

## Research Application Summary

### **Organization of baobab leaf powder market in the sudano-guinean zone of Benin: Case of the municipality of Dassa-Zoumè**

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#### **Abstract**

The nutritional value of baobab leaf powder and its contribution as a source of income to households in Benin call for the need of effective marketing channels. This paper aimed to investigate the market of baobab leaf powder at Dassa-Zoumè by characterizing the market channel and determining consumers' perception. Data were collected from 11 collectors, 46 processors, 72 retailers and 187 consumers using a snowball sample through individual interviews. Descriptive statistics were used to characterize the different actors while demand, supply and attainment index were used to analyse the consumers' preference. The results show that Idaatcha and Mahi ethnic groups are involved in baobab leaf chain from the collection to consumption while Peulh ethnic group are just consumers. Dendi ethnic group are retailers. The results obtained indicated that baobab leaf chain actors are grouped into three main categories: retailers, drivers and collectors, processors and consumers. Processors supply leaf powder by direct selling transaction to consumers and retailers. Leaf processing activity is favorable for all the actors involved in the value chain during shortage season. Consumers' preference analysis revealed that consumers are generally satisfied and their expectations are met. Baobab leaf powder market is still underdeveloped and deserves attention for an effective and sustainable development of its value chain.

Keywords: Baobab leaf chain, marketing channel, consumers' preference, snowball sample, attainment index.

#### **Résumé**

La valeur nutritionnelle de la poudre de feuilles de baobab et sa contribution en tant que source de revenus pour les ménages béninois nécessitent des circuits de commercialisation efficaces. Cet article visait à étudier le marché de la poudre de feuilles de baobab à Dassa-Zoumè en caractérisant le circuit de commercialisation et en déterminant la préférence des consommateurs. Les données ont été recueillies auprès de 11 collecteurs, 46 transformateurs, 72 détaillants et 187 consommateurs en utilisant un échantillon par boule de neige à travers des entretiens individuels. Des statistiques descriptives ont été utilisées pour caractériser les différents acteurs tandis que les indices de demande, d'offre et de réalisation ont été utilisés pour analyser la préférence des consommateurs. Les résultats montrent que les ethnies Idaatcha et Mahi sont impliquées dans la chaîne des feuilles de baobab depuis la collecte jusqu'à la consommation alors que le groupe

ethnique Peulh est juste consommateur. L'ethnie Dendi est détaillante. Les résultats obtenus indiquent que les acteurs de la filière feuille de baobab sont regroupés en trois grandes catégories: les détaillants, les conducteurs et les collecteurs, les transformateurs et les consommateurs. Les transformateurs fournissent de la poudre de feuilles par vente directe aux consommateurs et aux détaillants. L'activité de transformation des feuilles est favorable pour tous les acteurs impliqués dans la chaîne de valeur pendant la saison sèche. L'analyse de la préférence des consommateurs a révélé que les consommateurs sont généralement satisfaits et que leurs attentes sont satisfaites. Le marché de la poudre de feuilles de baobab est encore sous-développé et mérite une attention pour un développement efficace et durable de sa chaîne de valeur.

Mots-clés: Chaîne de feuilles de baobab, circuit de commercialisation, préférence des consommateurs, échantillon par boule de neige, indice de satisfaction

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## Introduction

In Benin, baobab tree is an agroforestry specie widespread from the Sudanian zone (Boukoumbé, Tanguiéta, Porga and Karimama) to the Guinean zone (Bohicon and Comè) via the Sudano-Guinean zone (Dassa-Zoumè) (Assogbadjo *et al.*, 2005). The fresh or dried leaves are consumed as a viscous/slim sauce. The leaf powder market provides a source of income as well as an important source of food security, thereby reinforcing the overall development of poverty reduction goals. Indeed, baobab leaves are rich in calcium (307-2640 mg/100g), iron (1.2-254 mg/100g), potassium (140-1080 mg/100g), magnesium (93.6-549 mg/100g) and phosphorus (115-875 mg/100g) (Chadare *et al.*, 2017). The dried leaf is also rich in glucids, amino acids and lipids, especially Omega-3 and  $\beta$ -sitosterol which can be useful in food industry and contribute to control blood cholesterol (Tsetegho Sokeng *et al.*, 2019). Baobab leaves can contribute to decrease the iron and calcium deficiencies recorded within children of rural populations. However having this potential, they are still neglected and consumed mainly by local rural populations as a sticky sauce (Gbaguidi *et al.*, 2020). Moreover, studies carried out on baobab leaves in Benin provided information about its main use (Chadare *et al.*, 2008; De Caluwe *et al.*, 2009; Assogbadjo, 2010), nutritional composition (Chadare *et al.*, 2009; Chadare *et al.*, 2017) and optimization of the leave's drying (Gbaguidi *et al.*, 2020). Unfortunately, study for improving the marketing of the leaf powder has not been undertaken. The present study investigated the organization of the baobab leaf powder market. Specifically it (i) characterized the market channel, and (ii) determined consumers' preference.

## Material and Methods

**Study area.** The study was conducted in Dassa-Zoumè, the Sudano-Guinean zone with higher distribution of baobab trees and consumption of the leaves. In total, four villages (Gbafo, Awaya, Atinkpayé and Akofodjoulè) and three boroughs (Zongo, Betou and Ayedero) of Dassa-Zoumè were visited.

**Sampling.** A snowball sampling was used to select the individuals to be investigated because there was no official statistical database on the individuals for this activity. We started from a retailer who indicated us the processor that supplied it with powder, and so on until reaching all the categories of actors of the chain. In total, 11 baobab leaves collectors, 46 processors, 72 traders and 187 consumers were surveyed.

**Data collection.** The data were collected following a two steps method. Firstly, questionnaires

were elaborated and tested in focus group with 10 members of each group of actors. Based on the validated questionnaires, the respondents were interviewed individually using a questionnaire specific to the category to which they belonged. Collected data were related to the socio-demographic characteristics of the actors, roles and relationships to elaborate the baobab leaf powder market channel and the consumers' preference.

For the first objective, the experience in the activity, period of strong marketing of the leaf powder, sale's periods and customers of the actors were identified. Processors were asked to describe the processing operations they used to apply. About the consumers' preference, the focus groups were engaged to identify the most important quality attribute for the leaf powder. The identified attributes were: nutritional and therapeutic virtues, taste, sliminess, granulometry, smell and colour. Then, each respondent appreciated each attribute on its importance (as very important, important, or not so important) and how well it meets or satisfies his expectations (very good, good, poor), after what he/she also gave to each attribute a rank.

**Data analysis.** After the data collection, data were entered using Epidata, then treated and analyzed using SPSS statistics 23. Descriptive statistics (percentage) were realized to characterize each actor and the outcomes were presented in tables.

Analysis of the market channel consisted of identifying chain actors at each stage and discerning their roles and relationships.

In order to analyze data on consumer preference, the attributes were classified according to the rank. The attribute that obtained the lowest rank were placed first as the most important attribute and this was followed by the other attributes. The Kendall concordance test was used to check whether the ranking was homogeneous within the sample.

Consumers' preference were analyzed using the approach applied by Sall *et al.* (2000). This approach has been applied to innovative structures for the conservation of maize in south Benin (Adégbola, 2008). It uses three index:

- The demand index (D) which is a measure of how important the consumers perceive a particular characteristic. A value of 1 indicates that all consumers perceive the characteristic to be very important. The minimum value of the index is  $>0$ , and is reached when all consumers perceive the characteristics to be of little importance.
- The supply index (S) which is a measure of the perception of consumers on how well a characteristic is being embodied in leaf powder. A maximum value of 1 indicates that all consumers perceive the characteristic supplied as being of very good quality. The minimum value of the index is  $<0$ . The minimum value will be reached if all consumers perceive the quality of the characteristic being supplied as poor.
- The attainment index (W) which provides a measure of how well consumers perceptions of the importance of the characteristic matches consumers perceptions of how well it is being supplied in the leaf powder. The maximum value carried by W is 1, and implies a perfect match. In such a situation, all consumers rank the particular attribute as very important and rank the quality supplied of it as very good. The minimum value of the index depends on the supply weights chosen.

## Results

**Characterization of the baobab leaf powder chain actors.** Table 1 shows the socio-demographic characteristics of the actors in term of sex, ethnic groups and locations. The results show that the collection of baobab leaves is mainly done by men (63.6%), the consumption by both men (20.2%) and women (79.3%) but the processing and the retail are exclusively done by women. Concerning the ethnic groups involved in baobab leaf powder chain, Idaatcha (74.5% of collectors, 67.5% of processors, 48.6% of retailers and 63.6% of consumers) and Mahi (25.5% of collectors, 23.7% of processors, 20.8% of retailers and 10.9% of consumers) are the most represented as opposed to Peulh (13.3%) who are just consumers. Baobab leaf powder collectors are mostly located at Atinkpayé (31.8%), Akofodjoulè (27.7%) and Gbafo (22.3%) where there are also more processors and consumers. Retailers are more concentrated at Zongo (38.9%).

Table 2 shows the experience in the activity, period of strong marketing of the leaf powder, sale's periods and customers of the actors. These factors vary from one category of actor to another. With regard to experience, results showed that 45.4% of collectors had been engaged in the business for 5-10 years while processors and traders carrying out the activity since more than 10 years. In terms of sale's period, 61.2% of collectors, 78.6% of processors and 48.84% of retailers make their activities during the shortage season (dry season). This season represent the period of strong marketing of baobab leaf powder. So, 27.2% of surveyed retailers sold well from October to March while 72.8% consider December from February as the period of good sale. An average of 30.4% of processors and 69.6% of fresh leaves consumers buy the leaves from leaves collectors. In addition, processors sell leaf powder to retailers (34.6%) and consumers (65.4%). Finally, retailers sell to other retailers (33.04%) and directly to consumers (66.96%).

**Table 1. Socio-demographic characteristics of actors**

		Percentages (%)			
		Collectors (N=11)	Processors (N=46)	Retailers (N=72)	Consumers (N=187)
Sex	Men	63.6	0	0	20.2
	Female	36.4	100	100	79.3
Ethnic groups	Idaatcha	74.5	67.5	48.6	63.6
	Mahi	25.5	23.7	20.8	10.9
	Peulh*	-	-	-	13.3
	Dendi*	-	3.3	18.1	8.5
	Yorouba*	-	5.5	12.5	3.7
Locations	Gbafo	22.3	21.4	13.5	11.8
	Awaya	-	2.2	-	4.8
	Zongo	18.2	13.6	38.9	16
	Betou	-	-	11.5	4.3
	Ayedèro	-	-	9.7	4.8
	Atinkpayé	31.8	37	13.9	33.7
	Akofodjoulè	27.7	25.8	12.5	24.6

(-): not identify

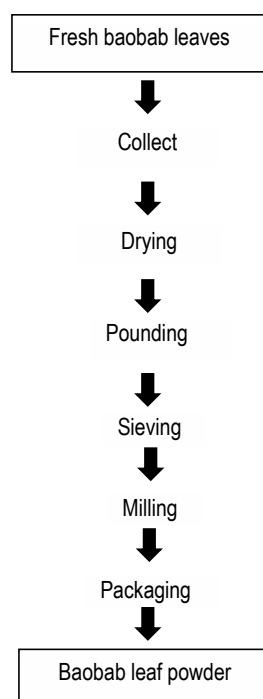
\*: not native of Dassa-Zoumè

**Table 2. Experience in the activity, period of strong marketing of the leaf powder, sale periods and costumers of the actors**

		Collectors	Processors	Retailers
Experience in the activity (year)	5-10	45.4%	6.5%	23.6%
	10-15	36.4%	47.8%	51.4%
	More than 15	18.2%	45.7%	25%
Period of strong marketing of baobab leaf powder	October to Mars	-	-	27.2%
	December to February	-	-	72.8%
	All year	-	-	37.21%
	Rainy season	38.8%	21.4%	13.95%
	shortage season	61.2%	78.6%	48.84%
Customers	Powder processors	30.4%	-	-
	Powder retailers	-	34.6%	33.04%
	Sauce consumers	69.6%	65.4%	66.96%

(-): not identify

**Production of baobab leaf powder.** To obtain baobab leaf powder, fresh, young and old leaves are first collected from baobab trees. Among those surveyed, 30.4% of the processors obtained from the collectors while 69.6% collected the leaves themselves. After collection, the leaves are sun-dried on hills with no washing by 87% of processors for 1 to 2 days and shade-dried after washing by 13% of processors for 4 to 5 days. Next, they pounded the leaves at home using a mortar and a pestle, then sieved. Sieved product is further milled into powder and packed in bags for storage or in white small packets for retail selling. Concerning the production frequency, 34.8% of the surveyed processors produce once a week, 45.7% once a fortnight and 19.6% once a month. The flow diagram for the processing of baobab leaf powder is shown in Figure 1.



**Figure 1. Processing diagram of baobab leaf powder as applied by surveyed processors**

**Marketing channel of baobab leaf powder.** Figure 2 shows the marketing channel of baobab leaf powder as found during the survey. Baobab leaf powder reach the final consumer through various channels. Processors choose two different market outlet to supply their products: direct sale to consumers and direct sale to market retailers. Figure 2 indicates that actors of baobab leaf powder marketing channel are grouped into three main categories: the main commercial actors, secondary actors and the partners of the main commercial actors.

- The main commercial actors in baobab leaf powder channel are retailers. They are generally traders and are those last link between processors and consumers. Two types of retailers were identified who buy leaf powder from processors and those who buy from other retailers. Retailers sell to consumers in markets and at homes. Baobab leaf powder is sold at 50F CFA per bag of 30g, 100F CFA per 5 bags of 30g and 11 bags of 30g at 200F CFA. The price per kg varies from 300-1000F CFA depending on the season.
- The secondary actors are drivers and millers. Drivers help the main commercial actors and retailers in their journeys to markets or milling points. They have two means of transport: motorbikes and cars. Millers on the other hand help processors to mill the sieved powder at a price of 50F CFA per kilo.
- The partners of the main commercial actors are the leaves collectors, the leaf powder processors and the consumers of sauce from the leaf powder. They are at upstream (the collectors and the leaf powder processors) or downstream (sauce from the leaf powder consumers) of the chain.
- Leaves collectors: they are independent operators who search for baobab leaves and transport them on foot or by bicycle from the hills, bush and fields using “Dangote” bags for sale to processors. They are paid according to the quantity they manage to deliver. Fresh leaves are sold at 500F CFA per kg. Sometimes, they do not collect the leaves but indicate to the processors where they can find well-leafed baobab trees and receive a fee for this information. They also sell the fresh leaves at the market and house to house to households (consumers) during the abundance period of the leaves. They often have special relationships with processors (parents, friends, village neighbor).
- Leaves processors: They are the major partners of the retailers. There are two types of processors in baobab leaf value chain: the processors who sometimes get their leaves from collectors and those who collect them themselves (they are considered as those who get leaves from collectors in the analysis). They transform the leaves into powder and make them available to traders (of the municipality and Glazoué city) and consumers. This activity is artisanal and the processed quantities vary greatly. It is important to specify that the distinction between the roles of each actor is not so obvious in reality. It is therefore common to find retail processors.
- Baobab leaf powder sauce consumers: consumers are final purchasers of baobab leaf powder from retailers and processors for sauce preparation purpose. They are individual households (rural and urban dwellers). They are the only outlets for baobab leaf powder marketing channel.

**Consumers' preference.** The Table 3 summarizes the rank, order of importance, demand, supply and attainment indices of the consumers' perceptions. According to the results, Kendall test gave a coefficient of 0.809 (p 0.001). The table indicates that the most important consumers' perception is the nutritional and therapeutic virtues ranked 1, followed by the taste and the sliminess respectively ranked 2 and 3. The leaf powder granulometry is ranked 4, the smell is ranked 5 while the least important perception mentioned is the color which was ranked 6. What consumers want in terms of the different characteristics is reflected in the demand indices. The value of the demand index of the nutritional and therapeutic virtues, the taste and sliminess is 1 while the value of the demand index of granulometry, smell and colour is respectively 0.98, 0.86 and 0.93 indicating that consumers attach great importance to all the attributs. In terms of the supply index, Table 3 shows that the value of the supply index vary in general from 0.98 to

1, indicating satisfaction. The attainment indicates how well the consumers' needs are being supplemented. The value of the attainment is 1 for the first criteria. For the sliminess and the granulometry, the attainment index is respectively 0.99 and 0.97 while it is respectively 0.85 and 0.93 for smell and colour. Consumers' expectations are therefore met.

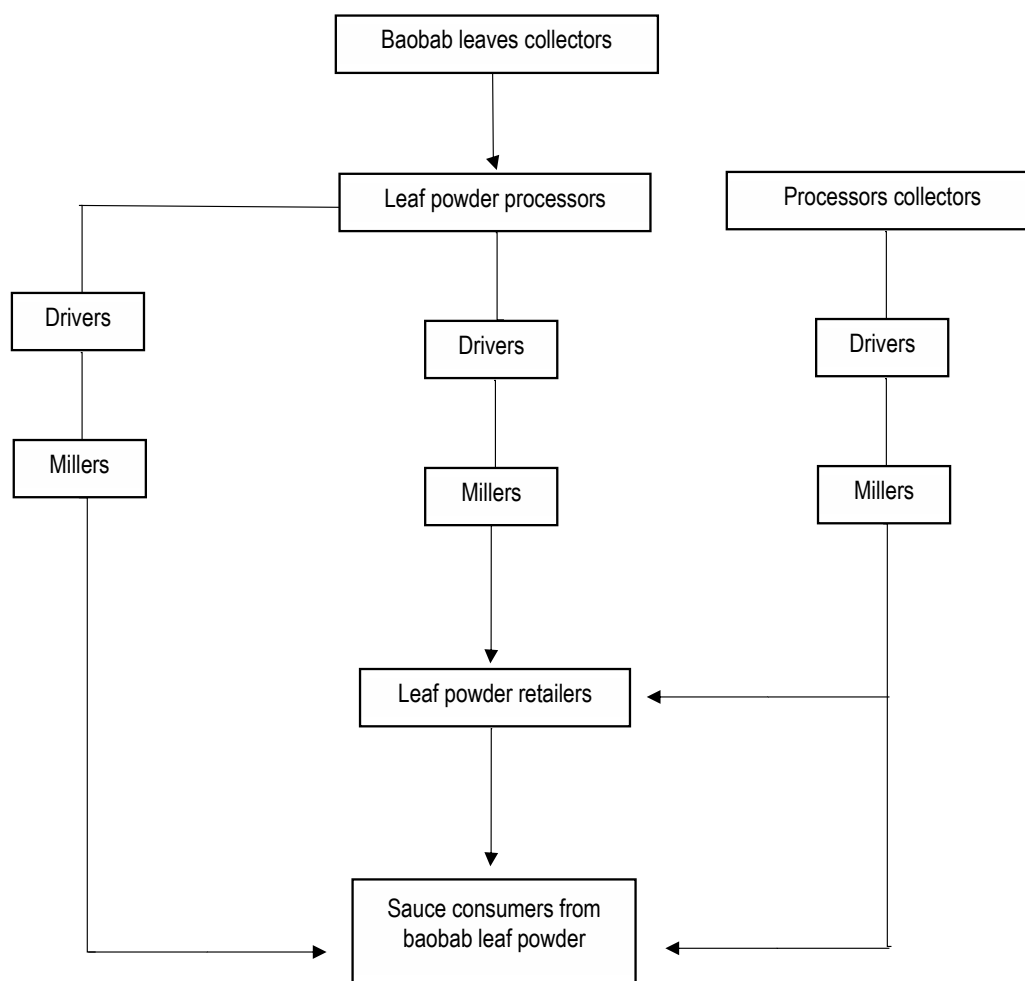


Figure 2. Marketing channel of baobab leaf powder in Benin

Table 3. Rank, order of importance, demand, supply and attainment indices for baobab leaf powder

Criteria	Rank	Order of importance	Demand index	Supply index	Attainment index
Nutritional and therapeutic virtues	1.66	1	1.00	1.00	1.00
Taste	1.73	2	1.00	1.00	1.00
Sliminess	2.77	3	1.00	0.99	0.99
Granulometry	4.43	4	0.98	0.98	0.97
Smell	5.13	5	0.86	0.98	0.85
Colour	5.37	6	0.93	0.99	0.93

The Kendall concordance test:  $w=0,809$ ;  $x^2=756,062$ ;  $ddl= 5$ ;  $p=0,001$

## Discussion

This study indicates that the baobab processing and trading are activities largely carried out by women. These activities constitute secondary source of income for women, the first being field activities. The Idaatcha and Mahi ethnic groups dominate the baobab leaf value chain while Peuhl ethnic groups are just consumers. The actors of commercialization are mostly rural natives belonging to Idaatcha and Mahi ethnic groups. But, there is also Dendi ethnic group which represent the main actor in baobab leaf powder business in north Benin (Assogbadjo *et al.*, 2006). The processing of the leaves into powder and the consumption of sauce from baobab leaf powder are more concentrated in the villages where native ethnic groups have gained rich experience and knowledge in processing technics (Chadare *et al.*, 2008) and in therapeutic use, the leaves are involved in the treatment of several diseases such as hemorrhoids and anemia (Assogbadjo, 2010). Due to their experience and knowledge, consumers prefer more the nutritional and therapeutic qualities of the leaf powder for their well-being than organoleptic attributes. However, the consumption of the powder in urban areas surveyed (Betou, Ayedero and Zongo) is very low. In fact, baobab is culturally associated with witchcraft. So, some urban population avoid the consumption of products of baobab.

The results show that the collection and processing activities take place after the rainy season. Indeed, during the rainy season, fresh leaves are available with a high water content. The collection becomes difficult because of the risk of slipping while climbing large trees. In addition, during raining, the level of sunshine is very insufficient to effectively dry the leaves in a short time. Whereas after the rainy season, the leaves have time to dry on the tree. This is similar to the findings of De Caluwé *et al.* (2009) who reported that baobab leaves are harvested abundantly during the last months of the rainy season, and are dried for domestic use and for marketing during the dry season. The collected leaves are therefore transformed into powder using a traditional process as described by Chadare *et al.* (2008). The powder obtained is available and sold throughout the year. But from December to February, the demand for the leaf powder is extremely high and the selling price increases. Therefore, retailers record more sales during this time because the other vegetables such as *Abelmoschus esculentus*, *Sesamum radiatum*, *Corchorus tridens*, *Vernonia amygdalina* or *Amarantus cruentus* are not available for use.

According to Adugna (2009), a marketing channel involves a series of intermediaries through which vegetables pass from producers to consumers. The main actors involved in the leaf powder marketing channel are collectors, processors, retailers and consumers. They can be found in urban and rural area of Dassa-Zoumè. The marketing channel of baobab leaf powder is mainly composed of a short channel from processor to consumer and processor to retailer circuits. The marketing channel is short leading directly to consumers. However, the leaf powder market is not well organized as an ideal marketing system and the same actors play several roles. The limited number of actors involved in the marketing system also indicate that the sector has not yet developed its potential. There is also need to diversify the end product form so as to give and promote baobab leaf powder trade. However, a particular attention should be given to quality issues so as to inspire new businesses (new baobab leaf products) in the sector, create new markets and to reach a acceptance.

## Conclusion

The major actors involved in baobab leaf powder marketing channel are collectors, processors,



retailers and consumers. They are from Idaasha, Mahi, Peulh and Dendi ethnic groups and have between 5 and 15 years of experience in the activity. Consumers' expectations regarding nutritional and therapeutic virtues such as taste, sliminess, granulometry, smell and colour are generally met. However, the social and economic characteristics which influence the consumers' perceptions need to be investigated to guide the market functioning improvement needed. Studies are also recommended to identify best upgrading practices so as to ensure a well-organized regional and national market.

### Acknowledgement

The authors are thankful for the support of Field Attachment Program Award (FAPA) RU 2020 FAPA 02 provided by the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM). This paper is a contribution to the Seventh Africa Higher education Week and RUFORUM Triennial Conference held 6-10 December 2021 in Cotonou, Benin.

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