a small network called Réseau Vente Autrement (RVA) initially funded by Pharmacie sans Frontière which was then relayed by the NGO ENDA SANTE, which made canteens for them. These actors ensure a retail sale.

II.1.3 Retailers

They are actors who take advantage of the availability of resources to carry out a lucrative activity¹¹. In other words, a retailer is a merchant who finds products from suppliers and resells them to consumers for a profit.

It is the most dynamic link in the kinkeliba market, because it is practiced by all the other players in the sector, including some collectors / suppliers. They are found in both production and marketing areas. Those under 50 are found in this link (figure 1). There are men and women (figure 2) who source kinkeliba by purchase or by self-supply (figure 3).

Retailers in production areas may be the suppliers themselves or other salespersons specializing in retail sales.

As a result, the supplier data overlaps with that of the retailers at this level. The latter are often found on the Diass, Sindia, kiniabour, Lalane, Pout highways, and we see them retailing kinkeliba boots and sachets (figure 8). In Dakar, they are found in the markets, in particular, in Thiaroye (figure 7) and in Grand Yoff. The last category of retailers is represented by shopkeepers who reside in the neighborhoods.

II.1.4 Consumers

A consumer is defined as a person who performs a set of acts about a product from its purchase to its ultimate use. And these in order to best meet its expectations throughout the normal expected period of use.

The study of this link in the sector has enabled us to understand the circuit of kinkeliba in areas of high consumption. Consumers represent the largest link in the Kinkeliba sector because the product is highly prized in Senegalese society and at the level of all social strata. They can get supplies at various levels either at the market or in neighborhood shops. Some of them get kinkeliba from their parents or relatives who are in the production areas. Surveys have revealed that indeed some of these consumers are sourcing from the production areas targeted for this study. The others obtain their supplies elsewhere in the national territory and even outside the country.

Figure 2: Distribution of players in the kinkeliba sector according to their age

Figure 3: Distribution of players in the kinkeliba sector by sex

Figure 4: Distribution of players in the kinkeliba sector according to the supply method

Figure 5: Kinkeliba leaf drying techniques used by collectors / suppliers in Diass

Figure 6: Sorting and packing session for Kinkeliba leaves in Lalane

Figure 7: Kinkeliba leaves packaged in plastic bags at Diass

Figure 8: Sale of kinkeliba sachets at Thiaroye market

Figure 9: Sale of sachets and bundles of kinkeliba leaves by the roadside in Lalane

II.2 Organization of the marketing of kinkeliba

According to Terpend¹⁰, the functional analysis must start from the way in which the actor describes his role and his action in the sector and his assessment of his situation within it. It is sometimes important to know how the actor views the industry, its position and its importance in the industry; the way in which the other actors perceive this actor within the framework of their activities: it is then necessary to analyze the relations and the exchanges.

So since kinkeliba is a plant that grows in the wild, there are no producers in the strict sense. To get it, you just have to travel through the areas used for its development. The period of high production goes from June to January. This period is lagged behind when medicinal products from species such as *Cordyla pinnata*, *Detarium microcarpum* and *Detarium senegalense* are heavily harvested¹¹. This can be explained by the phenology of *Combretum micranthum*, which is a semi-caducifoliate species, whose leaf initiation occurs at the end of the dry season and which loses its leaves late¹². Outside this period, it can only be obtained from suppliers who stock it during periods of high production. However, the sale is made throughout the year. There are periods of intense marketing and periods of scarcity.

During the period of high production, in the production areas, the collection activity is very intense; retailers are self-sourcing, so another category of collectors / suppliers is added to those who are busy full time in this work. During this period the sale is made at fairly substantial weights but

at a fixed price (Table I). In case of scarcity, the activity of collecting is left to the old women collectors / suppliers.

In marketing areas such as Dakar, the supply varies depending on the point of sale. At the Grand Yoff market, the suppliers are men from areas not targeted in this study, specialized in collecting medicinal plant organs (roots, leaves, bark) with a well-targeted clientele who are herbalists / traditional healers.

II.3 Institutional environment

The NGO Enda Tiers Monde, through the Enda Santé Plantes Médicinales (ESPM) sector, created in 1987, has long been involved in supporting populations. ESPM developed in 2002 a network of herbalists in order to optimize the marketing of medicinal plants.

Enda Santé's support concerns, among other things, support for the acquisition of kiosks for the storage of medicinal products, the training of actors in the sector in organizational and technical plans¹¹.

The water and forest services are responsible for the management of forest resources as well as the protection of species. But the kinkeliba, considered a common species, does not benefit from a specific policy.

And lastly, the main mission of local communities is to meet the daily needs of the population. Among their responsibilities are the development and maintenance of markets including lighting, security, sanitation. The funds for the management of the markets come mainly from the rental

money of the kiosks built by the town hall and from the taxes paid by the vendors having a stall in the market.

II.4 Financial structures

The existing financial structure consists of a system of tontines where the operators pay, according to a predefined time, a sum of money. Eventually everyone receives all of the assets that they have paid in installments. In this system, too, members can benefit from one-off loans. This type of financial system is quite common in the commercial sector in Senegal and in other African countries, especially in the informal sector ANSD¹³; Dieng¹¹; Sneyd¹⁴.

III. Economic analysis of the sector

The costs incurred in the kinkeliba sector depend on the players and the places of sale. At the level of the collectors / suppliers, the costs incurred are rarely perceived and when they exist, they come from the acquisition of the product or the transport. In fact, for the most part, these actors obtain their supplies themselves and not a far from residential area, which means that for the most part, they do not have to bear the costs of purchasing the product or the fuel transport. It is only in the event of scarcity that some fall back on men (who ensure the collection) or they pay for transport to go themselves to production areas that have become more remote.

The costs borne by the retail traders in the marketing areas are the purchase of the product as well as the costs of packaging. For traders (herbalists / traditional healers) with suppliers not located in the market, transport costs are shared with their suppliers after delivery. In both cases, there are municipal tax costs and labor costs which include the costs of meals, babysitting and transport for the merchant.

Kinkeliba is marketed in different formats: by bag, by bundle and by small sachets. In times of scarcity, prices per bag of average weight 5 kg in production areas can go up to 1500 F against 600 F to 1000 F during high production, while bags

with an average weight of 9.75 kg are sold at 2000F. At this level the retail sale is done in bundles at 100 F or 200 F depending on the size or in bags of 250 g-300 g whose price is 100 F and bags of 400 g at 475 g at 200 F.

At the Grand Yoff market, suppliers sell per 5 kg bag between 1750 F and 2000 F and 9.75-10 kg bags between 5000 F and 5500 F. At the Thiaroye market, the suppliers are women collectors; they sell by bag of about 5 kg at 1500 F or bags of 9.75 to 10 kg at 3750 F. And finally at the level of the shops of the districts, the suppliers are itinerant traders collectors / suppliers coming from the region of Thiès; they supply these shopkeepers not by bags but by sachets weighing between 150 and 175 g which they deliver at 75 F per unit.

The retail price depends on the locality, at Grand Yoff market the price is 200 F for average weight 200 g sachets, in Thiaroye it is 100 F for average 162.5 g sachets. Selling prices similar to those in Thiaroye were also recorded for leaves of Sudanese woody species in Dakar¹¹. In case of scarcity of the product, the prices remain the same but the weight of the bags decreases. The price difference observed between the Thiaroye market and that of Grand Yoff could be explained by the fact that the Thiaroye market constitutes a kind of convergence site for products for medicinal use, from which other traders get their supplies for then resell.

Consumers, for their part, can obtain supplies at various levels either at the market or in neighborhood shops.

According to Adotevi¹⁵, it is the often well-organized resellers who derive the greatest benefits from the work of the producers. In the kinkeliba sector, the benefit as well as the added value are positive and evolve increasingly from production areas to marketing areas (Figure 9). The herbalists retailers being the most structured actors, record more than 50% of the added value; values close to that of the ditax fruit (*Detarium senegalense*), the retail sale of which generates 51% added value¹¹.

Table 1: Summary of selling prices per bag and per bag according to the study locations

	Bag weight in kg	Selling price per bag in CFA	Bag weight in grams	Sachet selling price in CFA
Production area	5	600 – 1000	400 à 475	200
	9,5 à 10	2000	250 à 300	100
Marché Thiaroye	5	1500	150 à 175	100
	9,5 à 10	3750		
Marché Grand Yoff	5	1750 à 2000	200	200
	9,5 à 10	5000 à 5500		
Shop	-	-	150 à 175	100

Figure 10: Added value (VA) and profits (B) for an average weight bag of 9.75 kg in the production and marketing areas

IV. Constraints, strengths of the sector and recommendation

The main constraint mentioned by the various actors in the sector relates to the scarcity of the plant. This situation is mainly explained by the expansion of towns or villages and the construction of infrastructure. In fact, the construction of the toll motorway and the Diass airport as well as the development of agro-industry on the Dakar-Thiès-Mbour axis induce modifications to the natural environments¹⁶; which encroaches on kinkeliba supply areas. The sector nevertheless has advantages, particularly strong demand and current and potential medicinal applications. There is a need to better structure the industry in order to boost it and protect the species.

CONCLUSION

As part of this study, the production and collection sites of Diass, Sindia, Kiniabour, Pout, Thiès and Lalane are involved in supplying the Dakar region with *Combretum micranthum* leaves. The main wholesale places are the Thiaroye and Grand Yoff markets. This study showed that the exploitation of kinkeliba is above all an activity dedicated to women who are mainly engaged in collection and retail marketing. The profit as well as the added value is positive and evolves in an increasing way from suppliers / collectors to retailers. The kinkeliba sector, with its constraints and above all its strengths, deserves to be better structured by a more extensive study involving all the focal points of the marketing of kinkeliba leaves.

REFERENCES

- Ekly-Natey R. D., Balet A. African Pharmacopoeia: Dictionary and Multilingual Monographs of the Medicinal Potential of African Plants. West Africa Edition: Traditions and Medicine. Éditions d'en bas. 2012; p.V. DOI: <https://doi.org/10.4000/africanistes.459>
- Kerharo J., Adam. The traditional Senegalese pharmacopoeia; medicinal and poisonous plants. Ed. Vigot Frère, Paris.1974; 1011p, pp 343-345.
- Bassène E., olschwang D., Pousset J. L. Characterization of inositol and sorbitol, probable active ingredients of kinkeliba *Combretum micranthum* G. Don: Dakar Médical. 1981; 26 (2):219 - 225.
- Bassène E. Fatty acid from the leaves of *Combretum micranthum* G. DON (Kinkeliba). s.l: Herba Hungarica. 1986(a); 25 (2):7-14.
- Bassène E. The alcaloides of *Combretum micranthum* G.DON (kinkeliba). Annales Pharmaceutiques Françaises. 1986 (b); 44(3):191-196.
- Bassène E. Flavonoids of *Combretum micranthum* G. DON (Kinkeliba). Medicinal plants and Phytotherapy. 1987; XXI (2):173-176.
- Prabhakar M. C., Hassina B., Kumar I., Shams M. A., Khan M. S. Y. Pharmacological investigations on vitexin. Planta Medica. 1981; 43(4):396 - 403. DOI: <https://doi.org/10.1055/s-2007-971532>
- Chika A., Bello S. O., Antihyperglycaemic activity of aqueous leaf extract of *Combretum micranthum* (Combretaceae) in normal and alloxan-induced diabetic rats. J Ethnopharmacol. 2010; 129: 34th. DOI: <https://doi.org/10.1016/j.jep.2010.02.008>
- Welch C., Zhen J., Bassène E., Raskin I., Simon J. E., Wu Q., Bioactive polyphenols in kinkeliba tea (*Combretum micranthum*) and their glucose-lowering activities. Rutgers University USA. Journal of Food and Drug Analysis. 2017; journal of food and drug analysis xxx. DOI: <https://doi.org/10.1016/j.jfda.2017.05.009>
- Terpend N. Practical guide to the sector approach: The case of the supply and distribution of food products in cities. FAO. 1997; www.fao.org/ag/sada.htm.
- Dieng S. D. Filière des produits à usage médicinal issus de *Cordyla pinnata*, *Detarium microcarpum* et *Detarium senegalense* au Sénégal. 2019. DOI: <https://doi.org/10.21248/fvss.22.78>.
- Mahamane A., Mahamane S., Lejoly J., Phenology of some woody species of the "W" National Park of Niger. Drought. 2007; 1E (4):1-13
- ANSD, 2017: Global report of the general census of enterprises Dakar, page 101.
- Sneyd L. A missed opportunity for research and development interventions. Gender and the forest food trade in urban Cameroon. 2016; In Njuki J., Parkins J.R. and Kaler A. Transforming Gender and Food Security in the Global South. Routledge Studies in Food, Society and the Environment. (ed.) 2016; pp 138-159. DOI: <https://doi.org/10.4324/9781315564111>
- Adotevi, J. B., Market gardens are on the sand. Grain de sel p. 9.
- Albarelo L. Becoming a practitioner - researcher: how to reconcile research and social practice. 2003; De Boeck Supérieur, Brussels. 1997; 136 p.
- Ngom M.C., Badiane S.D., Diongue M., Mbaye E., Agro-industries of the Dakar-Thiès-Mbour metropolitan interface: land issues and territorial development. Cahiers de géographie du Québec. 2017; 61 (172):33-53. DOI: <https://doi.org/10.7202/1042714ar>