Original Research Article

Ethnobotanical and socio-economic study of *Blighia sapida*, a wild food plant in Togo.

ABSTRACT

Aims: In Africa, and particularly in Togo, fruit trees occupy a special place because for several millennia the plant species have been used for their medicinal and food virtues, although there is little scientific data on these plants. This study aimed to identify the different uses of *Blighia sapida* in the study area.
Methodology: To this end, ethnobotanical and socioeconomic investigations were conducted among 300 *B. sapida* users in nine (09) villages in the prefectures of Tône, Kozah and Haho. The choice of the study area was based on its representativeness in relation to the geographical distribution of *B. sapida*; the presence of resource persons with endogenous knowledge and the existence of markets where *B. sapida* organs and fruits are traded. The actual data collection phase took place in households and markets during the months of March to October 2021. In the targeted prefectures, the administration of a questionnaire required three collection methods: focus groups, individual survey and semi-structured method. For easy access to information, the present study required a translator or not depending on the need and focused on the socio-demographic characteristics of the respondents; the use of this plant species by the populations, the routes of administration or formulations as well as the quantity sold per day.
Results: Information collected showed that *B. sapida* is used for nutritional, therapeutic and cosmetic purposes with the main route of administration being oral. Investigations revealed that the respondents were predominantly female and subjects over 55 years of age made up more than a third of the study population. The supply of the fruits of this plant is by purchase and the average amount sold daily is 2500 F (≈4 €).
Conclusion: This study showed that various organs of *B. sapida* are used by the communities in the study area sampled. It is a first step towards the valorization of plant resources.

Keywords: Blighia sapida; Survey; Vegetable species; Food security; Togo.

1. INTRODUCTION

Despite a multitude of food and therapeutic plants in the world, food insecurity remains a current problem. According to FAO data, the number of people suffering from hunger daily in the world is approximately 855 million, including 820 million in developing countries, 25 million in in transition and 10 million in so-called developed countries [1]. Similarly, the same organization claimed that Sub-Saharan Africa would be one of the poorest regions in the world [1].

In Africa, fruit trees occupy a special place because they are involved in solving many problems on several levels: medicinal, food, agricultural and even socio-economic. According to the FAO [2], these plant species significantly improve household incomes by contributing to food security and the nutritional status of populations. Therefore, to avoid the danger of losing knowledge related to plant species endowed with medicinal

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and food properties, ethnobotanical investigation proves to be the most reliable and commendable approach for the development of traditionally improved drugs and food formulations containing macronutrients and micronutrients. In addition, there has been a growing interest in food plants in recent decades because they play a role as nutraceuticals. Thus, the discovery of this potential of indigenous genetic resources for especially rural populations is a lever for the perfect knowledge of the Togolese flora because in Africa conventional medicines and food formulations are not within the reach of the populations. Moreover, according to Anjarwalla et al. [3], these plants are also used as pesticides. Notwithstanding, the therapeutic and nutritional merits of these plants are only based on purely empirical bases, most often without any scientific proof.

Among the food plants, *Blighia sapida* is a plant genetic resource whose fruits consumed for the nutrition of the Togolese population are less studied. Indeed, it is a plant species that belongs to the *Sapindaceae* family. It is found in several regions of the world (Africa, Jamaica and Haiti). According to Dossou et al. [4] this fruit tree has very interesting medicinal and aesthetic values. Almost all the parts of the plant like its roots, its leaves, its bark and its seeds, are used in particular in the food sector and in traditional medicine for the treatment of certain pathologies [4]. The aril of *Blighia sapida* is of great nutritional importance for humans and is eaten raw, boiled or fried [5]. Thanks to its richness in oil (45.5%), special attention is paid to this plant species. Moreover, in Jamaica it is significantly included in the diet of the populations and where it represents the emblem of the country.

Despite the proven nutritional values of the aril of *B. sapida*, this plant remains a formidable source of poisoning. It is toxic especially when consumed at an early stage of maturation. Indeed, the consumption of the unripe fruit of this plant has been the cause of many deaths in many children due to it high concentration (1000 ppm) in hypoglycine A [6]. In Togo, stands of *B. sapida* are mainly present on fertile, deep and well-drained soils, but also on calcareous soils [7].

Several studies have been conducted in Togo and elsewhere on the virtues of so-called nutraceutical plants, but the ethnobotanical survey and the scientific work carried out in Togo and in the sub-region on *B. sapida* are almost non-existent. Nevertheless, some work has been carried out on *B. sapida*, particularly on the physicochemical composition of the arils of this plant in Côte d'Ivoire [6]. Because of its importance for the Togolese population and the harmful effects generated especially by the immature arils of this plant, it is therefore urgent to carry out an ethnobotanical and socioeconomic study to discover the real therapeutic and food potential of *B. sapida* in order to expand and deepen knowledge for its use and subsequent more sustainable management. Thus, the main objective of this work was to carry out an ethnobotanical and socio-economic survey on *B. sapida* to realize what the populations of the study area make of this plant species.

2. MATERIAL AND METHODS

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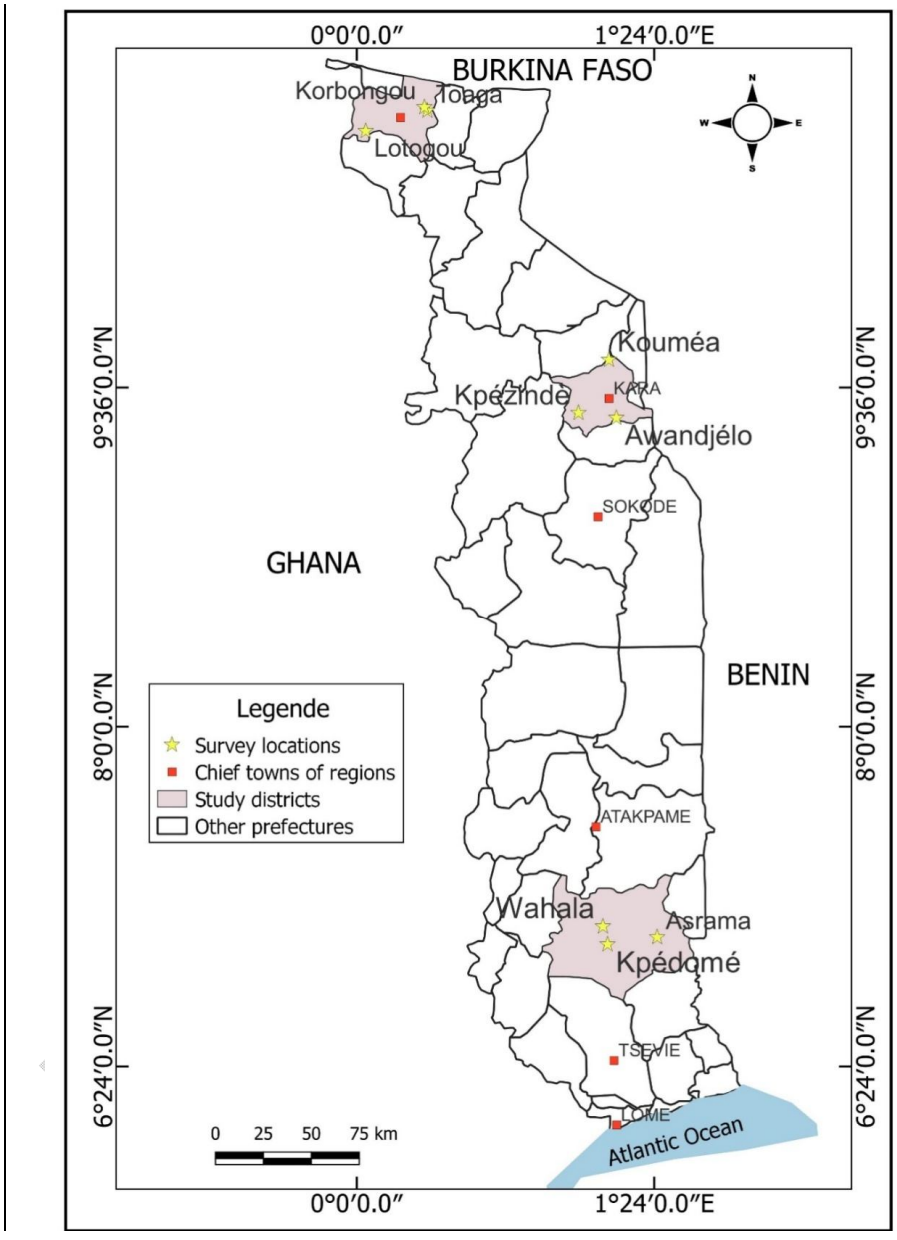
2.1. Study area

The ethnobotanical and socio-economic investigations took place in three prefectures (Kozah, Haho and Tône) of Togo (Figure 1). These three places were selected based on three main reasons: i) the representativeness in relation to the geographical distribution of the plant *Blighia sapida* in the local plant formations according to the analytical flora of Togo [8] and the water and forest service which were completed by the exploratory phase, ii) the presence in these localities of resource people with endogenous knowledge of the *Blighia sapida* plant, and iii) the existence of markets where the organs and fruits of *B. sapida* are sold.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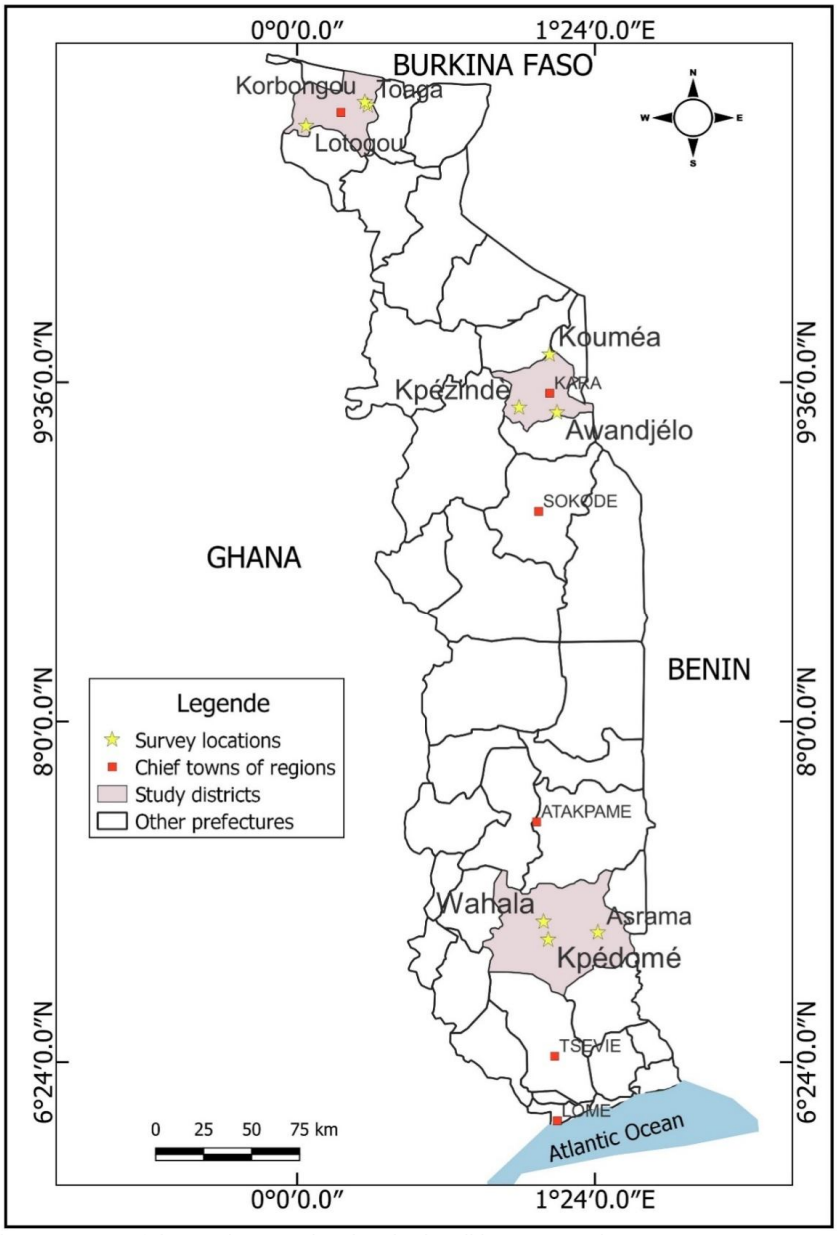

Figure 1: Map of the study area showing the localities surveyed

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2.2. Sampling methods and data collection

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2.2.1. Ethnobotanical aspects

The criteria for choosing the surveyed localities mentioned above are intended to provide the necessary information on the economic importance of the *B. sapida* tree for local populations. Thus, after the exploratory phase, the actual data collection phase took place within households and markets by administering a survey sheet to collect quantitative and qualitative data. Indeed, after choosing study areas elucidated, three (03) villages per prefecture were selected. The selected per villages are: Kouméya, Awandjélo and Kpezindè for the prefecture of Kozah, Wahala, Kpedomé and Asrama for the prefecture of Haho and Lotougou, Toaga and Korbongou for the prefecture of Tône Thus, to have a representative image of the populations surveyed, the size of the sample was set at 300 persons following the normal approximation of the binomial distribution of Dagnélie [9]. The decisive stage of data collection in the field took place during the months of March to October 2021.

Thus, in the targeted prefectures, the administration of the questionnaire required three collection methods: i) the "focus group" which allows the questionnaire to be filled in during the talks and debates; ii) the individual survey which consists of interviewing a single person and iii) finally the semi-structured interview method [10, 11] which allows men and women to be questioned separately. To do this, a preliminary survey of our respondents was carried out beforehand with local authorities (traditional chiefs, mayors, elders) and the water and forest service in order to obtain their consent to participate in our study.

Furthermore, socio-economic and socio-linguistic groups were randomly targeted. In addition, for easy access to information, this study required a translator or not depending on the need. Finally, the ethnobotanical information concerned the habitat and management method of the plant species *Blighia sapida*, the socio-demographic characteristics of the respondents (age, sex, level of education), the use made of it by the populations of this plant species, the parts of the plant used (roots, fruits, leaves), the places of supply, the routes of administration or formulations as well as the prohibitions and the side effects linked to each preparation.

2.2.2. Socio-economic aspects

The socio-economic survey was conducted using the semi-structured interview method [11, 12] and was carried out mainly in the markets of the study area which constitute the places where the organs and fruits of *Blighia sapida* are marketed. The sample size of our respondents was fixed at 45 users per prefecture of *B. sapida* fruits evenly distributed in the three localities using the normal approximation of Dagnelie [9]. Thus, per village, 15 people were selected taking into account the richness of their display as well as their age. This socio-economic aspect was assessed using a questionnaire designed for the occasion. This survey concerned the selling prices of *B. sapida* fruits, the quantities sold per day, quantitative and qualitative information relating to the socio-economic characteristics of the actors involved as well as the marketing channels.

2.3. Statistical analysis of data

At the end, the data which are of two orders, the ethnobotanical and socio-economic data were coded and inserted into the Excel 2016 databases and analyzed by the Minitab 17.0 and GraphPad Prism 7 software. These softwires were also used to plotting graphs. Thus, the data collected was grouped by prefecture, by village and by sociolinguistic group in order to verify whether or not there is a link between ethnic groups and the different uses made of the organs of *B. sapida*. Finally, the quantitative and qualitative variables relating to the socio-economic data were subjected to an analysis of variance (ANOVA) relating to the profitability of the organs and fruits sold.

3. RESULTS AND DISCUSSION

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3.1. Results

3.1.1. Ethnobotanical aspects

3.1.1.1. Uses of Blighia sapida

Blighia sapida is a plant species used for therapeutic, nutritional and cosmetic purposes. Considering it nutritional uses, only the aril was reported to had a nutritional potential. It is usually eaten raw, or incorporated into a sauce, fried or dried. *Blighia sapida* oil contributes significantly to the diet of many Togolese because it is used by a certain tribe to improve the taste of dishes. The survey revealed that during the food lean period when there is a shortage of food, the dried arils of this plant species are significantly involved in the diet of certain communities. The study revealed that the immature fruit is used to catch fish. Indeed, the crushed seeds and valves are dumped into the waterways where the fish are poisoned and die. This revelation was made in the prefectures of Haho and Kozah.

For it medicinal uses, *Blighia sapida* was mentioned in many therapeutic potentialities. Indeed, this plant is reported to be involved in the treatment of childhood diseases. In addition, several households have revealed the effective role of combining the bark of *B. sapida* with the roots and flowers of other plant species in the treatment of jaundice. In addition, the roots of *B. sapida* are full of real aphrodisiac potential (and sexual fatigue) in combination with honey. The oil traditionally extracted from *B. sapida* is also used as an antimicrobial because it is involved in the preservation of foodstuffs. Moreover, therapeutic investigations have shown that the bark of *B. sapida* mixed with pepper constitutes an ointment against pain; its crushed young leaves are applied to the forehead to treat severe migraines. *Blighia sapida* is a plant species used as incense to ward off evil spirits among certain peoples. In addition, on the socio-cultural level, the arils of this plant species chase away evil spirits because among the Kabyè they mystically protect the women producers of the local drink (tchoukoutou) against the deterioration of the flavor of the drink to be marketed and constitutes an insurance. for the transformer.

In cosmetic, according to our respondents, *B. sapida* is involved in saponification. Indeed, the valves of the fruits are burned and the ashes put in a pierced basin whose orifices are protected by stalks of dry cereals. Hot water is poured over the ashes while kneading them; the liquid that comes out is then boiled for an hour until a dark precipitate is obtained; then add melted shea butter and leave on the heat for 75-90 minutes, stirring regularly. A gray colored paste is then obtained, which constitutes the traditional soap which is sold in many markets. The seeds are sometimes used in conjunction with the valves for making this salt. This knowledge is generally held by women and shows that this product would relieve the populations on the therapeutic and cosmetic levels.

According to 35% of respondents, in addition to these different uses mentioned above, *B. sapida* plays several functions: providing firewood to households, protects the soil against water and wind erosion, participates in synergy with d 'other plants to the practice of market gardening.

3.1.1.2. Sociodemographic characteristics of respondents

Respondents in our study area were of several ethnicities and different age groups. Thus, Table I presents the characteristics relating to the ethnic group, the religion, the level of study, the age and the sex of the respondents. The ethnobotanical investigations focused on 300 individuals, 89% of whom were female against 11% male. In addition, the age group of the respondents is between 30 and 95 years old with an average age

of 50 years old. Subjects over the age of 55 represent more than a third of the study population. The analysis of this table shows that the animists are more in the majority (60%) while the Kabyè represent the most majority ethnic group (48%).

Table 1. Socio-demographic characteristics of respondents during the survey

Features	Modalities	Respondents (%)			
		Ko	Ha	To	Avera
Age	[30 years -40 years [	20	25	15	20
	[40 years -50 years [	20	15	15	16.67
	[50 years -60 years [	30	40	30	33.33
	[60 years -95 years]	30	20	40	26.67
Gender	Male	15	2	15	10.67
	Female	85	98	85	89.33
Education Level	Illiterates	90	85	66	80.33
	Primary School	5	15	14	11.33
	Secondary School and above	5	0	20	8.33
Religion	Animists	80	30	70	60
	Christians	10	40	20	23.33
	Muslims	10	30	10	16.67
Ethnic group	Kabyè	80	50	15	48.33
	Ewe	5	25	0	10
	Moba	5	0	60	21.67
	Kotokoli	10	25	25	20

3.1.1.1. Data on the different organs used, the method of preparation and the route of administration of Blighia sapida.

The table 2 indicates the administration routes, the preparation mode as well as the plant organs used. These results show that the most used organ of *B. sapida* by the surveyed population is arils (90%) almost in all the sampled localities; while the most preferred mode of preparation is decoction and varies according to the locality. Regarding the administration routes, the main route was oral.

Table 2: Different organs used, preparation method and administration route of *Blighia sapida*.

Parts used	Frequency of citation	Preparation method	Administration route
Sheets	**4%**	Decoction	Oral route
Roots, stem, bark	**5%**	Decoction, infusion	Oral route
Flowers	**1%**	Decoction	Oral route
Arils	**90%**	Cooking, drying	Oral route

3.1.1.3. Habitat, management method and prohibitions related to the use of Blighia sapida

Blighia sapida is a wild plant but often planted in its natural range as a fruit tree and ornamental shade tree. In the surveyed area, it prefers fertile, deep and well-drained soils, but it is also found on infertile sandy soils and on calcareous soils. In dry areas, it is often present on termite mounds. It does not tolerate waterlogged soils and does not support flooding. As a food plant, the fruits of this plant species are consumed in their natural state but can be preserved to prepare for periods of food lean seasons. Immature fruits, for example in the case of a food lean season, are used after drying. Regarding the prohibitions and side effects associated with the use of this plant, only unripe arils are recognized for their adverse effects. Thus, as side effects, vomiting, diarrhea, bitter taste and nausea have been reported.

3.1.2. Socio-economic aspects

Using the questionnaire designed for the collection of socio-economic data, it appears from this study that the selling prices of this plant species vary from 50 FCFA (≈ 0.08 €) to 100 FCFA (≈ 0.16 €) per pile of three fruits depending on the period; and that the sum sold daily was on average 2500F (≈ 4 €). This amount sold is not significant between the prefectures (p<0.05). In addition, this study made it possible to identify the following socio-economic groups: traders, fishermen, teachers, farmers, housewives, breeders, unemployed as well as administrators who have knowledge of the use of fruits of *B. sapida*. Moreover, the major socio-professional layer with more information on the marketing of this plant species was the traders, while the breeders were notified as a minority. In addition, the supply of *B. sapida* fruits is generally done by purchase. As far as gender is concerned, women were cited in this socio-economic survey as the majority.

3.2. Discussion

The importance of so-called nutraceutical plants is widely accepted in the food and therapeutic fields. It is with the aim of identifying the different uses of an edible vegetable plant called *Blighia sapida* that a survey was carried out the prefectures of Tône, Kozah and Haho in Togo. The results from this survey revealed that *B. sapida* is used for nutritional, therapeutic and cosmetic purposes. This plant can therefore be qualified as a food. Despite these virtues, scientific data on this plant are almost non-existent in Togo; this state of affairs therefore requires in-depth scientific studies to verify its harmlessness. These results would be in agreement with those of Dossou et al. [4] who revealed the same observations concerning the studies plant in Benin. In this study, several ethnic groups were prospected in order to identify the affinities and particularities with regard to the use of the organs of this plant. It should also be noted that this vegetable species is integrated into the eating habits of the entire population surveyed. These results corroborate those of Batawila et al. [12] who obtained similar results during a survey of vegetable plants in Togo. Moreover, speaking of the significant role of wild plants, an anthropological study carried out in Senegal reveals that wild vegetable species are to be appreciated because they provide fruits, seeds, leaves, sap, terminal buds, some of which are eaten raw, outside meals [13]. In addition, according to FAO [1], in India it has been estimated that 50 million households enrich their diet with these fruits collected from the surrounding forest and bush.

The results of the present study showed that almost all of the surveyed population recognizes that the consumption of the studied vegetable plant is a fact of inheritance but some ethnic groups like the Moba have acquired the food habit of *B. sapida* through cultural mixing. These results corroborate those of Batawila et al. [12] who revealed similar results on vegetable plants in Togo. In addition, the survey sampled several people with different levels of education because the level of knowledge about

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malnutrition, the consequences of malnutrition depend on the age and level of education of the respondents. According to the data of this study, the inhabitants of the population market the products of *B. sapida* to meet the needs of households such as: health problem, the schooling of children and the purchase of school supplies. These results are consistent with those of Dossou et al. [4] from Benin who reported that substantial assets from *B. sapida* are invested in schooling and family welfare. According to the information collected, many women are more involved in the marketing of *B. sapida* fruits and allows women to derive substantial financial income. This state of affairs is close to the African reality where the sale and marketing of articles are mainly reserved for women. Various studies in sub-Saharan Africa have shown the preponderant role of women and children in the management of vegetable crops [14].

Data recorded in this study showed that this plant species is known by more than 90% of the people surveyed and consumed by 82% of them. These results are consistent with those of Batawila et al. [12] who estimated the recognition and consumption rate of approximately 85% of the sampled population. Regarding the availability of fruits and vegetables, Shiundu [15] stipulates that the picking vegetables harvested in the rainy season are dried and reduced to powder, and preserved to cover the dry season or lean seasons. Indeed, according to Vodouche et al. [16], the nutritional value of wild vegetables would be an argument for their promotion since they are rich in vitamins, proteins and mineral salts that the body needs to ensure its nutritional balance, especially during lean periods. The most consumed parts of this vegetable species are represented by the fruits in their natural state or cooked because this most appreciated part is full of enormous nutritional potential.

Our investigation indicated that the method of cooking would have a significant impact on the toxicity and nutritional value of this plant. This was also reported by Vodouche et al. [16] who claimed that cooking in boiling water increased the protein and lipid contents of *Amaranthus hybridus* and *Solanum macrocarpum* lipids and the proteins of *Ocimum gratissimum*, which are three vegetable species acclimatized in Benin. Apart from the nutritional virtues, this plant species is full of enormous therapeutic potential and can therefore be a good candidate in the treatment of many pathologies. According to the survey, the main route of administration of *B. sapida* products is the oral route because most of the diseases are caused by a dysfunction of an internal organ. This study revealed that *B. sapida* organs represent a promising source of income generation for communities and clearly showed its impact in the diet and economy of rural populations.

4. CONCLUSION

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This study has shown that *Blighia sapida* occupies a prominent place in the lives of Togolese because it contributes to food and medicinal security. This investigation proves to be a very commendable approach to the point where it classifies this plant species among functional foods. In addition, this study has also emphasized the high nutritional potential of *Blighia sapida* for the population surveyed and demonstrates the special attention that must be given to this plant in order to fight against its disappearance. In perspective, we intend to verify the harmlessness of this vegetable species for its unambiguous use because the therapeutic and nutritional merits of these plants are only based on purely empirical bases, most often without any scientific proof.

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