

Research

Ethnonutritional study of fruits of *Solanum aethiopicum* L. and *Solanum melongena* L. in the district of Galim (Bamboutos) in West Cameroon

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Abstract

Solanum aethiopicum L. and *Solanum melongena* L. are endemic plants whose fruits are used in the composition of cultural dishes in West Cameroon including Yellow, Black, Eggplant, Nkui and Okra sauces. This work aims to conduct an ethnonutritional study based on the knowledge and consumption of these dishes. Surveys were carried out including 480 persons of the district of Galim (Kieneghang I and Mbezaté) in the Bamboutos division in West Cameroon and the results revealed that the vernacular and common names for *Solanum aethiopicum* L. and *Solanum melongena* L. are respectively “Shushui” and “sweet eggplant”; “Nzuinzuiè” and “bitter eggplant”. These fruits are rounded and spindle in shape. The fruits of *Solanum aethiopicum* L. exist in green, yellow and red colors with a mild flavor, while those of *Solanum melongena* L. are red and bitter. These fruits are preserved by sun-drying, smoking, and parboiled before drying. Their cultivation is traditional with a duration of 3–7 months using organic and chemical fertilizers. The age group 41–50 years had a good knowledge of fruits while the age group over 60 years had a better consumption frequency of eggplant-dishes. In addition, these fruits have important cultural values during traditional ceremonies at births, weddings, funerals, symbolisms such as acceptance, reconciliation, hospitality, consideration, and valorisation. These populations had knowledge for the prevention and or treatment of diabetes (6.66%), high blood pressure (25%), obesity (13.54%), cancers (1.66%) and mouth ulcers (2.70%). The valorization of these fruits could constitute a means of preserving cultural heritage.

Keywords Ethnonutritional · *Solanum aethiopicum* L. · *Solanum melongena* L. · Cameroon

1 Introduction

In Cameroon, more precisely in the western part, the fruits of *Solanum aethiopicum* L. and *Solanum melongena* L., are consumed in various ways depending on the growth stage. Immature, eggplants (*Solanum aethiopicum* L.) can be eaten raw. When ripe, the fruit pulp is fibrous; it has a fine texture [1] and the taste varies according to the species: it is bitter for *Solanum melongena* L. and smooth and/or sweet for *Solanum aethiopicum* L. In terms of food, eggplants are used in the preparation of many dishes, including soups, and in different forms [2].

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Over time, many traditional Cameroonian dishes prepared from eggplant are disappearing from our tables [3]. This is primarily due to the non-valorization (preservation of cultural heritage, knowledge of ancestral practices, conservation of food biodiversity) of the plants that make up these dishes, insufficient control over agricultural conditions and to a lesser extent the withering of the soils (Resilience to climate change and environmental pressures) [4, 5].

The aim of this work was to document the ethnonutritional knowledge associated with the fruits of *Solanum aethiopicum* L. and *Solanum melongena* L. in the district of Galim, in order to preserve their traditional value and food biodiversity. That being said, we proceeded from traditional knowledge of these fruits (vernacular and common names, shape, color, flavor and storage method of these fruits), then by a census of the agricultural practices applied to the cultivation of these plants, the cultural practices or traditional uses and the culinary and medicinal uses of these fruits.

This study was carried out to keep on our tables the fruits of *Solanum aethiopicum* L. and *Solanum melongena* L.-based dishes, which are endangered eggplants and its important contribution to food security, benefits for health and the Cameroonian culture.

2 Materials and methods

2.1 Materials

2.1.1 The study area

The study area was chosen based on the results of a pre-survey. This pilot study revealed that West Cameroon is a production basin. The survey carried out by random sampling made it possible to select the Bamboutos division; Galim subdivision; Bagam (Nkiénehang also called Kieneghang I) and Bamendjing (Mbenzate or Mbezaté) villages as seen on Fig. 1.

The Galim subdivision is located in the Bamboutos division of the West Region of Cameroon. Galim is located about 22 km from Mbouda on the regional road P 15 linking the Bamboutos division to that of Noun via Kouoptamo. The Galim municipality is located between longitude 5°30' and 5°50' North, and between latitude 10°15' and 10°35' East, at an altitude of 1168 m. Its area is 513 km² for a population of 45335 inhabitants [7] or approximately 88 inhabitants per km².

This geographical area is characterized by a long rainy season from mid-March to mid-October and a short dry season from mid-October to mid-March. The average annual rainfall is between 1500 and 2000 mm.

2.1.2 Duration of the study

The survey took place over a period of 9 months, from the 1st of September 2021 to the 14th of June 2022.

2.1.3 Study population

This population belongs to the Grassfields (precisely the Bamilékés) who live essentially on agricultural practices. She is a non-cosmopolitan population who speak the same dialect and who have the same culture.

2.1.4 Inclusion criteria

Adults aged over 20 living in the village and who gave their consent to participate in the study.

2.1.5 Non-inclusion criteria

People who refused to participate in the study and minors under the age of 21 were not included because the survey was spontaneous and needed to obtain a clear written consent from their parents. Furthermore, the culture of this fruits is older than two decennaries.

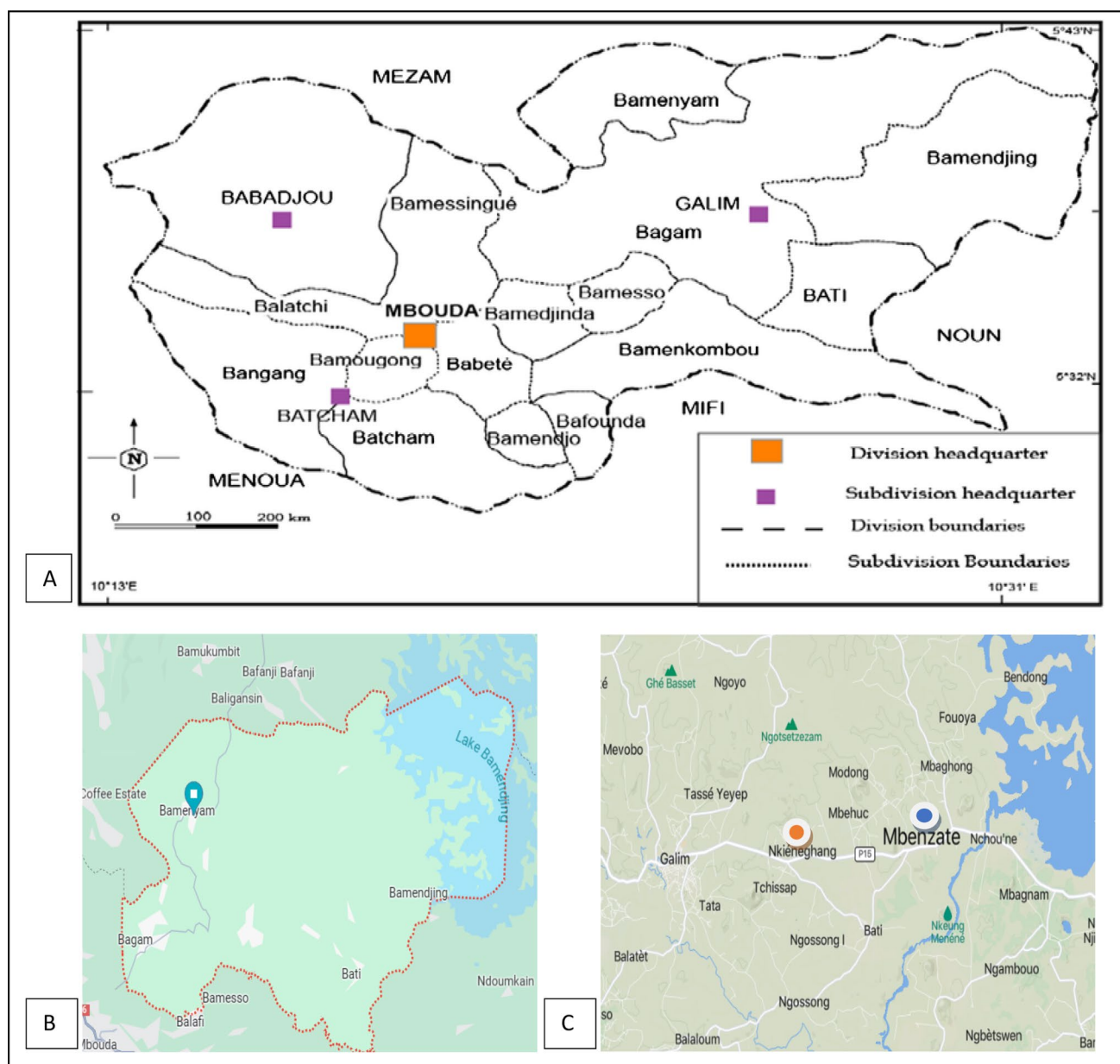


Fig. 1 Maps showing the study areas in the West region of Cameroon [6]: [Bamboutos division (a) Galim subdivision (b) Kieneghang I and Mbezaté villages (c)]

2.2 Methods: procedures

2.2.1 Ethical clearance

A request for ethical clearance was sent on July 28, 2021 to the Institutional Ethics Committee for Human Health Research at the University of Douala, and on August 17, 2021, an investigation authorization valid for 1 year was obtained (n° 2904/CEI-UDo/08/2021/T). The protocol was approved by the Institutional Ethics Committee for Human Health Research at the University of Douala in accordance with the International Ethical Guidelines for Health Research involving Human participants (By the Council of International Medical Organizations in collaboration with the World Health Organization/Geneva 2016). Prior to participating to the survey, a written consent was obtained from each participant.



Fig. 2 Plants: *Solanum aethiopicum* L. (a) and *Solanum melongena* L. (b) [8]



Fig. 3 Fruits: *Solanum aethiopicum* L. (a) *Solanum melongena* L. (b) [8]

2.2.2 Sample collection and identification

The plant material used consisted of the fruits of *Solanum aethiopicum* L. and *Solanum melongena* L. as seen on Figs. 2 and 3, respectively. They were collected in accordance with national guidelines and approved by the Institutional Ethics Committee for Human Health Research at the University of Douala. The fruits have been identified at the National Herbarium of Yaoundé with the following references:

- *Solanum aethiopicum* L.: registered under N°-43053/HNC;
- *Solanum melongena* L.: registered under N°-34757/HNC.

3 Investigation

3.1 Sampling method

The sampling carried out was not probabilistic.

3.2 Determination of sample size

The sample size was calculated from the equation below [9].

$$n = \frac{t_p^2 \times P(1 - P) \times N}{t_p^2 \times P(1 - P) + (N - 1) \times y^2}$$

where:

n = expected sample size.

t = 1.96 at 95% confidence level.

N = size of the target population according to the “Bureau Central des Recensements et des Etudes de Population” (BUCREP).

P = Estimated proportion of the population with the characteristic studied in the study (50%).

y = margin of error (fixed at 5%).

Thus, the minimum sample size was estimated at 470 people.

3.2.1 Survey method

In our study, a total of 480 participants of both genders and above 20 years old were surveyed. The survey was carried out using a questionnaire and fruit pictures. Thus, it was, therefore, a matter of collecting information on the level of knowledge of the respondents, the identification of cultivars, names (Vn: Vernacular name which is the name in the local language; Cn: Common name which is the usual name), methods of conservation and culinary uses. The survey was conducted in French and in the local language in the presence of translators. The interview was either scheduled for some or spontaneous, taking an average of 27 min each.

3.2.2 Citation frequencies

The frequency of citation is a good index for evaluating the credibility of the information received by the surveyed population. The citation frequency (**fc**) is given by the following formula:

$$fc (\%) = \frac{n}{N} \times 100$$

where **n** is the number of respondents who gave a score and **N** is the total number of respondents during these surveys.

4 Data analysis

Data collected were introduced in Sphinx Plus²-V5 software in order to determine the frequency of each modality. XLSTAT 2014 software was used to establish the Pearson correlation between variables at 5% threshold.

5 Results

5.1 Traditional knowledge and preservation of fruits

Table 1 presents the names in the vernacular and common names, the different botanical characteristics and the methods of preserving the fruits. The vernacular and common names for *Solanum aethiopicum* L. and *Solanum melongena* L. are respectively “Shushhui” and “sweet eggplant”; “Nzuinzuiè” and “bitter eggplant”. Roughly half of the population surveyed recognise them as plants with a height comprised between 40 and 60 cm. The fruits come in two shapes, namely rounded and spindle-shaped. There is a preponderance of the spindle shape in all species.

Table 1 Traditional knowledge and preservation of fruits

Group of parameters	Identified parameters	Number of citations (Frequencies)
Name of fruits	<i>Solanum aethiopicum</i> L	
	Sweet eggplant (Cn)	304 (63.33%)
	Shushui (Vn)	88 (18.33%)
	No response	88 (18.33%)
	<i>Solanum melongena</i> L	
	Bitter eggplant (Cn)	336 (70%)
	Nzuinzuiè (Vn)	120 (25%)
	No response	24 (5%)
	<i>Solanum aethiopicum</i> L	
	Plant 40–60 cm	224 (46.66%)
	No response	256 (53.33%)
	<i>Solanum melongena</i> L	
	Plant 40–60 cm	240 (50%)
	No response	240 (50%)
Fruit shape	<i>Solanum aethiopicum</i> L	
	Rounded fruits	40 (8.33%)
	Spindle fruits	368 (76.66%)
	No response	72 (15%)
	<i>Solanum melongena</i> L	
	Rounded fruits	32 (6.66%)
Fruit colour	Spindle Fruits	224 (46.67%)
	No response	224 (46.67%)
	<i>Solanum aethiopicum</i> L	
	Green	128 (26.66%)
	Yellowish-green	88(18.33%)
	Red	208 (43.33%)
Flavor	No response	56 (11.67)
	<i>Solanum melongena</i> L	
	Green	32 (6.33%)
	Red	448 (93.33%)
	<i>Solanum aethiopicum</i> L	
	Mild	288 (60%)
Storage method of fruits	No response	192 (40%)
	<i>Solanum melongena</i> L	
	Bitter	328 (68.33%)
	No response	152 (31.67%)
	Sun drying	160 (33.33%)
	Attic drying (smoking)	72 (15%)
	Boiling then drying	128 (26.66%)
	No response	120 (25%)

Vn Vernacular name, Cn Common name

The fruits of *Solanum aethiopicum* L. come in 3 colors, namely: green, yellow and red with a mild flavor, on the other hand the fruits of *Solanum melongena* L. are mostly red (93.33%) and characterized by their bitterness.

These fruits are best preserved either by sun-drying process, by smoking, or by parboiling before the drying procedure as seen on Fig. 4. Drying in the sun (33.33%) and parboiling followed by drying (26.66%) are more common, unlike smoking (15%).



Fig. 4 Storage method of Fruits of *Solanum aethiopicum* L. and *Solanum melongena* L. [8]Smoking fruits of *Solanum aethiopicum* L. (a); Dried fruits of *Solanum melongena* L. (b); Fruits de *Solanum melongena* L. boiled for drying (c); Flour of fruits of *Solanum aethiopicum* L. (d); Dried fruits of *Solanum aethiopicum* L. (e)

5.2 Culinary practices of fruits

Table 2 presents the condition of the fruits consumed, the different sauces prepared, the reason for the low consumption of the fruits and the substitutes used. The fruit is mainly used in different forms (dried and fresh) to make sauces. These fruits are used as spices and food. *Solanum aethiopicum* L. is utilized in the preparation of the Yellow sauce, Eggplant sauce and Black sauce, while *Solanum melongena* L. is utilized in the preparation of Nkui sauce, Black sauce and Okra sauce as seen on Fig. 5.

Several reasons are given for the low consumption of these fruits: For *Solanum aethiopicum* L., small fruits are not highly appreciated, moreover fruits are not always available and the nutritional value is unknown. Concerning *Solanum melongena* L., the dishes are less consumed because their fruits are unavailable and the nutritional values are unknown.

About the dishes made with *Solanum aethiopicum* L., the fruits are often substituted by other species (88.33%) while for *Solanum melongena* L. no substituent is mentioned.

5.3 Knowledge of fruit consumption, frequency of dishes according to age groups and localities surveyed

Table 3 below describes the age group distribution according to the respondents, knowledge of fruits and frequency of consumption of dishes.

From the survey and according to the Table 3, the most represented age group is 41–50 years, followed by that of 31–40 years, and lastly 51–60 years.

Concerning the knowledge of *Solanum aethiopicum* L. according to the different age group, majority of the surveyed populations knows the fruit of *Solanum aethiopicum* L. irrespective of the survey area. In Mbezaté, all the people

Table 2 Culinary use of fruits

Group of parameters	Identified parameters	Number of citations (Frequencies)
Condition of the fruits	Fresh	320 (66.66%)
	Dried	72 (15%)
	No response	88 (18.33%)
Dishes	<i>Solanum aethiopicum</i> L. and Quantity of eggplant	
	Yellow sauce/Major ingredient (Food)	272 (56.66%)
	Eggplant sauce/Major ingredient (Food)	64 (13.33%)
	Black sauce/Major ingredient (Food)	8 (1.66%)
	No response	136 (28.33)
	<i>Solanum melongena</i> L. and quantity of eggplant	
	Nkui sauce/Minor ingredient (Spice)	96 (20%)
	Black sauce/Major ingredient (Food)	224 (46.66%)
	Okra sauce/Spice (minor ingredient)	16 (3.33%)
	No response	144 (30%)
Reasons for the low consumption of the fruits	<i>Solanum aethiopicum</i> L	
	Berries	32 (6.66%)
	Rare fruits	248 (51.66%)
	Nutritional value unknown	16 (26.66%)
	No response	184 (38.33%)
	<i>Solanum melongena</i> L	
	Less consumed dishes	88(18.33%)
	Rare fruits	96 (20%)
	Nutritional value unknown	64 (13.33%)
	No response	232 (48.33%)
Ingredients substitutes used in dishes	<i>Solanum aethiopicum</i> L	
	Other species	424 (88.33%)
	None	32 (6.66%)
	No response	24 (5%)
	<i>Solanum melongena</i> L	
	None	440 (91.66%)
	No response	40 (8.33%)

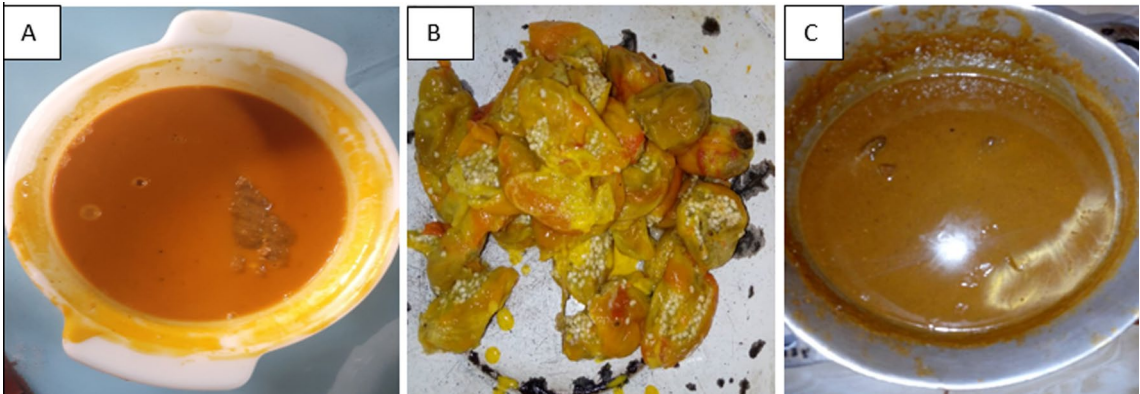


Fig. 5 Culinary uses of fruits of *Solanum aethiopicum* L. and fruits *Solanum melongena* L [10]. Yellow Sauce Dish (a); Fruits of *Solanum melongena* L. boiled (b); Black sauce dish (c)

Table 3 Age group distribution according to the knowledge of fruits and frequency of consumption of dishes

Age group (years)	Number of respondents		Knowledge of <i>Solanum aethi-</i> <i>opicum</i> L		Frequency of consumption (per month) of dishes made from <i>Solanum aethiopicum</i> L		Knowledge of <i>Solanum melon-</i> <i>gena</i> L		Frequency of consumption (per month) of dishes made from <i>Solanum. melongena</i> L	
	Kieneghang	Mbezaté	Kieneghang (%)	Mbezaté (%)	Kieneghang (%)	Mbezaté (%)	Kieneghang (%)	Mbezaté (%)	Kieneghang (%)	Mbezaté (%)
21–30	(16)	(9)	50	100	5	35	100	100	17	12
31–40	(55)	(95)	100	90	19	12	100	95	11	22
41–50	(73)	(123)	100	100	28	6	100	100	23	22
51–60	(17)	(76)	100	80	19	12	100	85	11	22
> 60	(7)	(9)	100	100	29	35	100	100	38	22
Total	168	312			100	100			100	100

surveyed know the fruit, unlike in Kieneghang. Regarding the consumption frequency of *Solanum aethiopicum* L. dishes according to the different age groups, Table 3 shows the average consumption per month of dishes based on *Solanum aethiopicum* L. of respondents according to their age group. In Kieneghang, people aged between 41 and 50 and over 60 years old consume *Solanum aethiopicum* L. based dishes on average 3 times a month, while those aged between 31 to 40 and 51 to 60 years old consume it twice a month. The lowest consumption is once every 2 months for people between 21 and 30 years old. In Mbezaté, people aged over 60 and those aged between 21 and 30 consume *Solanum aethiopicum* L. based dishes on average 3 times a month, followed by once a month for people aged between 31 to 40 and those aged between 51 to 60 years old. People aged between 41 and 50 years old consume these dishes on average once every two months.

We observed that the knowledge of *Solanum melongena* L. according to the different age groups of respondents regardless of the survey area was high. However, depending on these age groups, in Kieneghang, the frequency of citations is higher than that of Mbezaté.

Frequency of consumption of *Solanum melongena* L. dishes according to age groups: The consumption of dishes based on *Solanum melongena* L. is greater (3 times per month) among people over 60 years in Kieneghang, followed by the group of people aged between 41 and 50 years old who consume on average twice per month, once a month for those aged between 31 and 40 years old and once every two months for those aged between 21 and 30 years old. In Mbezaté, respondents aged between 31 and 40 years old, those aged between 41 and 50 years old, those aged between 51 and 60 years old and those over 60 years old consume *Solanum melongena* L.-based dishes on average once a month, while people aged between 21 and 30 years old consume *Solanum melongena* L. based dishes once every 2 months.

Table 4 below shows the Pearson correlation between knowledge and consumption of *Solanum aethiopicum* L. and *Solanum melongena* L. in the area survey.

We had:

A significant positive correlation (0.87) and a non-significant positive correlation (0.48), were observed between the knowledge of fruits of *Solanum aethiopicum* L. and the consumption of their corresponding dishes respectively in Kieneghang and Mbezaté.

A null correlation (0) was observed between the knowledge of the fruits of *Solanum melongena* L. in Kieneghang and the consumption of dishes containing *Solanum melongena* L.

A non-significant negative (− 0.34) correlation was observed between the knowledge of *Solanum melongena* fruits L. and the consumption of dishes containing *Solanum melongena* L.

5.4 Agricultural practices of *Solanum aethiopicum* L. and *Solanum melongena* L.

Table 5 presents the means of obtaining seeds from fresh and dried mature fruit by seed extraction. Also, Fig. 6 shows the extracted grains and seeds. The cultivation is mainly traditional (85.83%) with the duration of cultivation varying between 3 and 7 months.

In addition, the use of several types of fertilizer were also observed: organic fertilizers (60.41%) are used more than chemical fertilizers (6.66%). The cultivated areas were very small and less than 5 m² with very low production yields. They are mainly used for the growth of crops for consumption, although a small proportion is often marketable (3.12%). The fruits are sold on the basis of the number of fruits ranging from 15 to 20 fruits for a value of 100 CFA francs.

Table 4 Pearson correlation coefficients between knowledge and consumption of *Solanum aethiopicum* L. and *Solanum melongena* L. depending on the survey area

Correlation	Consumption <i>Solanum aethiopicum</i> L. (Z.1)	Consumption <i>Solanum aethiopicum</i> L. (Z.2)	Consumption <i>Solanum melongena</i> L. (Z.1)	Consumption <i>Solanum melongena</i> L. (Z.2)
Knowledge <i>S.a</i> (Z.1)	0.87*			
Knowledge <i>S.a</i> (Z.2)		0.48		
Knowledge <i>S.m</i> (Z.1)			0	
Knowledge <i>S.m</i> (Z.2)				− 0.34

*significant digit at the 5% threshold

(Z.1): Zone 1: Kieneghang (Z.2): Zone 2: Mbezaté

Table 5 Agricultural practices of *Solanum aethiopicum* L. and *Solanum melongena* L

Group of parameters	Identified parameters	Number of citations (Frequencies)
Seed production	Dried fruit seed extraction	40 (8.33%)
	Fresh fruit seed extraction	96 (20%)
	No response	344 (71.66%)
Type of growing	Traditional	412 (85.83%)
	No response	68 (14.17%)
	From March to November	376 (78.33%)
Period of growing	No response	104 (21.66%)
	Chemical fertilizers	56 (11.66%)
	Biological fertilizers	290 (60.41%)
	Others	32 (6.66%)
Type of fertilizers	No response	102 (21.25%)
Cultivated area	< 5 m ²	88 (18.33%)
	No response	392 (81.67%)
Treatments used	Chemical (pesticides)	16 (3.33%)
	Biological	0 (0%)
	Other	7 (1.45%)
	None	29 (6.04%)
	No response	428 (89.17%)
Yield	< 1 t/ha	29 (6.04%)
	No response	451 (93.96%)
Reason for cultivation	Consumer	36 (7.5%)
	Commercialization	15 (3.12%)
	No response	429 (89.37%)
Selling price	100FCFA (15–20 fruits)	26 (5.41%)
	No response	454 (94.58%)

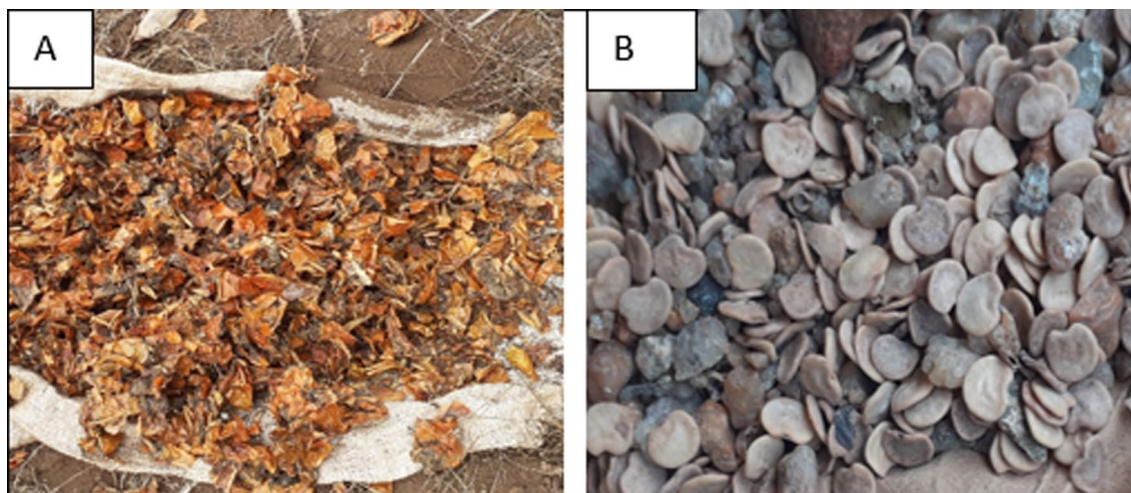
**Fig. 6** Agricultural practices of fruits of *Solanum aethiopicum* L. and fruits *Solanum melongena* L [10]. Grains extraction (a); Seeds (b)

Table 6 Cultural practices or traditional uses with thier symbolisms

Cultural ceremonies	Cultural ceremonies values	Number of citations	Frequencies (%)
Birth	Acceptance, consideration,	35	7.29
Weddings	Acceptance, reconciliation,	72	15
Death/Funeral	Valorization hospitality, consideration,	198	41.25
No response	–	175	36.46

5.5 Cultural practices or traditional uses

Table 6 below shows the Cultural practices or traditional uses related to *Solanum aethiopicum* L. and *Solanum melongena* L. During cultural ceremonies such as births, weddings, funerals, eggplant dishes are always present on the tables. These dishes serve to honor the guests and reflect the consideration of the guests, with values such as acceptance, reconciliation, hospitality, consideration, and valorization.

5.6 Medicinal practices or uses

Table 7 revealed that population had empirical knowledge for the prevention and or treatment of pathologies. Eggplants have therapeutic properties and are used in traditional medicine. Among these diseases we have, diabetes (6.66%), high

Table 7 Medicinal practices or uses

Group of parameters	Medicinal practices Identified parameters	Number of citations (Frequencies)
Diseases treated or prevented	Diabetes	32 (6.66%)
	Hyper blood pressure	120 (25%)
	Obesity	65 (13.54%)
	Cancer	8 (1.66%)
	Mouth ulcers	13 (2.70%)
	No response	242 (50.42%)
Part of the plant used	Fruits	255 (53.12%)
	Leaves	13 (2.70%)
	No response	212 (44.17%)
Condition of fruit used	Fresh	176 (36.66%)
	Dry	240 (50%)
	No response	64 (13.33%)
Condition of the leaves used	Fresh	8 (1.66%)
	No response	472 (98.33%)
Usage	Maceration	16 (3.33%)
	Decoction	16 (3.33%)
	Other	128 (26.66%)
	No response	320 (66.67%)
Method of administration	Oral	112 (23.33%)
	Other	13 (2.70%)
	No response	355 (73.96%)
Dosage	1 glass × 3/day (Diabetes)	48 (10%)
	1 glass × 2/day (Hyper blood pressure)	24 (5%)
	1 to 2 applications/day (Obesity)	8 (1.66%)
	Consume as much as you want (obesity; cancer)	136 (28.33%)
	No response	264 (55%)

blood pressure (25%), obesity (13.54%), cancers (1.66%) and mouth ulcers (2.70%). Most of these diseases are either cured or prevented by the use of fruits (53.12%), whether fresh or dry in liquids (maceration and/or decoction) in order to obtain potions with well-established dosages per pathology for oral administration. On the other hand, for the prevention of obesity and cancer, unlimited consumption (28.33%) is mentioned. For mouth ulcers in particular, the use of fresh crushed leaves with a topical oral application of 1 to 2 times a day (1.66%).

6 Discussion

According to Dibong et al. [11], information on plants varies from one respondent to another and each individual holds a secret that has been passed on to them either by their ancestors, or during training with the keepers or that they have acquired over years of experience, but communication between individuals from neighboring villages promotes an exchange of knowledge [11]. This exchange of knowledge, culinary and therapeutic uses of *Solanum aethiopicum* L. and *Solanum melongena* L. in the district of Galim (Bamboutos) in West Cameroon is more noticeable when the populations share the same cultures (languages, customs).

Eggplants are herbaceous plants, characterized by an average height of 0.6–0.7 m with stem that are most often green in colour [12–14]. The shapes and colors of the fruits vary depending on the variety [15]. The eggplant fruits encountered in this study are wild varieties mainly characterized by their small size. The cultivars domesticated had large volumes and were improved: this is the case, for example, with *Solanum melongena* L. which has improved cultivars of purple color, large volume (0.15–0.20 m in length by 0.06–0.08 m in diameter) and not bitter, originally from India, which were transported to North Africa by the Arabs where they are heavily cultivated [16].

In this geographical survey area, the different fruits have vernacular names respectively “Shushhui” (sweet eggplant) for *Solanum aethiopicum* L. and “Nzuinzuiè” (bitter eggplant) for *Solanum melongena* L. according to their flavor. This flavor is due to the phytochemical composition of the fruits with non-nitrogenous steroid glycoalkaloids and saponosides of the furostanol type which are the reason for the taste and health quality of eggplant fruits [17]. The levels of these substances vary according to the physiological stage of ripeness of the fruits [18]. In addition, the presence in a plant of nutrients of interest depends on several factors, including agricultural and ecological conditions. Thus, the sustainability of the cultivation of a plant is linked to the maintenance of soil fertility [4].

The cultivation of eggplants is suitable in the rainy season, because it is a fruit with a high-water content like most *Solanaceae*. Nevertheless, cultivation remains possible in the dry season with water supply. Its cultivation is possible in very varied climates [19] depending on climate change, soils, and amendments.

Fruit harvesting begins between 5 and 6 months after sowing, and lasts between 1 month and 6 weeks. It is a very favourable crop in tropical environments requiring water and regular watering [3].

Once harvested, the physiological ageing of the fruits is initiated and to avoid losses due to deterioration, several treatments are applicable, including blanching and drying, which allow a better preservation after transformation into flour for the specific case of eggplants used in the preparation of cultural sauces in West Cameroon [20]. Blanching can decrease or increase the bioavailability of nutrients and consequently alter the nutritional potential of fruits and their health benefits [21]. Drying, on the other hand, is one of the oldest methods used in the preservation of food, as it removes water from food to prevent the activity of microorganisms [22]. It reduces the weight and size from the fruit for easier storage.

Each of the eggplants have specific culinary uses depending on the dishes. For this purpose, they are used either fresh when harvested or dry after undergoing a preservation process. *Solanum aethiopicum* L. is used as a food (major ingredient) for the preparation of Yellow and Eggplant sauces, while *Solanum melongena* L. is used as a spice (minor ingredient) for Nkui and Okra sauces [23]. According to Djiazet et al. [5], each meal has characteristics that differentiate it from others. When spices are mixed appropriately, they play an important role from a sensory point of view, bringing a special taste and flavor to a meal [5]; It's therefore necessary to bring back to the tables the initial ingredients of cultural dishes from eggplant cultivars to ensure the original food biodiversity and to value them as spicy Shiro flour and Berber powder in Ethiopia rich in cultural value [24].

The low consumption of these wild fruits of *Solanum aethiopicum* L. can be explained by the strong presence on the market of highly prized and especially available large-volume domesticated cultivars that are easily substituted for the preparation of sauces based on *Solanum aethiopicum* L. thereby weakening the cultivation of these wild varieties. There is therefore a need to value them and encourage their cultivation in order to make them available and to avoid the loss of these fruits over time, thus threatening the knowledge of traditional African foods and eating habits [3].

The fruits of *Solanum aethiopicum* L. and *Solanum melongena* L. in the district of Galim (Bamboutos) in West Cameroon are grown on small plots and in association with other plants (apples, beans, maize) as in the cultivation of squashes reflecting a traditional agriculture of subsistence, with products that are poorly marketed [25]. This practice is very rudimentary and is characterized by empirical techniques, lack of use of technology, a practice on very small areas marked by a diversity of crops. This could explain the very low production of eggplants. For example, the lack of a drainage system limits cultivation in some areas, such as swamps during the dry season, thus favouring the reduction of low production. Yet, cultivation is possible all year round with maximum production in the rainy season. In this traditional agriculture, the use of chemical fertilizers is low, unlike organic fertilizers, which are essentially made up of plant and animal matter, and kitchen waste [26]. The seeds are produced by extractions on fresh and/or dried mature fruits. Specifically, it is suggested to extract the seeds from the fruits of the first and second harvests, because their germination power is higher than the seeds extracted from the fruits harvested afterwards. For modern agriculture, seeds are extracted mechanically using a seed extractor and not manually. In addition, seed storage is subject to precise conditioning and relative humidity control to avoid deterioration and/or loss of germination of seeds [27].

Several cultural dishes in the Grassfields region of western Cameroon are rich in symbolism. This is the case of the yam (*Dioscorea schimperiana*) which is eaten indifferently on traditional ceremonial days and on normal days with a socio-cultural importance that stands out for its use during the period of widowhood [28]. Thus, as *Dioscorea schimperiana* dishes based on the fruits of *Solanum aethiopicum* L. and *Solanum melongena* L. are usually prepared during special events and less like a regular meal. They make it possible to prepare sauces with cultural values [29]. During several traditional ceremonies (mourning, marriage, birth), these dishes are essential as a key ingredient for several social practices. These dishes are made with symbolisms such as acceptance, reconciliation, forgiveness, and hospitality. In addition, these dishes are reserved for solemn circumstances and used to honor distinguished guests. In short, these dishes are of high quality in the Grassfields, whose values in particular, socio-economic values, are not very often ignored [30]. It is also noted that in these villages, these dishes are intended to a category of people “notables and adults” during ceremonies.

According to the analyses of our study, the 41–50 years old age group was the most represented, followed by the 31–40 and 51–60-years old age group. In addition, we were able to note that the 41–50 years old group had a very good knowledge of fruit compared to the others. Moreover, the age group over 60 years old had a better frequency of consumption of eggplant-based dishes compared to other age groups. This would be because the latter have retained their eating habits, and are less inclined to modern culinary conveniences. Thus, the knowledge of eggplant fruits does not necessarily imply their consumption according to the different dishes. On the other hand, the rate of consumption of traditional foods gradually decreases over time due to inadequate transfer of intergenerational knowledge, lack of documentation and the unavailability of modernized ready-to-use traditional food products [5]. These dishes can prevent certain ailments because according to Suleyman [31], the decline in the consumption of indigenous African food crops has been implicated in the emergence and spread of chronic diseases in Africa [31].

Furthermore, people surveyed equally eat eggplant as a food for the related therapeutic properties, and the main pathologies mentioned were diabetes, hypertension and obesity, thus corroborating the work of Siegfried Didier Dibong et al. (2016) describing the traditional use of *Solanum melongena* L. against the above-mentioned pathologies [32].

Eggplant contains several secondary metabolites with therapeutic properties, including phenolic compounds, which are powerful antioxidants responsible for antitumor and anticarcinogenic activities by scavenging free radicals. It has a low calorific value and is rich in fiber, which is why it is used against obesity and diabetes [16] as claimed by the population surveyed.

The inhabitants of Galim prevent high blood pressure by consuming eggplants like the populations of the villages of Mefou-et-Mfamba, Nyong-et-So and Nyong-et-Mfoumou, three divisions of the Centre Region [11] demonstrated by studies of Vandi Deli et al. (2017). According to our study, eggplant leaves are used for mouth ulcers; They also have several applications for skin conditions such as abscesses, burns, scabs [16].

7 Conclusion

The ethnonutritional survey carried out revealed that eggplants (*Solanum aethiopicum* L. and *Solanum melongena* L.) are respectively used as foods and spices. Commonly referred to as “Shushui; Nzuinzuiè” in the Bamboutos division in West Cameroon, these eggplants are mainly used for sauces. The fruits are most cultivated during the rainy season and, are known and consumed in several states, fresh and dry. *Solanum aethiopicum* L. is used as food for the preparation of Yellow and Eggplant sauces, while *Solanum melongena* L. is used as a spice for Nkui and Okra sauces. These sauces from

West Cameroon have cultural values. Beyond their culinary properties, these eggplants would also be used for their therapeutic properties such as antihypertensives, antidiabetics and antioxidants. The low generational transmission of cultural knowledge and practices associated with these fruits has led to a reduction in the cultivation of these eggplants, a substitution of these ingredients and in the long term has caused a loss of food biodiversity. Hence, the need to enhance these fruits and evaluate their nutritional intake to bring them back to the table.

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Data availability All data generated and/or analyzed during this study are included in this published article.

Declarations

Competing interests The authors declare no competing interests.

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