Appetite 97 (2016) 176–184

Contents lists available at ScienceDirect

Appetite

journal homepage: www.elsevier.com/locate/appet

Factors influencing consumption of nutrient rich forest foods in rural Cameroon

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ARTICLE INFO

Article history:
Received 13 October 2015
Received in revised form
25 November 2015
Accepted 6 December 2015
Available online 12 December 2015

Keywords:
Forest foods
Food habits
Cultural beliefs and ethnic foods

ABSTRACT

Studies show that a number of forest foods consumed in Cameroon are highly nutritious and rich in health boosting bioactive compounds. This study assessed the knowledge and perceptions towards the nutritional and health promoting properties of forest foods among forest dependent communities. The relationship between knowledge, perceptions and socio-demographic attributes on consumption of forest foods was also determined. A total of 279 females in charge of decision making with respect to food preparation were randomly selected from 12 villages in southern and eastern Cameroon and interviewed using researcher administered questionnaires. Multivariate logistic regression analysis was used to identify the factors affecting consumption of forest foods. *Baillonella toxisperma* (98%) and *Irvingia gabonesis* (81%) were the most known nutrient rich forest foods by the respondents. About 31% of the respondents were aware of the nutritional value and health benefits of forest foods. About 10%–61% of the respondents expressed positive attitudes to questions related with health benefits of specific forest foods. Consumption of forest foods was found to be higher among polygamous families and also positively related to length of stay in the forest area and age of respondent with consumption of forest foods. Education had an inverse relationship with use of forest foods. Knowledge and positive attitude towards the nutritional value of forest foods were also found to positively influence consumption of forest foods. Since knowledge was found to influence attitude and consumption, there is need to invest in awareness campaigns to strengthen the current knowledge levels among the study population. This should positively influence the attitudes and perceptions towards increased consumption of forest foods.
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1. Background

Cameroon and much of the other sub Saharan countries have unacceptably high prevalence of under nutrition (CDHS, 2011; IFPRI, 2014). Current malnutrition prevalence statistics indicate stunting level of 32.5% and underweight at 14.6%, among Cameroonian children aged below five years. Compared to the recommended limits of 2% for stunting and 3% for underweight (CDHS, 2011; IFPRI, 2014) for healthy populations, the stunting and underweight prevalences in Cameroon are respectively 15 and 5 times higher. This shows that under-nutrition is a public health problem in Cameroon. Recent reports indicate that the sub-Saharan population, including that of Cameroon, is at an increased risk of undernutrition, as a result of the changes in the food systems and dietary patterns (FAO, WFP and IFAD, 2014; IFPRI, 2014; Sneyd, 2013). A shift from the diversified traditional to simplified and monotonous diets, has resulted in increased consumption of rice, maize, and wheat products and drastic decrease in the consumption of traditional foods that are abundantly available within the region (Frison, Smith, Johns, Cherfas, & Eyzaguirre, 2006; Keller, Mndiga, & Maass, 2006; Penafiel, Lachat, Espinel, Van Damme, & Kolsteren, 2011; Pingali, 2007). The change in lifestyle has partly been associated with the loss of indigenous African knowledge on the use and preparation of many traditional food dishes (Akpavi et al., 2008; Maundu, 1996). On the other hand, nutrient composition studies of forest foods indicate that some forest food species have quite high content of essential nutrients and bioactive compounds (Fungo et al., 2015; Penafiel et al., 2011). Forest foods contribute 36% of total vitamin A and 20% of iron in Gabonese diets

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http://dx.doi.org/10.1016/j.appet.2015.12.005
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(Blake et al., 2009) and 31% of RAE (vitamin A) and 19% of iron in the Tanzanian diets (Powell, Maundu, Kuhnlein, & Johns, 2013). Forest foods have substantial potential to increase intake of essential nutrients among the forest foods consumers. In South Africa and Togo, negative perceptions and attitudes towards traditional foods have been documented (Akpavi et al., 2008; Dweba & Mearns, 2011). Traditional foods are referred to as "food for the poor" by the educated and a section of the urban residents across Africa, resulting in their neglect and abandonment (Akpavi et al., 2008; Dweba & Mearns, 2011). These observations have been corroborated by some recent case studies among the forest dependent communities of Kisangani in DR Congo (Termote et al., 2012), Guiziga tribe in Cameroon (Hamawa, 2013) and residents of Lama Forest reserve in Benin (Boedecker, Termote, Assogbadjo, VanDamme, & Lachat, 2014). These studies revealed that despite the communities having access to abundant nutrient and phytochemical rich forest foods, food insecurity and under-nutrition are rampant.

The value of forest foods and diets is being periodically re-evaluated worldwide with good examples of studies revealing the considerable recognition of the potential health and nutritional contribution of forest foods among local communities in Tanzania (Powell et al., 2013), Vietnam (Ogle, Hung, & Tuyet, 2001) and Peru (Roche, Creed-Kanashiro, Tuesta, & Kuhnlein, 2008). These studies revealed that traditional forest foods often represent well adapted interactions between human perceptions and beliefs assigned towards the health and nutrition importance of forest foods that ensure meeting of nutritional and health needs of communities. Self-beliefs, attitudes and perceptions influence achieving healthy dietary habits (Sparks, Shepherd, Wieringa, & Zimmermanns, 1995). Consumption of wild and forest foods by the populations adjoining forests, contributes to the realisation of a healthy diet (Gil, Gracia, & Sanchez, 2000). Different studies indicate that consuming forest foods belongs to the community cultural tradition and indigenous knowledge of the local populations (Boedecker et al., 2014; Penafiel et al., 2011; Pieroni, 2008) while some studies indicate that consuming forest foods represents the cultural identity of the community (Dansi et al., 2008; Pieroni, Nebel, Santoro, & Heinrich, 2005). However, there is paucity of information on the knowledge and attitudes towards the perceived health and nutritional benefits of forest foods and the factors that affect consumption of the forest foods in Cameroon. Therefore the aim of this study was to investigate the perceived health and nutritional benefits of forest foods and household socio-demographic factors that affect consumption of forest foods in southern and eastern Cameroon.

2. Materials and methods

The study was conducted in the eastern and southern regions of Cameroon (Fig. 1). The population around the eastern site is about 25,783, mainly composed of the Kako, Pol and Baka pygmy ethnic groups, living in 41 villages (Medinof, 2004). The population in the southern site is estimated to be 79,353, consisting of the Bulu ethnic group, living in 29 villages (Enviro Consult, 2009).

2.1. Study design

A three-stage cluster sampling technique involving one stage of purposeful selection and two stages of randomization were used in the selection of the study villages and households. In the first stage, districts within each site were purposefully selected on the basis of their accessibility, ethnicity, willingness of the community to participate in the study and existence of the logging activities in the surrounding forests. In the second stage, villages were randomly selected within the chosen two districts. In the third stage, households were randomly selected. From the eastern site, the study was conducted in seven villages, namely Kouedjina, Kagnol 3, Ndembo, Petit Pol, Melambo, Nkolbikon and Bonando; while in the southern site the study was conducted in five villages, namely Ngon, Bissam, Ondondo, Methyikpwale and Meyos. Using Fishers (1998) formula below, a total of 276 households to be interviewed, in the two sites was calculated based on the estimated proportion (9.9%) of the rural population directly depending on forests for food (Chao, 2012).

$$n = \frac{t^2 \times p(1-p)}{m^2}$$

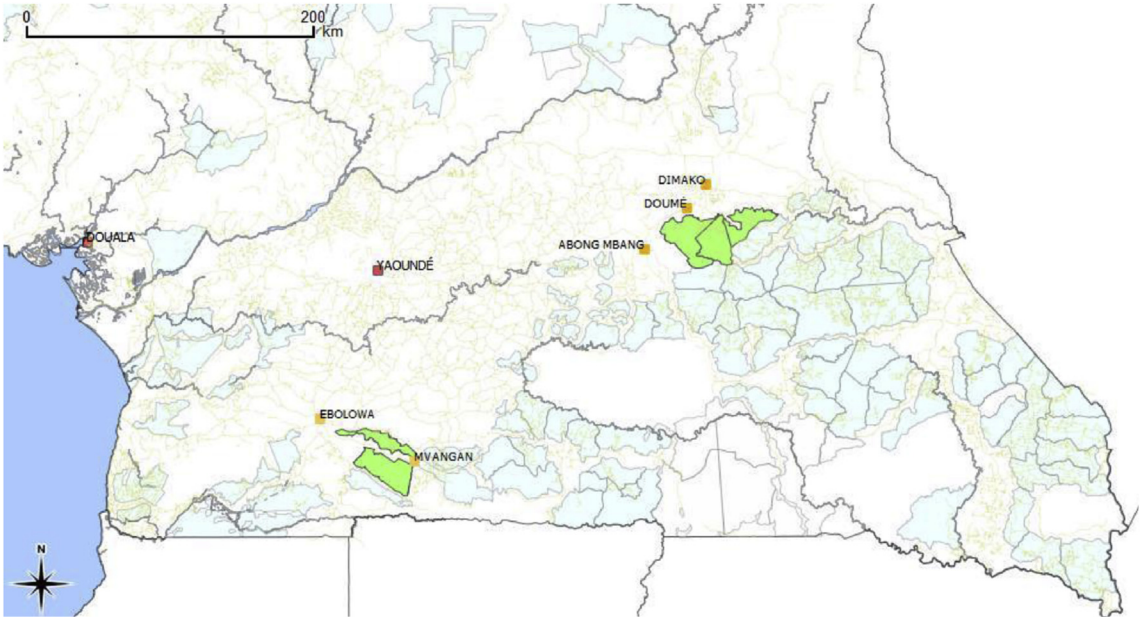

Fig. 1. Location of study sites.

Table 1
Household socio-demographic characteristics.

Household characteristics	n	%[a]
Age of respondent	*277*	
Average age		43.7 ± 14.2
Minimum		17.0
Maximum		82.0
Education of respondent	*277*	
No formal education		4.7
Primary class 1–4		21.3
Completed primary school		42.2
Completed secondary form 4		28.9
Completed University		2.9
Household size	*258*	
Low [1–4]		33.7
Medium [5–9]		56.2
High [10–14]		10.1
Period of stay within the study area	*275*	
<12 months		2.2
1–2 years		3.6
>2<5 years		7.3
>5<10 years		6.2
>10 years		80.7
Place of residence in the study area	*277*	
Same area (outskirts of forest)		75.1
Another forest (not current forest site)		13.0
Another part of this forest		8.7
Inside the forest		3.2
Ownership of house	*276*	
Owned		92.4
No ownership (user rights)		4.8
Rented		1.9
Provided by employer		1.1
Roofing of house	*277*	
Iron-sheets		62.5
Tree branches and leaves		32.1
Grass thatch		2.9
Tiled		2.5
House walls	*277*	
Timber		47.7
Concrete or brick walls		31.8
Harvest tree branches		15.9
Mud walls		4.3
Grass		0.4
Energy source for cooking	*276*	
Fire wood		97.2
Charcoal		2.2
Paraffin stoves		0.8
Source of energy for lighting	*277*	
Kitchen firewood		66.9
Electricity		30.0
Paraffin lanterns		3.3
Water source	*276*	
Pond		62.0
River		17.0
Public spring		10.5
Bore hole		9.1
Piped		1.6
Economic activities of forest dependent communities	*279*	
Farming		51.8
Hunting and gathering forest foods		28.0
Trading		7.6
Artisan works		5.3
Salaried employment		3.2
Artisanal logging & informal timber trading		2.9
Pension		1.1
Casual employment		0.4

n: Number of households.
[a] Percentage of total number of household.

Where n = required sample size, t = confidence level at 95% (standard value of 1.96) p = estimated proportion of population depending on the forests with regard to the total population, m = margin of error at 5% (standard value of 0.05). To cater for attrition, during the data collection process, the number of households per site was increased by 5%, totalling 303 households. However, data were captured from a total of 279 households in the two sites, representing a response rate of 92%. This sample size was about 40% of total number of households in each village.

2.2. Data collection

2.2.1. Household interviews

Enumerator administered questionnaires were used to collect data on socio-demographics, knowledge of nutritious and health boosting forest food species, uses and attitudes towards health benefits of forest foods. Interviews took place at homes of the female respondents' who are in charge of decision making with respect to food preparation, during the months of May and June 2012. Questionnaires were first pre-tested and adapted to the local context. The study was approved by the ethical committees of the forestry and health departments of Bertoua City, the capital of east region and Ebolowa City, the capital of the south region. The chiefs of the selected villages approved the research protocol. Informed oral consent was also obtained from the participating respondents.

The socio-demographic part of the questionnaire included questions on the age, gender, economic occupation, education level of the respondent and material used to construct household houses. The nutrition part of the questionnaire included questions on list of nutrient rich forest foods in order of importance. Respondents were also asked to indicate i) if they were aware that malnutrition can lead to disease and ii) if they were aware that forest foods were nutritious and health promoting. The options for these questions included: 'aware', 'not aware' or 'uncertain'. Attitudes were assessed by posing five questions (see Table 3) that used a narrative scale that explored the respondents' agreement, disagreement and uncertainty about the importance of forest foods to their health and nutrition. Four questions assessed practices related to use of forest foods (see Table 4). The response options for question on number of times of preparing forest foods were 'none', 'once', '2–3 times' and 'more than 4 times'. The other three questions were open ended. The levels of knowledge, attitude and practices for each question were computed as the proportion of respondents who gave a positive answer.

2.2.2. Data analysis

All data were analysed using SPSS version 21 (SPSS Inc., Chicago Ill, USA). The mean values were computed for continuous variables while proportions were computed for the categorical variables. Multinomial logistic regression analysis was performed to identify the household demographic factors (age, education, household size, period of stay in study area, place of residence in study area, ownership of house, roofing of house, walls of house, energy source, water source and source of income) influencing use of forest foods. During multinomial regression analysis and for comparison purposes two age groups of <46 years (considered to be within reproductive age for women) and >46 years (beyond reproductive age) were created. These age categories have been used in similar studies (Dweba & Mearns, 2011; Kimiywe, Waudo, Mbithe, & Maundu, 2007; Musinguzi, Kikafunda, & Kiremire, 2006). The relationships between consumption of forest foods with perceived attitudes towards the health benefits of consuming forest foods and knowledge of the nutritional and health benefits of forest foods were also determined. The 7 respondents who were single were not included in the regression analysis when determining how perceptions varied with the consumption frequency of forest foods. Singles rarely prepare food themselves. They majorly buy food from restaurants (Blake et al., 2009). The significance level for variables entering the logistic regression models was set at 0.05 and for

Table 2
Forest foods identified to be of high nutritional value by forest dependent communities in Southern and Eastern Cameroon.

Scientific name	Number of female respondents	Percentage
Baillonella toxisperma (African pearwood)	273	97.8
Irvingia gabonesis (Bush Mango)	226	81.0
Trichoscypha abut (Mvout)[a]	70	25.2
Elaeis guineensis (Palm oil)	54	19.3
Ricinodendon heudolitii (African wood-oil nut)	41	14.6
Bush meat (Gibier)	30	10.9
Funtumia Africanum (Wild spinach)	30	10.9
Imbrasia spp (Caterpillars)	27	9.7
Agaricus bisporus (Mushrooms)	23	8.4
Achatinidae spp (Snails)	17	5.9
Coula edulis (African walnut)	14	5.0
Ampelocissus spp (Wild grape)	10	3.7
Maranthacae spp (Ngong)[a]	10	3.7
Miel (Honey)	7	2.5
Dacryodes edulis (Bush butter tree)	7	2.5
Termites	7	2.5
Rhynchophorus phoenicis (Palm weevil)	3	1.2
Cola acuminata (Cola)[a]	3	1.2
Dioscorea spp (Wild yams)	3	1.2
Angylocalyx talbotii (Nkana)	3	1.2
Afrostyrax lipidophyllus (Wild onion)	3	1.2

[a] Forest foods consumed without an English name. *Trichoscypha abut* is a timber producing tree with it is bright purple nutritious fruits sought for food (Fungo et al., 2015). The fruits of *Maranthacae* spp are harvested and consumed as condiments. *Cola acuminate*, has caffeine containing fruits that are consumed as stimulants (Burdock, Carabin, & Crincoli, 2009). *Angylocalyx talbotii* is a species of a legume in the Fabaceae family, whose leaves are consumed (APD, 2013).

Table 3
Forest dependents knowledge and perceptions about forest foods.

Attitudes (perceptions) and knowledge aspects assessed[a]	Agree (%)	Disagree (%)	Uncertain (%)
Nutritionally rich	30.9	29	40
Good sources of health boosting nutrients for health	36.2	39.1	24.7
Not good for health	15.3	60.7	24.0
Good for eye sight	52.6	4.7	42.7
Bush meats contribute more to increase in height in comparison to forest plants	10.0	64.9	25.1
Can substitute Vitamin A and iron supplements	10.4	54.1	35.5

[a] Assessed 279 female respondents.

Table 4
Practices of preparing forest foods.

Practices (uses)	Percentage of total
Times forest foods are prepared	(n = 109)
None	14.7
Once	12.8
2–3 times	45.0
More than 4 times	27.5
Who decides type of food to prepare	(n = 109)
Father	21.1
Mother	77.1
Children (girl)	0.9
Grand mother	0.9
Member of household who prepares foods	(n = 109)
Father	2.5
Mother	96.4
Children (girl)	0.7
Grand mother	0.4
Forest foods processed into products?	(n = 279)
Baillonella toxisperma (Moabi)	68.8
Irvingia gabonesis (Bush Mango)	9.3
Elaeis guineensis (Palm Oil)	6.9
Ricinodendon heudolitii (Djangsang)	0.4
Pentaclethra macrophylla Benth (Ebaye)	0.4
None	14.3

removing at 0.10. Associations between the independent and dependent variables were expressed as odds ratios. A confidence interval of 95% was used to determine significant differences in all statistical analyses.

3. Results

3.1. Respondent characteristics

Average age for female respondents was 44 years. The majority of respondents had attended or completed primary school (64%) and more than half (56%) had 5-9 dependents (Table 1). About three quarters (75%) of the households, were natives of the study area, and therefore the knowledge and perception they possessed could be considered local. Despite being forest-dependent communities, majority (52%) of the households also practiced farming.

3.2. Knowledge of nutrient rich forest foods

Almost all (98%) female respondents knew and listed the fruits of *Baillonella toxisperma* (African pearwood) as the most important nutrient rich forest foods (Table 2). These were followed by *Irvingia gabonesis* (Bush mango) was the second highest known forest food (81%). Other forest food tree species mentioned included *Elaeis guineensis* (palm oil), *Trichoscypha abut* (Mvout) and *Ricinodendon heudolitii* (Djansang). Animal foods collected from forests included bush meat ('gibier'), (11%), *Imbrasia* spp (edible caterpillars), (10%), Achatinidae spp (snails) (6%) and Termitoidae spp. (termites) (3%).

Results further revealed that 61% of the respondents were aware malnutrition can lead to disease while about a third (31%) of the respondents were aware that forest foods were nutritious and health promoting.

3.3. Attitudes towards the health benefits of forest foods

A considerable proportion of respondents generally expressed positive attitude towards some specific benefits accrued from consuming forest foods, with most (61%) correctly expressing positive attitudes towards the safety concerns of forest foods (Table 3). The least (10%) expression of positive attitude was recorded among respondents who agreed that bush meat is nutritionally important and respondents who believed vitamin A and iron content in forest foods is adequate to maintain a healthy lifestyle.

3.4. Use of forest foods

About 40% of the female respondents prepared meals using forest foods daily (Table 4). Among the respondents that prepared forest foods, about 85% of households reported eating forest foods once to more than 4 times a day. Preparation of household meals was exclusively done by women (96%) and most respondents (77%) expressed that women were responsible for making key decisions regarding choice of foods used in household meals. About 69% of the respondents mentioned that they processed *B. toxisperma* into edible oil, a more valuable product for consumption and income security. Some (20%) respondents mentioned processing other valuable forest foods, notably *I. gabonesis* (9%), *E. guineensis* l (7%), *R. heudolitii* (0.4%) and *Pentaclethra macrophylla* (0.4%).

3.5. Household demographic factors, knowledge, attitudes and practices that affect consumption of forest foods

Logistics regression analysis revealed that respondents aged 46 and above, were 1.4 times more likely to prepare forest foods (OR = 1.37 95% CI 0.60 to 3.13), than respondents aged below 46 (Table 5). Education had an inverse relationship with use of forest foods. Compared to the university trained respondents, uneducated respondents were 6.3 folds more likely to prepare forest foods (OR = 6.26 95% CI 0.60 to 18.09) than respondents who did not complete primary school, those who completed primary school or secondary school. Polygamous families were more than 6 times (OR = 6.96 95% CI 0.13 to 37.24) more likely to prepare forest foods, than families that were monogamous. Results further indicated that consumption of forest foods increased with period of stay in an area. Regarding the relationship between knowledge and consumption of forest foods, the analysis revealed that consumption of forest foods significantly increased by 4 times (OR = 4.02 95% CI 0.59 to 5.04) among respondents who knew that forest foods were nutritious and by 1.1 times among (OR = 1.11 95% CI 0.27 to 4.60) among those that knew that poor nutrition can lead to disease and death. The multivariate analysis further revealed that respondents who expressed positive attitude towards the health and nutrition benefits of consuming forest foods were more likely to prepare and consume forest foods. For example the highest registered likelihood of about 13 times (OR = 12.74 95% CI 1.74 to 35.82), to prepare forest foods was registered among respondents who agreed that forest foods can substitute for vitamin and iron supplements. Women were about 12 times more likely to prepare forest foods (OR = 12.65 95% CI 0.59 to 26.71) than their daughters and grandmothers (see Table 6).

3.6. Influence of social demographic and perceptions factors on consumption frequency of forest foods

The number of times of consuming forest foods considerably increases with respondents who were in a polygamous marriage, knowledgeable about the nutritious forest foods and those that had positive perceptions towards health benefits of forest foods. Highlighting the importance of knowledge on consumption of forest foods, the highest possibility of consuming forest foods of 29 folds (OR = 29.01 95% CI 0.54 to 36.68) was registered among respondents who knew that forest foods have nutritional benefits. This was followed by the 25 folds (OR = 25.05 95% CI 0.19 to 32.19) registered among respondents who were aware that poor nutrition can lead to disease and death. However, respondents who were

Table 5
Logistic regression analysis on the socio demographic and KAPs factors associated with the practice of preparing and consuming forest foods.

Preparing/eating forest foods	Odds ratio	95% CI		P Value
Socio demographic characteristics				
Age				
<46 years	1 (reference)			
≥46 years	1.37	0.60	3.13	0.04
Education				
University trained	1 (reference)			
No formal education	6.26	0.60	18.09	<0.001
Primary school (class 1–4)	3.04	0.78	11.76	<0.001
Completed primary school	2.51	0.69	9.13	<0.001
Few years in secondary school	2.67	0.69	10.33	<0.001
Completed secondary school	1.37	0.26	7.09	<0.001
Marital status				
Single adult	1 (reference)			
Married (Polygamous)	6.96	0.13	37.24	0.007
Married (Monogamous)	5.16	0.14	18.56	<0.001
Period of stay in area by respondent				
<12 months	1 (reference)			<0.001
1–2 years	1.31	0.42	4.06	<0.001
>2≤5 years	6.03	2.13	16.90	<0.001
>5years	7.64	1.92	30.44	<0.001
Knowledge				
Forest foods are nutritious				
Do not know	1 (reference)			
Correct	4.02	0.59	5.04	0.04
Not correct	1.61	0.17	2.26	<0.001
Poor nutrition can lead to disease				
Do not know	1 (reference)			
Correct	1.11	0.27	4.59	<0.001
Not correct	0.87	0.35	2.18	0.004
Attitudes/perceptions				
Have health boosting nutrients				
Uncertain	1 (reference)			
Agree	6.43	1.22	33.88	<0.001
Disagree	2.50	1.02	62.61	<0.001
Not good for health				
Uncertain	1 (reference)			
Agree	3.76	0.45	31.44	0.002
Disagree	1.02	0.549	1.91	<0.001
For a good eye sight				
Uncertain	1 (reference)			
Agree	3.09	1.69	5.66	<0.001
Disagree	1.20	0.37	4.07	<0.001
Bush meat have nutrients that lead to growth				
Uncertain	1 (reference)			
Agree	8.77	0.46	16.75	<0.001
Disagree	3.69	0.45	7.13	<0.001
Can substitute vitamin A and iron supplements				
Uncertain	1 (reference)			
Agree	12.74	1.74	35.82	<0.001
Disagree	5.63	1.25	23.96	<0.001
Practices				
Who prepares food for children?				
Father	1 (reference)			
Children (daughters)	2.50	0.10	62.61	0.014
Grand mother	1.218	0.59	11.01	<0.001
Mother	6.43	1.22	33.88	<0.001
Who decides what food to prepare?				
Father	1 (reference)			
Children (daughters)	0.54	0.1	8.59	<0.001
Grand mother	1.17	0.86	4.08	<0.001
Mother	12.65	0.59	26.71	<0.001

Table 6
Multivariate association between social demographic and perceptions factors with consumption frequency of forest foods.

Factors and consumption frequency	Odds ratio	95% CI		P Value
Age (<46 as reference compared to ≥ 46)				
At least once	1.86	0.01	8.13	0.05
At least twice	7.53	0.4	9.29	0.01
More than 2 times	14.43	0.035	15.96	0.01
Family type (monogamous as reference compared to polygamous)				
At least once	1.97	0.21	4.01	0.04
At least twice	11.21	0.05	27.78	<0.001
More than 2 times	19.35	0.04	20.05	<0.001
Period of stay in area (1–12 months as reference compared to >1–2 years)				
At least once	1.33	1.02	8.10	0.08
At least twice	3.72	0.17	8.32	0.05
More than 2 times	22.88	0.25	30.76	0.05
Knowledge of nutritional benefits of forest foods (incorrect knowledge as reference compared to correct knowledge)				
At least once	0.93	0.15	6.76	0.01
At least twice	24.48	0.55	31.97	0.002
More than 2 times	29.01	0.54	36.68	0.003
Aware of nutritional benefits of forest foods (negative attitude as reference compared to positive attitude)				
At least once	1.811	0.74	4.45	0.02
At least twice	19.64	0.55	27.07	0.03
More than 2 times	24.09	0.54	46.06	0.04
Aware that poor nutrition can cause disease and death (negative attitude as reference compared to positive attitude)				
At least once	1.26	0.44	3.510	0.01
At least twice	15.22	0.09	25.39	0.004
More than 2 times	25.05	0.19	32.19	0.01
Forest foods are helpful as vitamin A and iron supplementation (negative attitude as reference compared to positive attitude)				
At least once	8.01	0.06	16.87	0.05
At least twice	11.01	2.68	18.35	<0.001
More than 2 times	15.24	2.21	22.40	<0.001

CI: Confidence interval.

knowledgeable about the nutritional importance of forest foods, were less likely to consume forest foods once (OR = 0.93 95% CI 0.15 to 6.76). The OR for consuming more than once was high (24.48), showing that although knowledge did not increase chances of consumption per se, those with knowledge of the nutritional value of forest foods generally consumed them more frequently.

4. Discussion

4.1. Knowledge of important forest food tree species

The 21 forest food species known by the respondents as the most healthful and nutritionally important in the present study are among the forest food species reported among the Guiziga tribe, in north of Cameroon (Hamawa, 2013). However, the known species in the present study are fewer than the number reported elsewhere. In Benin, 61 known wild plant species were found to be prepared in the local diets (Boedecker et al., 2014). In Uganda 34 plant species were known as traditional vegetables and fruits by rural residents of south western Rukungiri district (Musinguzi et al., 2006) and in South Africa 53 species of traditional and wild vegetables were reported to be eaten by rural people in the Venda region of the Limpopo Province (Nesamvuni, 2000). Studies indicate that wild edible food species vary from one region to another because food choices are influenced by culture, attitudes, values and people's beliefs (Adebooye & Opabode, 2004; Dweba & Mearns, 2011). Regression analysis between perception and consumption, in the present study, revealed that forest foods are important because of their health and nutrition benefits. This is in agreement with findings of Levang, Lescuyer, Noumbissi, Dehu, and Broussolle (2014), who reported that in southern Cameroon region of Ebolowa, forest foods are consumed because of their cultural attachment to the communities, being tasty and their health and nutrition benefits to children. Types of food Consumed reflect the regional identity of population (Kuhnlein et al., 2007). Consumption of wild or forest foods in the region is a clear example of how traditional knowledge of foods is spread throughout the communities (Hadjichambis et al., 2008; Kuhnlein et al., 2007; Parraga, 1990; Sneyd, 2013).

Almost all (98%) of the respondents identified the fruit tree species of *B. toxisperma* (African pearwood) and 81% of the respondents identified *Irvinga gabonensis* (bush mangoes) as the most important nutrient rich forest food species. The high demand of the two fruits can be attributed to their high market value in Cameroon and neighbouring countries, most especially in Nigeria (Awono, Djouguep, Zapfack, & Ndoye, 2009; Levang et al., 2014). Also, the nuts of *I. gabonesis* and *B. toxisperma* are locally processed to produce edible oil that is used in household cooking, while the surplus is sold (Levang et al., 2014). Furthermore, *I. gabonesis* fruits are popular and liked by children because of their sweet and nutritious yellow pulp (Ejiofor, Onwuboker, & Okafor, 1987). These fruits are nutritionally superior compared to conventional foods and reported to be used in control of obesity in some communities of Nigeria (Kengni, 2003). Previous work revealed high β-carotene and vitamin E content in the fruits of *B. toxisperma* (Fungo et al., 2015). Results of this study further revealed that bush meat was the most widely consumed animal food followed by the caterpillars. Bush meat provides proteins and essential micronutrients to the vulnerable forest dependent populations of Africa, Americas and Asia (Keegan, 1986; Koppert, Dounias, Froment, & Pasquet, 1993). However, of recent concerns have been raised, on how recommendations should be formulated with regard to the consumption of bush meat (Nasi, Taber, & Vliet, 2011; Penafiel et al., 2011; Tieguhong, Ingrame, Mala, Ndoye, & Grouwels, 2015). Although, bush meat provides essential nutrients, in Cameroon it is illegal to hunt and consume wild animals (Tieguhong et al., 2015). The non-respect of the prevailing legal rules has resulted in unsustainable forest management (Nasi et al., 2011; Tacconi, Boscolo, & Brack, 2003; Tieguhong et al., 2015), perpetuating reduction in forest resources including bush meat to the rural populations (Cerutti & Tacconi, 2006).

4.2. Attitudes towards the health benefits of forest foods

From the results it is clear that about a half (53%) to more two thirds (~61%) of the forest dependent communities, displayed positive attitudes towards forest foods importance in maintaining a good eye sight and the overall health, respectively. Studies among the Catalonian populations of Spain revealed that positive attitudes and beliefs were positively related to an increased recognition of the traditional diets as healthy diets (Serra-Majem et al., 2007). The high rates of positive attitudes towards health benefits of forest foods in the present study may be attributed to the respondents being in possession of health and nutrition information (Adams, 1999; Ramadasmurthy, Mohanram, Visweswara Rao, & Balakrishnaa, 1992). In Cameroon, mothers and guardians acquire health and nutrition information messages from health centres during the prenatal visitations and vitamin and mineral supplementation days (CDHS, 2011, Snyed, 2013).

On the other hand, it was further noted that some of the respondents held negative attitudes and perceptions towards specific health and nutrition benefits of consuming forest foods. This is demonstrated by the fact that only 10% of the respondents displayed positive attitudes towards bush meat having essential nutrients to permit growth and forest foods being as helpful as vitamin A and iron supplements. Also, about a third of the

respondents were positive about the nutritional and health benefits of forest foods. Adams (1999) observed that a community that does possess knowledge about specific concepts tends to rely on cultural or religious belief to inform perceptions, attitudes and practices. The nutrition information messages picked by women, during prenatal visits and vitamin and mineral supplementation days, may be lacking detailed nutrition information. There is need to invest in nutrition and health education programs aimed at imparting positive attitudes and beliefs of forest communities, by improving their knowledge base with respect to the health and nutrition benefits of forest foods.

4.3. Household demographic factors, knowledge, attitudes and practices that affect consumption of forest foods

The proportion (40%) of respondents in the present study that prepared household meals using forest foods was slightly higher than what is reported in previous findings. For example, in the Indian villages of Hura, Balarampur and Barabazar, 15%–20% of the population prepared meals with wild vegetables and fruits (Chakravarty, 2000). Logistic regression analysis in the present study positively associated the high practice of preparing and consuming forest foods with respondents aged 46 and above, lowly educated, polygamous, women making decisions which food to prepare and those who had stayed in the study area longer for. Education level of respondents was inversely related to rates of preparing forest foods in the present study. Although, university educated female respondents were few, this subgroup was included in the analysis because previous studies indicated that educated Africans have less preference to consume traditional and indigenous African foods (Dweba & Mearns, 2011; Kimiywe et al., 2007; Musinguzi et al., 2006; Oniango, Mutuku, & Malaba, 2003; Tabuti, Dhillion, & Lye, 2004). Educated South African populations and Ugandan populations have been found to consume less of wild fruits and vegetables, as compared to the consumption levels of the uneducated (Musinguzi et al., 2006; Pelto et al., 2004; Tabuti et al., 2004). In contrast, the educated European Mediterranean populations were found to possess higher nutritional knowledge and to consume more nutrient rich wild foods than the less educated (Serra-Majem et al., 2007). The difference in results of the present Cameroonian study and the European study can be attributed to difference in socio economic status, health consciousness and cultural differences (Adams, 1999; Pelto et al., 2004; Tabuti et al., 2004) and the low knowledge and perception levels of the rural forest dependent communities of Cameroon. The educated, are exposed to influences of globalization, urbanization and income growth, resulting in cultural and attitude changes, hence altering their traditional perceptions and beliefs, about traditional and local foods (Haddad, 2003). This has resulted in the elites moving away from traditional foods with strong cultural identity, to monotonous foods (Pingali, 2007; Sneyd, 2013). However, there is need to conduct further in-depth studies in Cameroon, to elucidate why education is negatively affecting the cultural beliefs and perceptions towards forest foods. Furthermore, an increase in the age of the respondents positively influenced the preparation of forest foods. Pelto et al. (2004) previously reported that the older the female respondents the better the levels of nutrition knowledge, attitudes and practices (KAPs). Also, findings from eMantlaneni village in South Africa revealed that elderly women were not only more knowledgeable about wild vegetables but also consumed more wild vegetables than younger women (Dweba & Mearns, 2011). The reduced preparation and consumption of forest foods among the younger generation have been attributed to the association of traditional foods with poverty and primitiveness, easy access to introduced foods and rapid deforestation (Adebooye & Opabode, 2004; Rensburg et al., 2007; Shava, 2000). The aggressive promotion of introduced food crops by the private sector, agricultural research and extension officers have been reported to pose a considerable challenge to the older generation's ability to successfully pass on, the indigenous knowledge to the younger generation (Dweba & Mearns, 2011; Keller et al., 2006; Rensburg et al., 2007). This has led to substitution of forest foods consumed in some communities (Levang et al., 2014).

Consumption of forest foods in the present study was considerably higher when women prepared household meals. Preparation and consumption of wild edible foods has previously been positively associated with women among the Bantu speaking tribes in southern Africa (Rensberg et al., 2004), the Basoga tribe of Bulamogi county in Uganda (Tabuti et al., 2004) and the Bantu and Luo tribes of eastern and central Kenya (Kimiywe et al., 2007). Collection of wild and forest foods in Africa, from the natural environment, is an activity that is reserved for women (Parsons, 1993). As a result, most African communities generally refer to wild foods as “female” foods (Hart & Vorster, 2006), although in terms of their consumption, gender distinctions do not apply (Kimiywe et al., 2007; Rensberg et al., 2004; Tabuti et al., 2004).

Logistic regression analysis further revealed existence of a significant ($P = 0.05$) positive association between consumption of forest foods with positive attitudes and perceptions towards health and nutrition benefits of forest foods. For instance, consumption of forest foods was more than 12 and 8 and 2 times, more likely to occur, among respondents who agreed that forest foods can replace vitamin A and iron supplements and bush meat was nutritionally important to humans. Also consumption frequency of forest foods significantly increased among respondents who had knowledge and positive attitudes towards the nutrition benefits of forest foods. These findings are in line with previous literature, which showed that having a positive attitude and perception towards health and nutrition benefits of the indigenous and traditional foods, is an important driving force for a person to improve his/her health and nutrition related practices and behaviours (Chen, He, Fu, & Wang, 2003). According to the theory of knowledge-attitude-practice, a positive attitude is the impetus of a correct practice and use of certain concepts (Sharma, Gernand, & Day, 2008). Positive attitudes are important factors that drive correct nutrition practices. In this sense, targeted nutrition education programs aimed at improving rural forest dependent communities need to be emphasized in Cameroon. These could target policy makers, health and forestry community workers and development practitioners.

This study is the first to assess and report the KAPs towards nutrition and health benefits among forest dependent communities of Cameroon. It has revealed the socio-demographic and KAPs factors that influence consumption of forest foods. However, the study does not cover the in depth understanding of the reasons for consuming or not consuming forest foods. These would best be explored using cultural and social anthropology studies.

5. Conclusions

While forest foods remain important to the nutrition of a large proportion of households in forest dependent communities, their contribution is hampered by inadequate knowledge about their nutritional value and health promoting properties. A number of factors, including; age, education and marital status, knowledge and attitudes towards health benefits of forest foods, were found to influence the consumption of forest foods. Initiatives aimed at promoting consumption of forest foods should, as a basic necessity, aim at raising community knowledge and improving attitudes about these foods. The success of such initiatives would most likely be influenced by a number of socio-demographic factors. These

factors should be taken into consideration when planning forest foods promotion interventions. Also, studies relating malnutrition prevalence among the study population with these factors need to be undertaken.

Conflict of interest

None declared.

Acknowledgements

The authors wish to thank the Congo Basin Forest Fund (CBFF) (5650155000601) of the African Development Bank and the CGIAR Research Programme on Forests, Trees and Agroforestry for the funding support. Also, the authors wish to thank Dr Julius Tieguhong, Ms Pauline Donn and Mr Obadia Tchingsabe for assistance in the data collection, the key informants in forest concessionaires of Southern site (FIPCAM) and Eastern site (SCTB).

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