

From Bush Mangoes to Bouillon Cubes: Wild Plants and Diet among the Baka, Forager-Horticulturalists from Southeast Cameroon

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Increasing deforestation affects tropical forests, threatening the livelihoods of local populations who subsist on forest resources. The disappearance of wild plants and animals and the increasing influence of market economies affect local health, well-being, and diet. The impact of these changes on wild meat consumption has been well documented, but little attention has been given to wild edible plants, despite their importance as sources of calories and micronutrients. Furthermore, the relationships among food behavior strategies adopted by local populations, their psycho-cultural representations of food, and their food preferences have been poorly explored. In this study, we investigate food behaviors with an emphasis on the role of wild edible plants among a forager-horticulturalist society from the Congo Basin: the Baka. By combining an ethnobotanical survey with data from interviews ($n = 536$) related to food behaviors and representations of food, our data show that the Baka valorize both agricultural and marketable foods, and that wild plants represent a minor part of their diet, both in frequency and diversity. Finally, by examining how some wild edible plants have shifted from being eaten to being sold, we explore how market-oriented uses of wild edible plants may affect dietary behaviors and biocultural resilience.

Key Words: Hunter-gatherers, Food behavior, Food preferences, Edibles, Nutritional transition, Ethnobotany.

Introduction

The exploitation of tropical forests drastically threatens the survival of local populations who rely on these environments. In the Congo Basin, 16.6 million hectares of forest were lost between 2000

and 2014 (Tyukavina et al. 2018), and the continuous pressures on local resources resulted in a dramatic decrease of big mammals, deforestation, and contamination of soils (de Wasseige et al. 2015).

The ecological and social changes driven by these pressures impact more than 60 million people, who rely on these forests for their subsistence and livelihood (Marquant et al. 2015). Local diets are changing, and many small-scale societies testify to a nutritional transition, impacting their health (Kuhnlein 2015). Recent studies reported that among the Baka, a forager-horticulturalist group from the Congo Basin, the level of sedentarization and market integration influences their dietary diversity (Reyes-García et al. 2019) and health (Dounias and Froment 2006). In

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this tropical region, while wild meat is the main protein source (Cawthorn and Hoffman 2015), and access to meat is closely tied with health and well-being (Dounias and Ichikawa 2017; Vliet et al. 2017), the increased demand for bushmeat in towns, the traffic of ivory, and the introduction of more efficient hunting practices have led to a bushmeat crisis (Duda 2017; Ichikawa and Kimura 2003). These changes have affected the way local populations use and perceive animals. Pressures on tropical forest resources touch more than just meat, however. Plants also are affected by non-sustainable extraction, especially those used for food, medicines, and handicraft by local populations (Ingram et al. 2010). Although wild edible plants are highly important as a source of micronutrients and for food security (Ong and Kim 2017; Vincetti et al. 2012), their use has decreased in different settings worldwide (Serrasolses et al. 2016). Despite this, few studies have explored the impacts of social and ecological changes on the consumption of wild edible plants by local populations in the Congo Basin (see Ndumbe et al. (2018) and Termote et al. (2010) for exceptions).

Therefore, this study aims to better understand the place of wild edible plants in the diet and livelihood of the Baka living in southeastern Cameroon by bringing empirical evidence of food preferences and food uses, and exploring the impacts of social and ecological changes on their food choices. This study takes a mixed approach to explore both Baka food behaviors and perceptions about food and wild edible plants. We use the theoretical framework of the food environment, which shows that food behaviors, that is, the way groups or individuals consume certain foods, are driven by affordability (the prices of food), convenience (the energy spent acquiring food), availability (presence of food based on environment, season, or market), and desirability (personal preference, which is related to socio-cultural factors) (Herforth and Ahmed 2015). Whereas many studies have explored how the first three categories explain the use of forest resources, few of them have considered desirability and psycho-cultural factors related to food behavior (Gaoue et al. 2017). However, these representations towards food strongly affect food choices (de Garine 1996a; Pollard et al. 2002), and vary among cultural and social groups, sexes, and individuals (Berbesque and Marlowe 2009; Sorokowska et al. 2017). By studying food preferences and cultural representations of food, we also

gain further insight into nutritional transitions (Somerville et al. 2017). In many small-scale societies that are facing dietary transitions, the conceptualization of food may also change, sometimes leading to a better diet and sometimes not (Reyes-García et al. 2015). Given their importance in many aspects of dietary behavior and dietary changes, socio-cultural dimensions of food provide insights that are not assessed when considering only behavioral and ecological aspects (Yamaguchi 2015). By crossing data from behavior and representations, we aim to assess the current food behaviors among the Baka, and the place of wild edible plants in the local diet and livelihood in this changing context.

Study Case

Though living in four different Congo Basin countries, the Baka are most populous in Cameroon, where they number around 40,000 individuals (Leclerc 2012). They used to live in forest camps, relying on hunting, gathering, and the exchange of forest products for agricultural products with their sedentary neighbors, Bantu-speaking farmers. Settlement processes beginning in the 1950s led to general sedentarization, and nowadays most Baka live in villages along the logging roads, close to their Bantu neighbors. Their livelihood is based on a combination of agricultural labor (in their own fields or in Bantus') and forest activities (hunting, fishing, and gathering). Their involvement in forest-orientated activities depends on the availability of game and wild edibles, which varies seasonally (Leclerc 2012). The major rainy season (September–November) is a period of high mobility: many Baka go to forest camps where they collect wild edibles and organize large hunting expeditions. However, it is also a period of frequent cacao harvesting in the Bantu fields. During the major dry season (December to mid-March), the Baka return to their villages to open new agricultural fields. It is also the main fishing season and the period when important marketable forest fruits ripen, particularly the mbalaka, *Pentaclethra macrophylla* Benth. (Gallois and Duda 2016). In mid-March the minor rainy season begins and the Baka combine agricultural activities with the collection of bush mango kernels (*Irvingia* spp.). From mid-June to end of August, minor dry season, the Baka work on their fields, mostly weeding and opening new small plots and spending time collecting caterpillars and moabi fruits (màbè, *Baillonella toxisperma* Pierre).

Methods

Data used for this study have been collected in southeastern Cameroon (Haut Nyong division), in the Lomié and Messok districts, during two main fieldwork seasons: 1) 18 months between 2012 and 2014, and 2) three two-month periods in 2018–2019. The first field period focused on two Baka communities (Mombokola and Elonda), while the second included two additional villages (Kungu and Le Bosquet). We first obtained Free Prior and Informed Consent in all four villages and from every individual participating in this study. For children, we also asked for parental consent. This study adheres to the Code of Ethics of the International Society of Ethnobiology and received the approval of the ethics committee of Leipzig University (196–16/ek), and the Ethical Committee from the Ministry of Health of Cameroon (n°2018/06/1049/CE/CNERSH/SP).

DATA COLLECTION AND ANALYSIS

Data related to dietary behaviors, perceptions towards food and wild plants, and their uses were collected through face-to-face interviews.

Dietary Behaviors

Food behaviors were assessed through a dietary diversity recall adapted from FAO Guidelines (Kennedy et al. 2011). We asked informants to free-list all items—both foods and drinks—they had consumed during the previous 24 h, both inside and outside their house. We assigned the individual food items into one of the 13 following FAO food groups: 1) cereals; 2) white tubers; 3) dark green leafy vegetables; 4) non vitamin-A vegetables; 5) vitamin-A rich fruits; 6) other fruits; 7) flesh meat foods (including insects); 8) organ meat; 9) fish; 10) legumes, nuts, and mushrooms; 11) fats (including oils); 12) sweets; and 13) spices (including condiments and beverages). Items of each food group are presented in Appendix 1 (Electronic Supplementary Material, ESM). We recorded the source of each food item, differentiating between items that were cultivated by the Baka, collected in the forest, or bought from the market. We performed these interviews during the first field season among two villages, with a total of 536 individuals: 269 adults (150 women and 119 men), and 266 children (135 girls and 132 boys). Individuals were considered as adults when they were older than 16 years.

We coded each food group as 1 (“present”) when the respondent reported consuming at least one food item in this group and 0 otherwise, and calculated the percentage of diets that included at least one food item in a food group. Regarding food sources, we created three variables (crop, wild, and market) which were coded as 1 if the food items came from that source and 0 otherwise. We considered an item as belonging to market source when it was acquired either from a local shop or from the Nzime—the Bantu farmers in this area—as salary paid in kind. While the Baka occasionally purchased food items from local shops, they never did so with white tubers. Therefore, those white tubers listed in the market category represent tubers that were given as payment by the Bantu. We then calculated by food group the percentage of sources for all the items mentioned in each food group. We calculated the frequency of every wild plant reported as consumed in the dietary recalls. Because wild plant availability might depend on the season, we also calculated the frequency of occurrence according to the season.

Perceptions towards Food and Wild Edible Plants

To assess the psycho-cultural representations of foods among the Baka, we asked three key questions (de Garine 1996b): a) What is the preferred food?; b) What food and beverages would be offered when receiving a special guest?; c) What food would you choose if you had all food in front of you and did not have to provide any effort or money? Subsequently, we asked for their preferred wild edible plants. For the analysis of food perceptions, we conducted 103 interviews (56 women and 47 men ranging from 20 to 70 years-old) from all four villages. The answers were analyzed using free-listing analysis with Flame (Pennec and Wencélius 2014). For each question, we analyzed the most salient food items (most frequently reported and most frequently first items reported) using the Smith Index for all participants and separately for both genders.

Wild Edible Plant Uses

In order to assess the potential impact of market integration on the use of wild edible plants, we conducted a survey on the frequency of selling vs. subsistence consumption for ten important forest species that were identified

earlier as commonly sold (Gallois 2015). For each species, we asked respondents to report the last time they a) gathered, b) ate, or c) sold the plant. We interviewed 100 individuals (52 women, 48 men) from all four villages (25 each). We first coded respondents' answers in seven categories: 1) today/yesterday; 2) within the week; 3) within the month; 4) within the year; 5) between 1 and 2 years; 6) more than two years; and 7) never. We then calculated the frequency of each time category for consumption and selling for each species.

Overall, the results coming from these quantitative approaches have been supplemented by a qualitative approach used during the long-term field seasons. Because the first author lived in the Baka villages, she was able to perform participant observation, conduct informal talks with the Baka, the wild edible plant traders, and the Nzime, and gather data that are crucial for our understanding of the different results presented below.

In order to match the Baka plant names with scientific ones, botanical expeditions were carried out in April and May 2019. Based on the list of Baka plant names derived from the interviews and preliminary identifications based on literature (Brisson and Boursier 1979; Dounias 1996; Letouzey 1976), we carried out forest walks around three villages (Le Bosquet, Kungu, and Elonda). We asked knowledgeable Baka adults (nine men, seven women) to search for the wild edibles on the list and to indicate any other edible plants that they saw in the forest. Voucher specimens were made using standard botanical methods. One duplicate was deposited at the National Herbarium of Cameroon (YA), and one was deposited in Naturalis Biodiversity Center (L) in Leiden, the Netherlands, where the final identifications took place. A third duplicate was kept in the field to verify and discuss with the Baka the local names and uses of the edible species. We updated scientific names by using The Plant List (www.theplantlist.org). When we did not succeed in collecting a voucher for a Baka plant name mentioned in the interviews, we based the scientific name on the literature previously mentioned (Appendix 2, ESM).

Results

DIETARY DIVERSITY AND WILD PLANTS

The evening meals are the main and sometimes only meal of the day, and usually consist of a starchy

base accompanied by a sauce dish. Starchy foods appeared in about 93% of the dietary recalls (Table 1). The two other food groups that predominate were the dark green leafy vegetables (71% of the recalls) and spices, condiments, and beverages (72%). The food sources varied according to the groups. Starchy foods, mainly cassava and plantain, came from the Baka's own fields (45% of the cases) or from the Nzimes' fields, and only 3% of them came from the forest. The fields were also the main providers for the categories other fruits (avocado, banana, 96%); vitamin A fruits (papaya, 73%), and oils and fats (mostly palm oil, 66%).

The market was the main provider for cereals (rice), sweets (candies), other vegetables (tomato sauce), and spices, beverages, and condiments. This last category deserves attention, given that when looking at the frequency of each food (data not shown here); we found that three marketable condiments were almost always present in the recalls (more than 96%): chili pepper, salt, and bouillon cubes. While chili pepper came from the fields, the other two products were purchased in shops. These are added to almost all dishes the Baka consume, but they can also be a dish on their own. In times of food scarcity, the Baka prepare *mòsukà*, a water-based sauce made with salt and a bouillon cube in which they soak starchy foods.

Meat and fish were predominantly sourced from the forest (>89%), as were the majority of green leafy vegetables (61%) and food from the legumes, nuts, and mushrooms group. Most items in this last group were mushrooms (51%).

The Baka reported having eaten 14 different species of wild plants, belonging to six food groups: white tubers (four wild yams species, *Dioscorea* spp.), dark green leaves (2 spp.), and other fruits (2 spp.). Four species were grouped in oil and fats, although they could also be considered as legumes and nuts because they were consumed raw, roasted, or prepared as a fatty input for the meal. While the seeds of *Aframomum* spp. are commonly used throughout Central Africa as a spice, the Baka eat the fresh pulp with the seeds and therefore we included them in the fruit group (Table 2).

The frequency of consumption of these 14 wild plants varied per species and per season. The most commonly consumed wild plant was koko (*Gnetum africanum* Welw., 40.7% of the recalls), with the highest consumption during the major dry season. The other wild plants were less frequently consumed (<8% of the recalls). Bush mango kernels (*Irvingia* spp.) were the second most frequently

TABLE 1. FREQUENCY OF CONSUMPTION OF ALL FOOD GROUPS, BY SOURCES OF THE FOODS ($N = 2377$ RECALLS, 536 INDIVIDUALS).

	Overall		Source (%)		
	Number	%	Crop	Wild	Market
Cereals	243	10.2	1.7	0.0	98.4
White tubers	2214	93.1	45.2	2.7	56.5
Green leafy vegetables	1686	70.9	40.5	61.3	9.4
Vitamin-A fruits	392	16.5	73.5	0.5	26.0
Other fruits	227	9.6	95.6	1.3	2.6
Non vitamin-A vegetables	16	0.7	37.5	0.0	62.5
Fleshmeat	865	36.4	0.0	89.3	10.6
Organ meat	231	9.7	0.0	99.6	2.1
Fish	271	11.4	0.0	97.1	3.0
Legumes, nuts and mushrooms	617	26.0	17.5	51.2	36.5
Oils and fats	1190	50.1	65.6	35.1	5.4
Sweets	46	1.9	0.0	23.9	76.1
Spices	1722	72.4	76.5	5.2	96.6

eaten wild products throughout the year (8.4% of the recalls). They can easily be stored and are consumed roasted or prepared as a fatty paste. *Irvingia excelsa* Mildbr. was the most frequently consumed, especially during the minor dry season. Moabi fruits (*Baillonella toxisperma*) are only available for a few

weeks per year, and their consumption peaked in the major rainy season. Although some moabi seeds were processed into oil and stored longer, most of the oil was sold. Other wild plant species, either from white tubers, spices, or other fruit categories, appeared in less than 2% of the recalls. Only three

TABLE 2. FREQUENCY OF WILD PLANTS SPECIES APPEARING IN DIETARY RECALLS ($N = 2377$), BY SEASON.*NDÓNDO IS A TERM THAT INCLUDES SEVERAL *DIOSCOREA* SPECIES (DOUNIAS 1996), BUT AS WE DID NOT KNOW TO WHICH SPECIES OUR INFORMANTS REFERRED, WE CONSIDERED IT AS ONE SPECIES.

Food groups	Baka name	Scientific name	Entire year	Major rainy	Major dry	Minor rainy	Minor dry
				season ($n = 778$)	season ($n = 773$)	season ($n = 693$)	season ($n = 133$)
White tubers	ba	<i>Dioscorea</i> cf. <i>praehensilis</i> Benth	0.3	0.8	0.0	0.3	0.0
	sapà	<i>Dioscorea praehensilis</i> Benth.	1.2	1.8	0.8	1.2	0.0
	keke	<i>Dioscorea burkiliana</i> J.Miège	0.2	0.0	0.5	0.0	0.0
	*ndóndo	<i>Dioscorea</i> spp.	0.2	0.0	0.5	0.0	0.0
Dark green leaves	koko	<i>Gnetum africanum</i> Welw.	40.7	23.7	55.2	43.9	39.1
	kata	<i>Milletia mannii</i> Baker	0.0	0.0	0.1	0.0	0.0
Other fruits	tondo	<i>Aframomum</i> spp.	0.1	0.4	0.0	0.0	0.0
	ngoyo	<i>Trichoscypha</i> cf. <i>abut</i> Engl & Brehmer, <i>Trichoscypha acuminata</i> Engl.	0.1	0.4	0.0	0.0	0.0
Oil fats	payo	<i>Irvingia excelsa</i> Mildbr.	7.6	6.8	5.0	8.1	24.1
	kanà	<i>Panda oleosa</i> Pierre	1.3	1.5	1.8	0.9	0.0
	pekè	<i>Irvingia gabonensis</i> (Aubry-Lecomte ex O'Rorke) Baill.	0.8	1.9	0.3	0.1	0.0
	màbè	<i>Baillonella toxisperma</i> Pierre	5.9	15.8	1.4	1.0	0.0
Spices	ngimbà	<i>Afrostyrax lepidophyllus</i> Mildbr.	1.5	0.0	1.4	2.7	4.5
	gobo	<i>Ricinodendron heudelotii</i> (Baill.) Heckel	0.1	0.0	0.0	0.3	0.0

species of wild yam were reported, appearing in 1.2% of the recalls or less.

PERCEPTIONS TOWARDS FOOD

When we asked the Baka about their preferred food, eight of the ten most salient items were starchy foods, and the first three were domesticated plants (Table 3). Only after these crops came three wild yam species.

When asked about the food they would prepare if they received an important guest, the Baka first named two starchy cultivated crops (Table 4). The only wild plant considered as prestige food was *Gnetum africanum*. Wild meat and fish were crucial components of the meal, followed by chicken and rice.

In contrast to the earlier representations towards foods, when we asked the Baka about the food they would choose if they could have all they wanted, the first most salient item reported was a wild yam (*Dioscorea* cf. *praehensilis*). Although the main starchy crops were also listed, two other wild yams appeared on this list (Table 5).

WILD PLANT PERCEPTIONS AND USES

When asked about their most preferred wild edible plants, the Baka reported five wild yam species, the first being *Dioscorea* cf. *praehensilis* (ba) (Table 6). Two kinds of honey were also reported: the “real one” from *Apis* spp.; and the Trigones’ honey, made by stingless honeybees belonging to the Meliponini tribe (from Apidae family). Because the Baka do not have a general term for the category “wild edible plants,” we had to use the term “food from the forest, such as trees, liana, herbs, flowers, fruits, leaves, roots” (jo na bele), and specify that it excluded game (so). Honey was

also perceived as food from the forest and was thus reported.

Beyond the dietary uses, wild edible plants also provide the Baka with cash income. Most plant species common in Baka diets (and thus appearing in their recalls) were also products targeted by external traders. The most commonly sold wild plants products were the fruits of *Aframomum* spp., the seeds of *Irvingia* spp., *Afrotyrax lepidophyllus*, *Panda oleosa*, and *Pentaclethra macrophylla*, and oil from the seeds of *Baillonella toxisperma*.

Although most plants that were sold were also eaten, *Aframomum* fruits and *P. macrophylla* seeds were collected primarily for the market (Fig. 1). Of the Baka interviewed, 52% never ate *Aframomum* fruits, while 4% ate them only during childhood; 66% had never eaten *P. macrophylla* seeds, and 30% declared they tried them during childhood only. While several women (and some men) told us that *Pentaclethra* fruits were edible, they did not eat them because they did not know how to prepare them. A few people could explain the processing methods, but had no personal experience with them. In contrast, wild yams, *Panda oleosa*, and *I. excelsa* were hardly ever sold.

Discussion

Several striking patterns emerged from our data. As former hunter-gatherers, the Baka relied heavily on cultivated starchy foods (cassava, plantain), given that they were reported in almost every meal. The predominance of agricultural products in Baka diets has been noted since the 1980s (Hladik et al. 1989), but the consumption of these crops has evolved through time. Our informants, as well as previous studies from this region (Leclerc 2012), indicated that plantain was the main starch produced and

TABLE 3. RESULTS OF THE FREE-LISTING ON THE PREFERRED FOOD, BY ORDER OF SALIENCY ($N = 103$ IND.).

Baka name	English name	Scientific name	Occurrence number	Frequency (%)	Smith Index
bomà	Cassava	<i>Manihot esculenta</i>	73	70.9	0.564
ndo	Plantain	<i>Musa paradisiaca</i>	71	68.9	0.515
lángà	Cocoyam	<i>Xanthosoma sagittifolia</i>	68	66.0	0.443
sapà	Yam	<i>Dioscorea praehensilis</i>	56	54.4	0.342
ba	Yam	<i>Dioscorea</i> cf. <i>praehensilis</i>	53	51.5	0.321
keke	Yam	<i>Dioscorea burkiliiana</i>	48	46.6	0.241
pokì	Honey	<i>Apis</i> spp.	31	30.1	0.177
mebùtá	Sweet potato	<i>Ipomoea batatas</i>	31	30.1	0.150
dándù	Trigones’ honey	undeterminate	30	29.1	0.148
koko	Koko	<i>Gnetum africanum</i>	20	19.4	0.129

TABLE 4. PREFERRED FOOD OFFERED TO A GUEST, BY ORDER OF SALIENCY (N = 103).

Baka name	English name	Scientific name	Number of citations	Frequency (%)	SmithIndex
bomà	Cassava	<i>Manihot esculenta</i>	71	68.9	0.464
ndo	Plantain	<i>Musa paradisiaca</i>	61	59.2	0.398
koko	Koko	<i>Gnetum africanum</i>	38	36.9	0.234
so	Meat	Various species	33	32.0	0.221
koko	Chicken	<i>Gallus gallus domesticus</i>	30	29.1	0.217
lánga	Cocoyam	<i>Xanthosoma sagittifolia</i>	40	38.8	0.211
dengbe	Blue duiker	<i>Philantomba monticola</i>	29	28.2	0.175
mbòke	Brush-tailed porcupine	<i>Atherurus africanus</i>	23	22.3	0.127
si	Fish	Various species	17	16.5	0.074
lee	Rice	<i>Oryza sativa</i>	9	8.7	0.070

consumed by both the Nzime and Baka some decades ago. The Baka language includes many terms testifying to a real expertise on plantain (Leclerc 2012). Recently, there has been a diversification of crops leading to an increase of cassava, probably influenced by agricultural development programs led by (inter-)national NGOs and the Cameroonian government. Today, agricultural products are important in Baka diet, as they provide carbohydrates from the starchy tubers and fibers, proteins, and minerals from cassava and cocoyam leaves that are eaten throughout the year.

Although our data were collected primarily among sedentarized Baka, empirical observation allows us to suggest that the predominance of crops might be the general food pattern among all Baka in this area, even those living more often in the forest. Wild yams have been mentioned as culturally important staple foods for the Baka living in forest camps (Dounias 2001; Sato et al. 2012; Yasuoka 2006). However, even if the Baka maintain a high degree of mobility between the village and the forest (Leclerc 2012), they tend to frequent camps that are within one day's walk of the village. While in the camps, they rely on

crops grown in small fields in the forest, or they travel back to the village to pick up some tubers and return to the forest the same day. The Baka rely on wild tubers when going on longer expeditions to more distant locations, for hunting or collecting non-timber forest products. Such expeditions can comprise two to three months per year. Our informants noted that on several occasions they shortened their stay in the forest because they could not find sufficient wild yams, and therefore came back to the village. Given that the Baka have a reduced access to agricultural products for only a short period of the year, we argue that the data presented give us a relevant overview of Baka diet.

Crops are also among the most preferred and valued foods. Starchy foods in general were always listed as the first items in the surveys on food preference and value. While the importance of wild meat among the Baka and the impact of its absence have been previously emphasized (Duda et al. 2018; de Garine and Pagezy 1990), we see that starchy domesticates can be considered as the base of Baka diet and are also their preferred food. Although not all Baka aspire to a farming livelihood (Gallois 2017), there is a tendency to value agricultural food.

TABLE 5. FOOD CHOSEN IF ACCESSIBLE, BY ORDER OF SALIENCY (N = 103).

Baka name	English name	Scientific name	Occurrence number	Frequency(%)	Smith Index
ba	Yam	<i>Dioscorea cf. praehensilis</i>	37	35.9	0.272
ndo	Plantain	<i>Musa paradisiaca</i>	37	35.9	0.267
bomà	Cassava	<i>Manihot esculenta</i>	36	35.0	0.228
sapà	Yam	<i>Dioscorea praehensilis</i>	30	29.1	0.199
lánga	Cocoyam	<i>Xanthosoma sagittifolia</i>	29	28.2	0.169
poki	Honey	<i>Apis</i> spp.	23	22.3	0.158
lee	Rice	<i>Oryza</i> spp.	16	15.5	0.113
keke	Yam	<i>Dioscorea burkilliana</i>	19	18.5	0.107
dengbe	Blue duiker	<i>Philantomba monticola</i>	12	11.7	0.077
dàndù	Trigones honey	undeterminate	13	12.6	0.071

TABLE 6. PREFERRED WILD EDIBLE PLANT SPECIES, BY ORDER OF SALIENCY (N = 103 IND.).

Baka Name	English name	Scientific name	No. of citations	Frequency (%)	Smith Index
ba	Yam	<i>Dioscorea cf. praehensilis</i>	49	47.6	0.385
pokì	Honey	<i>Apis</i> spp.	45	43.7	0.333
sapà	Yam	<i>Dioscorea praehensilis</i>	35	34.0	0.258
dàndù	Trigone' honey	<i>Trigona</i> sp. Meliponini tribe	35	34.0	0.214
keke	Yam	<i>Dioscorea burkilliana</i>	34	33.0	0.201
màbè	Moabi	<i>Baillonella toxisperma</i>	26	25.2	0.180
pekè	Wild mango	<i>Irvingia gabonensis</i>	21	20.4	0.133
èsumà	Yam	<i>Dioscorea semperflorens</i>	24	23.3	0.118
koko	Koko	<i>Gnetum africanum</i>	12	11.7	0.084
kuku	Yam	<i>Dioscorea minutiflora</i>	14	13.6	0.065

Further studies should explore the factors that drive such preferences, considering both the representations beyond agriculture and aspects such as reliability and food convenience.

Consuming market products and earning money are highly valued by both Baka adults and children (Gallois 2017). When the Baka earn money, they tend to spend it immediately, often on cheap alcohol, as it has been reported in other Baka settings (Kitanishi 2006). However, the most frequently bought items in local shops are actually salt and bouillon cubes. These items are highly valued by the Baka, who reported that only when they did not have enough money to buy them did they not use

them. Although the presence of bouillon cubes in Baka meals was reported 20 years ago (Joiris 1996), exposure to the market economy resulted in changes in their diet. Reyes-García et al. (2019) reported that Baka who were more exposed to the market economy had a lower dietary diversity and higher sugar consumption. Overall, even though the diversity of purchased food was low due to their lack of buying power, the high social value of these items might drive future changes in the daily diet. As shown among several other small-scale societies, the integration of marketable products, given the prevalence of processed foods and increased fat, sugar, and salt content, might have consequences

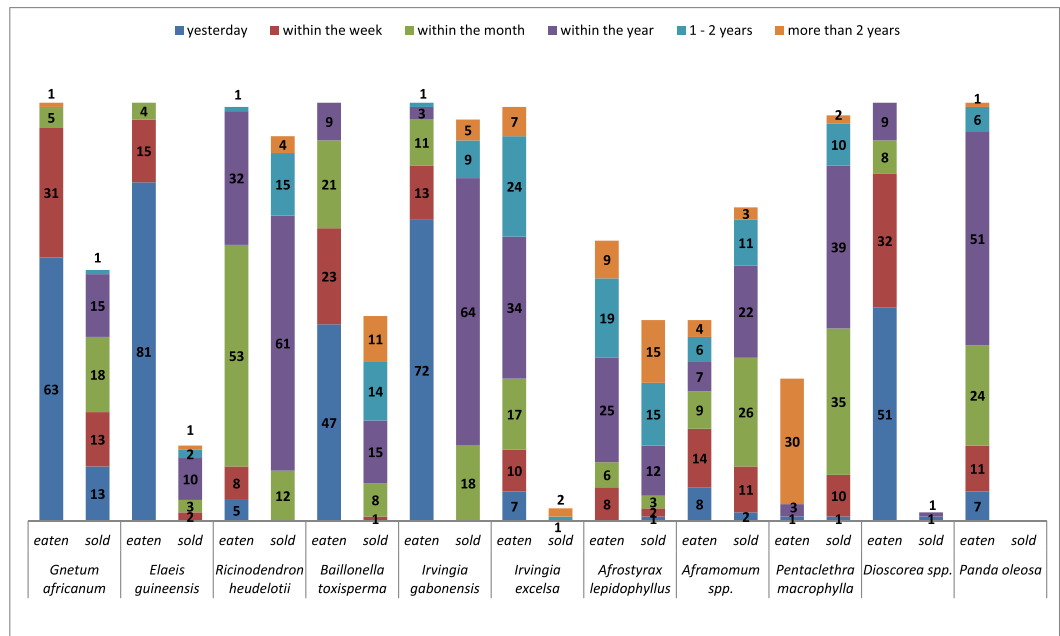


Fig. 1. Time of last sale and consumption by species, based on interviews with 100 individuals.

on local health, nutritional status, and well-being (Kuhnlein 2015; Popkin 2004).

Given the high use and value of agricultural and market foods, what is the place reserved for wild edible plants? Our free-listing data showed that the contribution of wild plants was quite modest (compared to agricultural and market products) in terms of both frequency and diversity. The consumption of *Gnetum africanum*, the most frequently consumed wild plant, was relatively recent in the studied area (our informants mentioned it was not eaten 40 years ago). This plant is ubiquitous in many Central African countries, to the extent that in some areas the trade is leading to declining populations of this liana (Oumar 2017). All other wild food plants appeared in less than 8% of the dietary recalls, and represented only a small proportion of the 70 different Baka names for edible plants that were reported in a previous study (Gallois et al. 2017). This outcome, however, may also be an underrepresentation caused by our free-listing method. A recent study showed that participants generally report many more items (species, names, and uses) in semi-structured interviews than in free-listings, and therefore the latter method may under-report local knowledge (Paniagua Zambrana et al. 2018). Moreover, our dietary recall was limited to the past 24 h, so chances of mentioning wild plant products only eaten once a week or less were small compared to daily-consumed food items. Whether reality or an artifact of the methods used, even a limited consumption of wild plants provide the Baka with important nutrients, such as fat, starch, and vitamins and thus play an important role in the nutritive intake provided. For example, *Gnetum africanum* leaves are rich in amino acids and are likely an important source of protein, particularly when meat is less available (Ali et al. 2011). Although previous studies explored the specific components of some of the local plants (Hladik et al. 1996), a more detailed analysis is needed on the nutritive content of wild plants products consumed by the Baka.

Beyond the nutritive aspects, wild edible plants are also integral part of Baka well-being, cultural identity, and cosmology. Species like bush mangoes and moabi undergo massive fruiting periods during which huge quantities of fruits are produced. This brings to a period of food abundance that is intimately related to the Baka conception of eating well and plenitude (Joiris 1996). Moreover, the Baka are recognized experts in the collection of wild edible plants, and they highly value their knowledge and

practices related to plant and honey gathering and hunting as part of what differentiates them from the Bantu. Wild edible plants are a major part of Baka cultural identity, and wild yams in particular play a specific role in their cosmology. They are considered as a link between humans, elephants, and the jengi spirit, because these three forest inhabitants share this symbolic food (Dounias 1996). For this reason, wild yams have been considered “Cultural Superfoods” (Dounias 1996), which also relates to the notion of a cultural keystone species (Garibaldi and Turner 2004).

In this light, our finding of a low consumption of wild yams deserves some explanation. We suspect this might be driven partly by the energy expenditure involved in yam collection and preparation. When asked what foods were preferred when no effort or money was needed, the Baka choose a wild yam (*ba*, *Dioscorea* cf. *praehensilis*) most frequently. Clearly, not all preferred foods were also the most consumed. Food preference, including symbolic representation, is not enough to explain the overall food environment. The case of the yams suggests that convenience—the tradeoff between energy spent and nutritional intake—might also strongly affect food behaviors among the Baka.

Given the Baka uses and perceptions of different types of foods and the current social and ecological changes, it seems pertinent to wonder about the evolution of dietary practices, but more broadly about the impacts of these changes on health, nutrition, and the Baka culture. Although the Baka still have a broad spectrum of forest resources and associated practices, the place of wild edible plants might change considerably due to new uses and values. The Baka’s high valuation of cultivated and commercial food is also reflected in their vocabulary used to describe wild foods. Several forest species are named in allusion to a crop: *Panda oleosa* nuts are called “peanuts of the forest”; the bark of *Afrostryax lepidophyllus* is known as “[bouillon] cubes of the forest.” Moreover, we can see that some plants are under pressure due to increasing demand from the national market. During the massive fruiting period, traders from other parts of Cameroon come to the Baka villages to buy seeds, inducing a pressure on the Baka to collect these NTFPs. To make quicker money, some Baka harvest the unripe fruits or cut off fruiting branches, thus weakening the resource. Therefore, some wild edible plants are now valued for what they can yield economically, and are collected for the purpose of marketing rather

than consumption. Commercial harvesting of NTFPs is already leading to declining resources in southeast Cameroon (Ingram 2014; Levang et al. 2015). Several forest seeds sold by the Baka appear as vulnerable on the IUCN Red list (*Afrostryrax lepidophyllus*, *Baillonella toxisperma*, *Ricinodendron heudelotii*) or as near threatened (*Irvingia gabonensis*). Logging also has a tangible effect on the availability of some species, such as *B. toxisperma*, the most frequently harvested timber in the region and becoming scarce in the study area. While a low diversity of wild plants was also observed in the diet of other hunter-gatherers in the Congo Basin (de Garine 1996b; Ichikawa 1996; Termote et al. 2012), the decrease of these wild plants in the environment is a concern for both local biodiversity and livelihood. Reducing amounts of wild plants in Baka daily meals will have an impact on their food security, given the recognized importance of wild species for the diversity of micronutrients they provide (Erskine et al. 2014; Fungo et al. 2016). Moreover, this is accompanied by a potential loss of local knowledge. Some processing methods of wild plants are already eroding, such as the preparation of *Pentaclethra macrophylla* seeds, which included several days of soaking in running water to eliminate toxic compounds. Only a few elder Baka still mastered this technique and remembered having consumed these seeds. Nowadays, these seeds are collected for the sole purpose of being sold to middlemen. This change in food behavior suggests a process of devaluation of certain wild plants and their respective practices, as has been reported among other forest-dwelling groups (Asprilla-Perea and Diaz-Puente 2018).

Conclusion

Our study emphasizes the importance of considering local representations of food when exploring dietary behaviors, even if they are not the only explanation for these food patterns. Future research should consider the several interconnected factors shaping food environment in order to further explore the drivers of food behaviors among local populations who are experiencing several socio-ecological changes. Given the increasing pressures on biodiversity and local livelihood, and the importance of wild edible plants for food security, it is crucial to better control the extraction of forest resources and to valorize the corpus of knowledge

of local populations in order to maintain biocultural diversity.

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