PERCEIVED NUTRITION BENEFITS AND SOCIO-DEMOGRAPHIC FACTORS AFFECTING CONSUMPTION OF FOREST FOODS IN EASTERN AND SOUTHERN CAMEROON

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ABSTRACT

African forests act as sources of both plant and animal foods that provide significant amounts of nutrients and healthy boosting bioactive compounds. This study investigated the relationship between knowledge, perceptions and socio-demographic attributes towards consumption of forest foods. 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 socio demographic factors and perceptions affecting consumption of forest foods. *Baillonella toxisperma* (African pearwood) (98%), *Irvingia gabonesis* (bush mango) (81%) and *Trichoscypha abut* (Mvout) (70%) were identified as the most nutritious foods. Among the animal forest foods, bush meat (11%) and *Imbrasia* spp. (edible caterpillars) (10%) were identified as the most nutritious. Consumption of forest foods was higher among polygamous families and also positively related to length of stay in the forest area, as well as age of female respondents. Education had an inverse relationship with use of forest foods. Perception towards the nutritional value of forest foods were also found to positively influence consumption of forest foods. Since negative perceptions were found to influence consumption, there is need to invest in awareness campaigns to strengthen the current knowledge levels among the study population.

Key Words: Consumption, indigenous foods, perceptions

RÉSUMÉ

Les forêts africaines sont des réservoirs d'aliments végétaux et animaux fournissant des quantités importantes de nutriments et composés bioactifs stimulants naturels. La présente étude analyse la relation entre les connaissances, les perceptions et les caractéristiques sociodémographiques de la consommation des aliments issus des forêts. Un total de 279 femmes responsables du choix et de la préparation des aliments familiaux ont été choisis au hasard dans 12 villages du Sud et de l'Est du Cameroun, et interviewé à l'aide de questionnaires administrés par des chercheurs. L'analyse de régression multi-variée a été utilisée pour identifier les facteurs sociodémographiques et les perceptions qui affectent la consommation desdits aliments. *Baillonella toxisperma* (Moabi) (98%), *Irvingia gabonesis* (mangue sauvage) (81%) et *Trichoscypha abut (*Mvout) (70%) ont été identifiés comme les aliments

végétaux les plus nutritifs. Pour ce qui est des aliments forestiers d'origine animale, la viande de brousse (11%) et *Imbrasia* spp. (chenilles comestibles) (10%) ont été identifiés comme étant les plus nutritifs. La consommation des aliments issus des forêts était plus élevée parmi les familles polygames et positivement corrélée à la durée de séjour dans la zone forestière, ainsi qu'à l'âge des femmes interrogées. Le niveau d'éducation avait une relation inverse avec l'utilisation des aliments forestiers. La perception de leurs valeur nutritives avait également une influence positive sur leur consommation. Étant donné que les préjugés qui ont longtemps marqués ces aliments influencent négativement leur consommation, il est nécessaire de sensibiliser et de renforcer le niveau de connaissance des populations étudiée sur la valeur nutritive de ces produits.

Mots Clés: Consommation, aliments indigènes, perceptions

INTRODUCTION

Sub-Sahara African countries, including Cameroon, have high prevalence of undernutrition compared to recommended limits of 2% for stunting and 3% for underweight (CDHS, 2011; IFPRI, 2014). About 33 and 15% of Cameroonian children aged below five years, suffer from stunting and underweight (CDHS, 2011). The stunting and underweight rates are public health problems in Cameroon, because they are respectively 15 and 5 times higher, compared to the recommended limits for stunting and for underweight (IFPRI, 2014). The high malnutrition rates may be attributed to the growing negative perceptions towards traditional foods, resulting in changes in the food systems and dietary patterns (IFPRI, 2014; FAO, WFP and IFAD, 2014).

A shift to simplified and monotonous diets, from the diversified traditional diets has resulted in increased consumption of staple foods, and a decrease in the consumption of traditional foods including forest foods that are abundantly and locally available within the region (Keller *et al.,* 2006; Frison *et al.,* 2006; Pingali, 2007; Penafiel *et al.,* 2011). Negative perceptions towards forest foods have been documented among rural communities in South Africa (Dweba and Mearns, 2011) and in Togo (Akpavi *et al.,* 2008). The adoption of western lifestyle has also been reported to be associated with the reduction in indigenous knowledge on the use and preparation of several traditional African food dishes (Maundu, 1996; Akpavi *et al.,* 2008).

Nutrient composition studies of forest foods reveal that some forest food species of plants and animals origin have high contents of essential nutrients and bioactive compounds (Maundu, 1996; Akpavi *et al.,* 2008; Blaney *et al.,* 2009; Dweba and Mearns, 2011; Penafiel *et al.,* 2011; Powell *et al.,* 2013; Fungo *et al.,* 2015). A recent study in south and eastern Cameroon revealed that there is considerable potential for forest foods to contribute to intake of essential nutrients among consumers of these foods (Fungo *et al.,* 2016a). In Gabon, forest foods contribute 36% of total vitamin A and 20% of iron (Blaney *et al.,* 2009), while in Tanzania 31% of RAE (vitamin A) and 19% of iron can be accessed in forest diets (Powell *et al.,* 2013). Furthermore, traditional forest foods are usually referred to as "food for the poor" by the educated and a section of the elite urban residents in Africa, resulting in their neglect (Akpavi *et al.,* 2008; Dweba and Mearns, 2011; Fungo *et al.,* 2016b).

These findings are corroborated by case studies in DR Congo among the forest dependent communities of Kisangani (Termote *et al.,* 2012), the Guiziga tribe in Cameroon (Hamawa, 2013) and populations adjoining Lama Forest reserve in Benin (Boedecker *et al.*, 2014). Despite these communities having access to abundant nutrient rich traditional forest foods, under-nutrition and food insecurity is rampant among them. However, there is paucity of information on how perceptions towards the health and nutritional benefits from forest foods and socio-demographic factors affect consumption of the forest foods. This study therefore, explored

the relationship between knowledge, perceptions and socio-demographic attributes towards consumption of forest foods.

METHODOLOGY

Study area description. The study was conducted in two sites, including one from the East and the other from the South of Cameroon. The geographical coordinates for eastern site are 3.98 longitudinal and 13.18 latitude and southern site are 2.93 longitudinal and 11.16 latitude (Noutcheu *et al*., 2016). The Eastern site has a population of about 25,783 people consisting of three indigenous ethnic groups; the Kako, the Pol and the Baka pygmies, living in 41 villages (Medinof, 2004). In the southern site, the population is estimated at 79,353 consisting of almost one major ethnic group the Bulu, living in 29 villages (Enviro Consulting, 2009).

Selection of study districts, villages and households. Selection of study districts, villages and households was done using a three-stage cluster sampling technique composed of one stage of purposeful selection and two stages of randomisation. The first stage involved purposefully selecting districts from both sites on the basis of communities in the districts relying on the forests as a source of livelihoods and their accessibility. The second and third stages, involved randomly selecting villages that are easily accessible within the chosen two districts and households within the selected villages. As a result of a higher ethnic diversity in the Eastern site, the study was conducted in seven villages including Kouedjina (10 households), Kagnol III (17 households), Ndembo (10 households), Petit Pol (44 households, Melambo (23 households), Nkolbikon (16 households) and Bonando (34 household). In the south, with only one ethnic group, the study was conducted in five villages, including Ngon (21 households), Bissam (39 households), Ondondo (39 households), Methyikpwale (20

households) and Meyos (6 households). Two Research Assistants (RAs) who had grown up in the villages of the two study sites were recruited and trained for acquaintance with the interview schedules. The two RAs aided in interpreting the cultural norms and meanings of local comments expressed by respondents during the interview.

Household sample. A total of 276 households, in the two sites was calculated using Fisher's (Fisher, 1998) formula below:

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

Where:

n = required sample size, t = confidence level at 95% (standard value of 1.96) p = 9.9% estimated proportion of population depending on the forests with regard to the total population (Chao, 2012) and m = margin of error at 5% (standard error of 0.05).

To cater for drop-outs during the data collection process, the number of households per site was increased by 5%. 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. The inclusion and exclusion criterion of households in the present study, included (i) households that depended on the forests for food, (ii) households with members that were residents of the target areas, and (iii) households with respondents who were healthy at the time of recruitment.

Ethical approval and consent. Prior to contact with the study populations, the study proposal was presented to the Regional Forestry Office and the Regional Health Office in the two study regions. During the meetings, a written permission was sought to carry out the study. In addition to the clearance by the Regional Forestry and Health Offices, further

permission was sought from the political leaders at district and village levels to assist the study gain the cooperation of the household respondents. All standards on human and health care ethics outlined in the Helsinki Declaration (World Medical Association Declaration of Helsinki, 2001) were adhered to.

Data collection. Interviews took place at homes of the respondents during the months of May and June 2012, with spouses of households. Also, women who were household heads and had dependents were interviewed. Women were interviewed because they are vital in the decision making with respect to food preparation (Becquey *et al.,* 2009).

Data collected included household socio-demographics, knowledge of nutritious and healthful forest food species, uses, perceptions and knowledge of health benefits of forest foods. Prior to interviews, questionnaires were pre-tested and adapted to the local context of Cameroon.

The socio-demographic questions included age, sex, occupation and education level of the respondent and material used to construct household houses. The healthful and nutritionally important forest foods were identified and listed by the respondents. Respondents were also asked (i) if they knew that malnutrition can lead to ill health, and (ii) if they were aware that forest foods were nutritious and healthful.

Five questions were used to assess the level of perceptions of the respondents (Table 3), towards the importance of forest foods to their health. Respondents had an option of using a narrative scale that explored the respondents' agreement, disagreement or uncertainty. Practices related to use of forest foods (Table 4) were assessed using four questions, with three questions being open-ended, while one question on number of times of preparing forest foods having response options of 'none', 'once', '2-3 times' and 'more than 4

times'. Computation of knowledge, perception and practices for each question, was done as the proportion of respondents who gave an affirmative answer.

Data analysis. All data were analysed using the Statistical Package for the Social Sciences (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 independent factors (Table 5).

Multinomial regression analysis was performed based on previous studies (Kimiywe *et al.,* 2007; Dweba and Mearns, 2011), where two age groups of (i) <46 years which is considered to be within the reproductive age for women who are energetic but constrained with the burden of baring children, and (ii) >46 years, which is beyond the reproductive age who have time but with diminished energy reserves, to adequately cater for their families were created, for comparison purposes (Onarheim *et al.,* 2016).

The level of significance for inclusion of variables in the logistic regression models was set at P<0.05, in order to have findings comparable to similar previous studies (Chen *et al.,* 2003; Serra-Majem *et al.,* 2007; Bojorquez *et al.,* 2015). 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.

RESULTS

Respondent characteristics. Average age of 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 75% of the households, were natives of the study area, and therefore the knowledge and perception they possessed could be considered

TABLE 1. Household socio-demographic characteristics in Eastern and Southern Cameroon

Household characteristics	n	Respondents (%)[†]
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

TABLE 1. Contd.

Household characteristics	n	Respondents (%)[†]
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. [†] = Percentage of total number of household

local. Despite being forest-dependent communities about half (52%) of the households also practiced farming.

Nutrient rich forest foods. Fruits of *Baillonella toxisperma* (African pearwood) were listed by 98% female respondents, as the most important nutrient-rich forest foods (Table 2). These were followed by *Irvingia gabonesis* (Bush mango), *Elaeis guineensis* (palm oil), *Trichoscypha abut* (Mvout) and *Ricinodendron heudelotii* (Djansang). Among animal foods collected from forests, bush meat ('gibier') was the most consumed (11%), followed by *Imbrasia* spp. (edible caterpillars), (10%), *Achatinidae* spp. (snails) (6%) and *Termitoidae* spp. (termites) (3%).

Perceptions towards the health benefits. A considerable proportion of respondents (>50%) generally expressed positive perceptions towards some specific benefits accrued from consuming forest foods, with most (61%) expressing safety concerns and health disorders related to malnutrition (Table 3). The least (10%) expression of positive perception was registered in two sets of respondents. This included one set of respondents who agreed that bush meat was nutritionally important and the second set of respondents who believed vitamin A and iron content in forest foods is adequate to maintain a healthy lifestyle.

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

Scientific name	Number of female respondents	Respondents (%)
Baillonella toxisperma (African pearwood)	273	97.8
Irvingia gabonesis (Bush Mango)	226	81.0
Trichoscypha abut (Mvout)*	70	25.2
Elaeis guineensis (Palm oil)	54	19.3
Ricinodendron heudelotii (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)*	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)*	3	1.2
Dioscorea spp. (Wild yams)	3	1.2
Angylocalyx talbotii (Nkana)*	3	1.2
Afrostyrax lipidophyllus (Wild onion)	3	1.2

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

TABLE 3. Perceptions towards forest foods consumption in Eastern and Southern Cameroon

Perceptions aspects assessed*	Agree (%)	Disagree (%)	Uncertain (%)
Forest foods are nutritious and healthy	31.2	39.2	29.7
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

*: Assessed 279 female respondents

Consumption of forest foods. About 40% of the respondents consumed forest foods daily for their meals (Table 4). Among the respondents that consumed forest foods, 85% of households reported eating forest foods once to more than 4 times daily. Preparation of household meals was exclusively done by women (96%); and most respondents (77%) expressed that women were responsible for making decisions regarding choice of foods to be consumed for household meals.

About 69% of the respondents mentioned that they processed *B. toxisperma* into edible oil, which is a more valuable product for household consumption and income security. A minority of respondents mentioned processing other valuable forest foods, notably *I. gabonesis* (9%), *E. guineensis* 1 (7%), *R. heudelotii* (0.4%) and *P. macrophylla* (0.4%).

Factors affecting consumption of forest foods. Logistics regression analysis revealed that female 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). On the other hand, education had an inverse relationship with use of forest foods. Illiterate 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

TABLE 4. Practices of preparing forest foods and forest foods processed in Eastern and Southern Cameroon.

Practices and processed forest foods	Respondents (%)
Times forest foods are prepared per day (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
Ricinodendron heudelotii (Djangsang)	0.4
Pentaclethra macrophylla Benth (Ebaye)	0.4
None	14.3

TABLE 5. Logistic regression analysis on the socio demographic factors and perceptions associated with the consumption of forest foods in Eastern and Southern Cameroon

Consumption of forest foods*	Odds ratio	—— 95% CI ——		P value
Socio demographic characteristics				
Age				
<46 years	1 (reference)			
>46 years	1.37	0.6	3.13	0.04
Education				
University trained	1 (reference)			
No formal education	6.26	0.6	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	16.9	<0.001
>5years	7.64	1.92	30.44	<0.001
Attitudes/perceptions				
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
Have health boosting nutrients				
Uncertain	1 (reference)			
Agree	6.43	1.22	33.88	<0.001
Disagree	2.5	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	1.2	0.37	4.07	<0.001

TABLE 5. Contd.

Consumption of forest foods*	Odds ratio	—— 95% CI ——		P Value
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)	2.5	0.1	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

*Dependent variable (consumption of forest foods) tested against independent variables (household demographic factors, perceptions and attitudes) that were controlled as indicated in Table 4. CI= confidence interval

primary school or secondary school. 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) those that knew that poor nutrition can lead to health disorders related to inadequate intake of nutrients and death.

Polygamous households were more than 6 times (OR= 6.96 95% CI 0.13 to 37.24) likely to prepare forest foods, than families that were monogamous (Table 5). Results further indicated that consumption of forest foods increased with period of stay in an area. The multivariate analysis further revealed that respondents who expressed positive perception towards the health and nutrition benefits of consuming forest foods were more likely to prepare and consume forest foods. The highest registered likelihood of about 13 times (OR=12.74 95% CI 1.74 to 35.82), was registered among respondents who agreed that forest foods can substitute for vitamin and iron supplements (Table 5). Mothers 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.

DISCUSSION

Nutrient rich forest food species. Out of the 21 forest foods perceived by respondents as most healthful and nutritionally important, 16 were plant based; while 5 were wild animal sourced foods. Among the plant forest foods, the oil producing foods (9 species) were identified as the most important nutrient rich and healthful forest foods. Of the nine oil producing species, five were among the most

nutrient rich overall including; *Baillonella toxisperma* (African pearwood), *Irvinga gabonensis* (bush mango), *Trichoscypha abut* (Mvout), *Elaeis guineensis* (palm oil) and *Ricinodendron heudelotii* (African wood-oil nut).

The high demand for oil producing fruits can be attributed to their high market value in Cameroon and neighbouring countries, such as Nigeria and Gabon (Awono *et al.*, 2009). In these countries the kernels are processed using traditional methods, to produce edible oil that is used in household food preparation, while the surplus is sold for income security (Levang *et al.*, 2014). The identified oil producing forest foods in the present study are also consumed as fruits. For example, the fruits of *I. gabonesis* are popular among children because of their attractive sweet yellow pulp, as result of their high β-carotene nutrient content (Ejiofor *et al.*, 1987; Fungo *et al.*, 2015). The multipurpose use of oil producing forest plant foods in Cameroon can be an important reason for their conservation.

Among animal forest foods, bush meat, *Imbrasia* spp. (Caterpillars) and *Achatinidae* spp. (edible snails) were the most consumed (Table 2). Bush meat provides considerable amounts of proteins and essential micronutrients to vulnerable communities residing in and adjacent to forests in (Keegan, 1986; Kopper *et al.*, 1993). Conservation studies in Cameroon reveal that non-respect of the wildlife legislation to protect wild life, has resulted in unsustainable hunting of wild animals for food (Cerutti and Tacconi, 2006; Nasi *et al.*, 2011; Fungo, 2016). The major identified forest foods in Cameroon in the present study, are similar to studies reported in Cameroon and other Congo Basin countries (for example, Tacconi *et al.*, 2003; Nasi *et al.*, 2011; Termote *et al.*, 2012; Hamawa, 2013; Boedecker *et al.*, 2014).

Perceptions towards the health benefits of forest foods. From our results, about a half to about two thirds of the forest dependent communities, displayed positive perceptions towards the importance of consuming forest foods in order to maintain a good eye sight and the overall health (Table 3). Consumption of forest foods is positively related to the recognition of these foods by communities, as healthy diets (Table 3). Forest foods were consumed because they had health boosting nutrients, good for eye sight and could substitute for vitamin A and iron supplements.

The relatively higher rates of positive perceptions towards the health benefits of forest foods in the present study may be attributed to the respondents being in possession of health and nutrition information. In Cameroon, health and nutrition information messages are disseminated to rural mothers and guardians at health centres during the prenatal and post-natal visitations and vitamin and mineral supplementation days (CDHS, 2011). Some of the respondents possessed negative perceptions towards specific health and nutrition benefits when forest foods were consumed. For example, only 10% of the respondents in the present study displayed positive perceptions towards bush meat as having essential nutrients to permit growth among children (Table 3). This can be attributed to some rural communities in Cameroon, lacking detailed specific knowledge concepts about the health and nutritional benefits of forest foods. There is need to invest in advocacy village level community nutrition education programmes aimed at imparting positive perceptions of forest populations by improving their knowledge base with respect to the health and nutrition benefits of forest foods.

Factors that affect consumption of forest foods. The 40% fraction of the female respondents that used forest foods for household meals in the present study (Table 4) was higher than what has been documented in previous findings. For example, in DR Congo about 30% residents of Kisangani and Turumbu areas prepared household meals with

forest foods (Termote *et al.,* 2012). The present study using the logistic regression analysis, positively associated the practice of consuming forest foods with respondents aged 46 and above, lowly educated respondents, polygamous households, women making decisions on which food to prepare and those who had longer stays in the study area.

Education level of respondents was inversely related to consumption of forest foods in the present study (Table 5). The present study concurs with previous studies which revealed that educated Kenyans, South Africans and Ugandans who earn more than the less educated, viewed traditional and indigenous foods as food for the poor; hence having less preference to consume traditional and indigenous African foods as compared to the western processed foods (Tabuti *et al.,* 2004; Kimiywe *et al.,* 2007; Dweba and Mearns, 2011). In comparison with the consumption levels, of the uneducated in Kenya, South Africa and Uganda, educated populations have been found to consume less of wild and indigenous fruits and vegetables (Oniang'o *et al.,* 2003; Pelto *et al.,* 2004; Tabuti *et al.,* 2004). The educated Kenyans, South Africans and Ugandans are exposed to influences of urbanisation and western lifestyles, which lead to adopting negative perceptions towards local and indigenous African foods (Haddad, 2003; Pingali, 2007). This has resulted in the African elites moving away from the more diverse traditional and indigenous diets with strong cultural identity, to monotonously processed imported and sometimes unhealthy diets.

An increase in the age of the respondents positively influenced the preparation of forest foods (Table 5). The older the household head the better the levels of perceptions towards nutrition and health benefits of forest foods. The elderly have a lifetime experiences that have shaped their individual values, habits and preferences, motivated by convenience, sensory appeal and perceived importance of traditional foods to health. These findings relating age with consumption of forest foods are similar to findings elsewhere (Pelto *et al.,* 2004; Dweba and Mearns, 2011).

Consumption of forest foods in the present study was considerably higher when mothers prepared household meals, than their daughters (Table 5). Collection and preparation of wild and indigenous forest foods from the natural environment, is an activity that is mostly done by spouses of households. Children, especially daughters in rural settings, learn from their mothers which traditional and indigenous foods are nutritionally superior and appropriate to prepare. As opposed to rural women who focus on gathering forest foods to feed their households, household heads in urban areas in Cameroon and elsewhere in Africa engage more in activities that generate higher income used to buy more of the imported refined food than forest foods (Parsons, 1993; Rensberg *et al.,* 2004; Hart and Vorster, 2006; Hamawa, 2013; Levang *et al.,* 2014).

A significant positive association was found between respondents' who expressed positive perceptions towards health and nutrition benefits of forest foods, with consumption and preparation of forest foods (Table 5). Specifically, the logistic regressive odds in Table 5 reveal that consumption of forest foods, was more than 9, 4, 6 and 3 times, more likely to occur, among respondents who agreed with statements; "consumption of bush meat can make a child taller", "forest foods are nutritious", "good nutrition can lead to less ill health" and "forest foods contain nutrients which are important for eye sight". These findings are in line with other literature, which showed that having a positive perception towards health and nutrition benefits of indigenous and traditional foods, was a driving force for a person to improve his/her healthful and nutrition knowledge, practices and behaviours (Chen *et al.,* 2003).

A positive perception is the driving force of a correct practice and use of certain concepts (Sharma *et al.,* 2008). Thus, positive perceptions appear to be important factors that

drive correct nutrition practices. In this sense, targeted community or village nutrition education programmes aimed to improve perceptions of rural forest dependent communities need to be emphasized to policy makers, health and forestry community workers and development practitioners.

CONCLUSION

A number of factors, including; age, education and marital status, perceptions towards nutritional and health benefits of forest foods influenced the consumption of forest foods.

Initiatives aimed at promoting consumption of forest foods should, as a basic necessity, aim equipping communities with information regarding the nutrition and health benefits of consuming forest foods. The success of such initiatives would most likely be influenced by a number of sociodemographic factors such as education, sex, age and marriage status. These factors should be taken into consideration when planning forest foods promotion interventions. Nutrition education materials on the health benefits of forest foods need to be developed and disseminated to the forest-dwelling population. In addition, studies relating nutrition status outcomes and links to forest food intake need to be scaled up to inform future interventions. Fundamentally, it is vital to adopt strategic policies and legislation that are sensitive to the nutritional health benefits of forest foods in order to conserve the bio-diversity, nutrition and development benefits that comes along with their eco-system.

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