

Wild and Semi-Wild Food Plants of Bunyoro-Kitara Kingdom of Uganda: Growth Forms, Collection Niches, Parts Consumed, Consumption Patterns, Main Gatherers and Consumers

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Abstract: Numerous publications provide detailed knowledge of Wild and Semi-Wild Food Plants (WSWFPs) in specific locations in Africa. These studies reveal that WSWFPs are essential components of many Africans diets especially in periods of seasonal food shortage. In this study, researchers present the commonly consumed WSWFPs in Bunyoro-Kitara kingdom of Uganda; their growth forms, collection niches, parts mainly consumed, consumption patterns, main gatherers and the main consumers. A total 385 respondents sampled according to Krejcie and Morgan from two sub-countries (Mutunda and Kiryandongo) of Kibanda country in Bunyoro-Kitara Kingdom were administered with semi-structured questionnaires. Focus Group Discussions (FGDs) were also held to validate questionnaire responses and to characterise the commonly consumed WSWFPs in terms of their growth forms and life cycles. Excel spreadsheet and MINITAB statistical software were used to analyze the questionnaire responses. The outputs of FGDs were subjected to thorough content analysis. A total of 62 WSWFPs were reported as being consumed. The most frequently mentioned were *Amaranthus dubius* Mart. ex Thell (73.8%), *Amaranthus spinosus* L (71.4%), *Tamarindus indica* L (69.1%), *Hibiscus sabdariffa* L (51.9%) and *Vitex doniana* Sweet (50.1%). But in terms of botanical family, members of Solanaceae (9.7%) and Fabaceae (9.7%) families were the most commonly consumed followed by Amaranthaceae (8.1%), Malvaceae (8.1%) and Asteraceae (6.5%) families, respectively. Out of the 62 documented WSWFPs, herbs (51.6%) and shrubs (24.2%) constituted the highest the numbers. Trees, vines/climbers and graminoid were few. Fresh leaves and shoots (97.1%) and fruits (74.3%) were predominantly consumed plant parts in the study area. Most WSWFPs were largely consumed as the main sauce and side dishes after cooking, raw as snacks and as condiments (spices or appetizers). Their consumption as wine and porridge component, beverages, raw in salads, potash salts in other foods and as relishes were infrequent. Women (85.7%) and children (75.1%) were the main gatherers. Few men (10.4%) engaged in gathering activities. Majority (75.8%) of the respondents reported that the gathered plants are consumed nearly by entire household members. About 21% said women are the major consumers. Collection niches varied greatly from forests (forest gaps and margins) (77.8%), bushlands (woodlands) (65.7%), cultivated farmlands (63.2%) and grasslands (59.8%). Other niches included homegardens (homesteads), swampy areas (wetlands), abandoned homesteads and farmlands, wastelands, farm borders, roadsides (footpaths) and areas around animal enclosures/cattle corridors. There is a need for more research on the possibility of adapting, growing and intentionally managing the WSWFPs on farms since large proportion of them are still gathered from out-of-farm niches.

Key words: Edible plants, wild foods, semi-cultivated food plants, food insecurity, Bunyoro, Uganda

INTRODUCTION

There has been renewed interest towards consumption of Wild and Semi-Wild Food Plants

(WSWFPs) (Delang, 2006; Johns and Eyzaguirre, 2006). Despite agricultural societies primary reliance on conventional crop plants, the tradition of eating WSWFPs has not completely disappeared, their nutritional roles

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and health benefits are being reported in many surveys worldwide (Balemie and Kebebew, 2006; Lockett *et al.*, 2000). The important contribution that these plants can make to poverty reduction through enhancing household food security and incomes has been recognised (Garrity, 2004; Russell and Franzel, 2004).

Wild gathered food plants have been part of human diet since time immemorial and it is argued that past societies made more use of the wild flora to overcome hunger than is done today (King, 1994; Diamond, 2002; Leonti *et al.*, 2006).

Although, currently eradicating extreme poverty and hunger (objective one of the millennium development goal) is the main focus of many international development agenda where wild food resources could help even in biodiversity-rich countries wild food resources still get little attention. Lack of clear examination of the links between poverty and the use of the wild food resources means that policy recommendations are rarely based on hard evidence (Bird and Dickson, 2005).

Numerous publications provide detailed knowledge of edible wild plants in specific locations in Africa (Campbell, 1986; Food Agriculture Organization, 2004; Tabuti *et al.*, 2004; Balemie and Kebebew, 2006; Tabuti, 2007). These studies reveal that wild plants are essential components of many Africans diets especially in periods of seasonal food shortage. A study conducted in Zimbabwe revealed that some poor households rely on wild fruits as an alternative to cultivated food for a quarter of all dry season's meals (Wilson, 1990). Similarly in Northern Nigeria, leafy vegetables and other bush foods are collected as daily supplements to relishes and soups (Loghurst, 1986). In Swaziland, wild plants are still of great importance and contribute a greater share to the annual diet than domesticated crops (Ogle and Grivetti, 1985).

Still many more wild species are believed to be edible and undocumented yet. The contribution that these wild food plants make to many poor peoples livelihoods (Bukonya-Ziraba, 1996; Poulton and Poole, 2001) is however, often not acknowledged in many national statistical reporting. This is a reflection of the general lack of official and scientific interest in these wild resources by policy makers (Leakey and Newton, 1994; Tchegang-Meguani *et al.*, 2001). Where such national level information is available, it is restricted mainly to a narrow range of exotic food plants such as mango, avocado and citrus that have sufficiently large and often international markets. This study makes the case that in addition to the conventional food plants, more attention should be paid to WSWFPs.

The information presented here about their growth forms, collection niches, parts consumed, consumption patterns, main gatherers and consumers in the Bunyoro-

Kitara kingdom of Uganda will therefore, be a major milestone for an authoritative look at these neglected categories of food plants which can contribute to poverty alleviation, food security, agricultural diversification and income generation. It is hoped that these information will increase the understanding of their importance in rural household livelihoods.

MATERIALS AND METHODS

Data collection: The study was conducted in Mutunda and Kiryandongo sub-countries of Kibanda country in Bunyoro-Kitara kingdom. Data were collected using a combination of methods namely: semi-structured questionnaires, focus group discussions and key informant interviews. A total of 385 households from the two sub-countries (Kiryandongo and Mutunda) were chosen for household survey following the method described by Krejcie and Morgan (1970). About 55 households each from the 3 parishes (Kakwokwo, Diima and Nyamahasa) of Mutunda sub-country and from 4 parishes (Kitwara, Kyankende, Kichwabugingo and Kikube) of Kiryandongo sub-county were then randomly selected. According to Krejcie and Morgan (1970) if one wished to know a representative sample size of a population of 9,000 people then one looks in to the table at level $N = 9,000$. The sample size in this example is 368. The table which is applicable to any population of a defined (finite) size is based on a Eq:

$$\text{Sample size} = \frac{X^2 NP(1-P)}{C^2(N-1) + X^2 P(1-P)}$$

Where:

X^2 = A constant value of 3.841 (the square of the Z value of 1.96 for 95% confidence level)

N = Represents the population size

P = The population parameter of 0.5

C = A 95% confidence interval (0.05) a probability that the samples represent the population

Using this method, 364 households were chosen for household survey because the documents gathered from sub-counties and county headquarter indicated that Kiryandongo and Mutunda had a total household number of 6788. However, 21 extra households were added to make a total of 385 samples for household survey. Krejcie and Morgan (1970) state that using this calculation as the population increases the sample size increases at a diminishing rate (plateau) and remains eventually constant at slightly >380 cases. There is little to be gained to warrant the expense and energy to sample beyond about 380 cases. Alfred and Settle (1995) provide

similar evidence. The selected households were administered with semi-structured questionnaire. Respondents were asked to name the wild food plants they gather, the parts consumed, the habitat in which the wild food plants are gathered, main gatherers, main consumers and the consumption patterns.

Focus Group Discussions (FGDs) were held to characterize the commonly consumed WSWFPs in terms of growth form (trees, shrubs, herbs, climbers, graminoids) and life cycle. Key informants were selected among the study community to corroborate household survey data.

Data analysis: Household questionnaire responses were analysed descriptively and inferentially using excel spread sheets and MINITAB statistical package. Mean frequency of citation of the consumption patterns, main consumers, main gatherers, plant parts consumed and the collection niches were computed. A two-tailed test was used to compare the knowledge of WSWFPs between male and female respondents. A box plot was also used to show the variation in number of WSWFPs reported by men and women.

Linear regression analysis was employed to show the relationship between the ages of the respondents and local knowledge of WSWFPs. Key informant interviews were condensed in form of quotes (Binnendijk, 1996). In-depth content analysis were conducted on the data gathered from FGDs.

RESULTS

Commonly consumed WSWFPs in the kingdom: About 62 WSWFPs belonging to 31 botanical families were reported as being consumed (Table 1). The most frequently mentioned were *Amaranthus dubius* (73.8%), *Amaranthus spinosus* (71.4%), *Tamarindus indica* (69.1%), *Hibiscus sabdariffa* (51.9%), *Vitex doniana* (50.1%), *Solanum nigrum* (49.1%), *Crotalaria ochroleuca* (47.8%), *Cleome gynandra* (45.2%), *Hibiscus acetosella* (44.7%), *Senna obtusifolia* (43.9%), *Aframomum angustifolium* (43.6%), *Vernonia amygdalina* (40.3%) and *Asystasia gangetica* (39.2%). In terms of botanical families, members of Solanaceae family (9.7%), Fabaceae (9.7%), Amaranthaceae (8.1%), Malvaceae (8.1%), Asteraceae (6.5%) and Brassicaceae (4.8%) were the most commonly consumed (Fig. 1).

Table 1: Commonly consumed WSWFPs, parts consumed and consumption pattern in the study area

WSWFPs	Botanical family	Local names	FPM (%)	Parts consumed	Consumption pattern
<i>Amaranthus dubius</i> Mart. ex Thell.	Amaranthaceae	Doodo	73.8	YLS	As main sauce or side-dish after cooking (boiled, stewed, fried or pasted with groundnut/sesame) as potash salt in other foods
<i>Amaranthus spinosus</i> L.	Amaranthaceae	Doodo y'amahwa	71.4	YLS	As main sauce or side-dish after cooking (boiled, stewed, fried or pasted with groundnut/sesame) as potash salt in other foods
<i>Tamarindus indica</i> L.	Fabaceae	Mukoge	69.1	RF, URF	Raw as a snack as refreshing juices, local wine, porridge and bread component
<i>Hibiscus sabdariffa</i> L.	Malvaceae	Bamya, Ekikenke	51.9	YLS, SD	Leaves as main sauce or side-dish after cooking (boiled and pasted with groundnut/sesame), leaves added to boiling beans as condiments to make the sauce thicker, seeds as condiments, paste and relishes
<i>Vitex doniana</i> Sweet	Verbenaceae	Muhornozi, Owelo	50.1	RF	Raw as snacks
<i>Solanum nigrum</i> L.	Solanaceae	Enswiga	49.1	YLS, RF	Leaves and shoots as main sauce or side dish after cooking (boiled, fried or steamed). Ripe fruits raw as a snack
<i>Crotalaria ochroleuca</i> G.Don	Fabaceae	Kumuro, Alaju	47.8	YL, F	As main sauce or side-dish after cooking (boiled, stewed, or pasted with groundnut/sesame)
<i>Cleome gynandra</i> L.	Brassicaceae	Eyobyoy	45.2	YLS, F, TS, LS, B	As main sauce or side-dish after cooking (boiled and pasted with groundnut/sesame or fried mixed with <i>amaranthus</i> sp). Crushed dried leaves use as a relish with porridge
<i>Hibiscus acetosella</i> Welw. ex Hiem	Malvaceae	Makawang kulo, Gwarya	44.7	YLS, SD	Leaves as main sauce or side-dish after cooking (boiled and pasted with groundnut/sesame, stew), leaves added to boiling beans as condiments to make the sauce thicker, seeds as condiments
<i>Senna obtusifolia</i> (L.) Irwin and Barmeby	Fabaceae	Oyado, Luge	43.9	YL	As main sauce or side-dish after cooking (boiled and pasted with groundnut/sesame)

Table 1: Continue

WSWFPs	Botanical family	Local names	FPM (%)	Parts consumed	Consumption pattern
<i>Aframomum angustifolium</i> K.Schum.	Zingiberaceae	Amatehe, Kongo amor	43.6	RF	Raw as a snack as juice (Sonnerat) wine and porridge component as condiments/spices for local breads
<i>Vernonia amygdalina</i> Del.	Asteraceae	Kibirizi	40.3	YLS	As side dish after cooking (boiled and pasted with groundnut/sesame). Boiled leaves as medicinal beverages
<i>Asystasia gangetica</i> (L.) T.Anders.	Acanthaceae	Temba, Odipa ikong	39.2	YLS, TS	As main sauce or side-dish after cooking (boiled and pasted with groundnut/ sesame)
<i>Capsicum frutescens</i> L.	Solanaceae	Kamulari, Alyera	38.4	RF, URF, YL	Fruits as spices/condiments/appetizers, leaves as main sauce or side-dish after cooking (fried or boiled and pasted)
<i>Asystasia mysorensis</i> (Roth) T.Anders	Acanthaceae	Nyante, Acwewanggweno	37.1	RF, URF, YL	As main sauce or side-dish after cooking (boiled and pasted with groundnut/sesame)
<i>Acalypha bipartita</i> Mull. Arg.	Euphorbiaceae	Egoza, Ayuu	36.6	YLS	As main sauce or side-dish after cooking (boiled and pasted with groundnut/sesame)
<i>Corchorus tridens</i> L.	Malvaceae	Eteke	36.6	YL	As stew in other foods as condiments.
<i>Bidens pilosa</i> L.	Asteraceae	Obukurra	35.1	YLS, F	As main sauce or side-dish after cooking (boiled and pasted with groundnut/sesame, stewed or fried) as a refreshing beverage
<i>Vigna unguiculata</i> (L.) Walp.	Fabaceae	Mugobiswa	35.1	YLS	As main sauce or side-dish after cooking (boiled and pasted with groundnut/sesame)
<i>Physalis peruviana</i> L.	Solanaceae	Ntuutu	34.8	RF	Raw as a snack and as part of salad. As juice and porridge component
<i>Sonchus oleraceus</i> L.	Asteraceae	Kizinyamicho, Apuruku	34.3	YL	As main sauce or side-dish after cooking (boiled and pasted with groundnut/sesame)
<i>Corchorus trilocularis</i> L.	Malvaceae	Otigo lum	34.0	YL	As stew in other foods as condiments.
<i>Basella alba</i> L.	Basellaceae	Enderema	33.8	YL	As main sauce or side-dish after cooking (boiled, stewed or fried), added to other cooking food as condiments
<i>Aframomum albioleaceum</i> (Ridley) K.Schum	Zingiberaceae	Amasaasi, Ocao	31.4	RF	Raw as a snack as juice, wine and porridge component as condiments/spices for local breads
<i>Cleome hirta</i> (Klotzsch) Oliv.	Brassicaceae	Akayoby o akasajja	31.2	YLS, F, TS, LS, B	As main sauce or side-dish after cooking (boiled and pasted with groundnut/sesame or fried mixed with <i>Amaranthus</i> sp.) Crushed dried leaves use as a relish with porridge
<i>Borassus aethiopicum</i> Mart.	Arecaceae	Ekituugu, Tugo	30.6	RF	As a snack, juice/beverage, wine and porridge component
<i>Ficus sur</i> Forssk.	Moraceae	Kabalira, Oduru	28.3	RF	Raw as a snack
<i>Canarium schweinfurthii</i> Engl.	Burseraceae	Empafu	24.7	RF, SD	Raw as snacks or after parboiling with salted water
<i>Oxygonum sinuatum</i> (Hochst. and Steud. ex Meisn.) Dammer	Polygonaceae	Kacumita bagege, Cuguru	21.8	YLS	As main sauce or side-dish after cooking (boiled and pasted with groundnut/sesame or fried)
<i>Dioscorea minutiflora</i> Engl.	Dioscoreaceae	Kaama/Ekihama	20.5	T	As part of the main meal/sauce after boiling
<i>Amaranthus graecizans</i> L.	Amaranthaceae	Nyabutongo, Ocoboro	20.3	YLS	As main sauce or side-dish after cooking (boiled and pasted with groundnut/sesame, steamed or fried) as potash salt in other foods
<i>Sida alba</i> L.	Malvaceae	Orucuhy	18.7	YL	As main sauce or side-dish after cooking (boiled, stewed or fried)
<i>Amaranthus hybridus</i> subsp. <i>Cruentus</i> (L.) Thell.	Amaranthaceae	Omujuiga	18.4	YLS	As main sauce or side-dish after cooking (boiled and pasted with groundnut/sesame, steamed or fried).
<i>Solanum lycopersicum</i> L.	Solanaceae	Bunyanya bunyoro	16.6	RF, URF	Raw as salad as main sauce or side-dish after cooking (boiled and pasted with groundnut/sesame or fried) as condiments
<i>Annona senegalensis</i> Pers.	Annonaceae	Mubengeya, Obwolo	16.4	RF	Raw as a snack
<i>Amaranthus lividus</i> L.	Amaranthaceae	Bwora, Mboog'emene	16.1	YLS	As main sauce or side-dish after cooking (boiled and pasted with groundnut/ sesame, steamed or fried)

Table 1: Continue

WSWFPs	Botanical family	Local names	FPM (%)	Parts consumed	Consumption pattern
<i>Carissa edulis</i> (Forssk.) Vahl	Apocynaceae	Omuyonza, Acuga	16.1	RF	Raw as a snack or as juices/beverage and wine
<i>Ocimum gratissimum</i> L.	Lamiaceae	Mujaja	15.6	YL	As condiments/spices and refreshing tea-like beverages
<i>Garcinia buchananii</i> Bak.	Clusiaceae	Museka	15.1	RF, SD	Fruits raw as snack, baked seeds eaten as snacks
<i>Phaseolus lunatus</i> L.	Fabaceae	Amajalero, Okuku	14.3	SD, YL, F	As main sauce or side-dish after cooking (boiled and pasted with groundnut/sesame, stewed or fried)
<i>Ximenia americana</i> L.	Olacaceae	Enseka, Olimo	13.8	RF	Raws as snacks
<i>Mondia whitei</i> (Hook.f.) Skeels	Apocynaceae	Omuronowa	13.5	R	Chewed raw as a snack as condiments/spices and wine
<i>Solanum anguivi</i> Lam.	Solanaceae	Obuhuruhuru, Katukuma	13.0	URF	As main sauce or side-dish after cooking (boiled, stewed, fried or pasted with groundnut/sesame)
<i>Solanum macrocarpon</i> L.	Solanaceae	Bugorra	11.9	YL, URF	As main sauce or side-dish after cooking (boiled, stewed, fried or pasted with groundnut/sesame)
<i>Hyptis spicigera</i> Lam.	Lamiaceae	Amola, Lamola	11.7	SD, YL, F	Seeds as condiments/paste for sauces and relishes. Leaves and flowers as main sauce or side-dish after cooking (boiled and pasted with groundnut/sesame)
<i>Ipomoea eriocarpa</i> R.Br.	Convolvulaceae	Acatolao, Podowia kuri	11.4	YLS	As main sauce or side-dish after cooking (boiled and pasted with groundnut/sesame)
<i>Ampelocissus africana</i> (Lour.) Merr.	Vitaceae	Anunu, Olok	10.4	RF, YL	Ripe fruit(s) raw as snacks, leaves as main sauce or side-dish after cooking (boiled and pasted with groundnut/sesame)
<i>Rhus pyroides</i> var. <i>pyroides</i> Burch.	Anacardiaceae	Obukanjankanja, Awaca	9.4	RF, URF	Raw as snacks and as porridge component
<i>Sesamum calycinum</i> Welw.	Pedaliaceae	Amacande ga kanyamunya	9.4	YL	Leaves as main sauce or side-dish after cooking (boiled, stewed or pasted with groundnut/sesame), leaves condiments in other foods
<i>Oxalis corniculata</i> L.	Oxalidaceae	Kanyunywa mbuzi	8.8	YL	Chewed raw as snacks
<i>Erucastrum arabicum</i> Fisch. and C.A. Mey	Brassicaceae	Oburobwenaku	8.6	YL	Leaves as main sauce or side-dish after cooking (boiled or fried)
<i>Phoenix reclinata</i> Jacq. as snacks.	Arecaceae	Omukindo	8.3	RF, SD	Fruits raw as snack, boiled seed kernels
<i>Oxalis latifolia</i> Kunth	Oxalidaceae	Kanyeebwa	8.1	YL	Chewed raw as snacks
<i>Crassocephalum crepidioides</i> (Benth.) S. Moore	Asteraceae	Ekinami	7.8	YL	Main sauce after cooking in mixture (stew) of other foods
<i>Cymbopogon citratus</i> (DC.) Stapf	Poaceae	Lemon grass	7.0	AP	As condiments/spices/flavouring or tea-like beverages
<i>Tristemma mauritianum</i> J.F. Grmel.	Melastomataceae	Oburo bw'enkombe	6.8	S, RF	Raw as a snack
<i>Abrus precatorius</i> L.	Fabaceae	Akarunga	6.0	YL	Leaves are chewed raw as a snack.
<i>Vangueria apiculata</i> K. Schum.	Rubiaceae	Matungunda	5.5	RF	Raw as a snack
<i>Rubus pinnatus</i> Willd.	Rosaceae	Amakerre	3.4	RF	Raw as a snack and as salad components
<i>Urtica massaica</i> Mildbr.	Urticaceae	Orugenyi, Ekicuraganyi	2.9	YL	As main sauce or side-dish after cooking (boiled and pasted with groundnut/sesame or fried)
<i>Lantana camara</i> L.	Verbenaceae	Jerenga, Abelwinyo	1.6	RF	Raw as a snack
<i>Imperata cylindrica</i> (L.) Raeuschel	Poaceae	Rusojo	1.3	RZ, S, F	Rhizomes chewed raw as a snack to satiate thirst, inflorescence and young shoots cooked and eaten (boiled and pasted)

FPM = Frequency of Plant Mention; YLS = Young (tender) Leaves and Shoots; YL = Young (tender) Leaves Only; S = Shoots only; SD = Seeds; F = Flowers/inflorescence; RF = Ripe Fruits; URF = Unripe Fruit; RZ = Rhizomes; AP = Aerial Parts; TS = Tender Stems; LS = Leaves Stalks; B = Buds; T = Tubers; R = Roots

Main parts of WSWFPs consumed and consumption patterns: Main parts of WSWFPs commonly consumed in Bunyoro-Kitara kingdom are shown in Fig. 2. Most people predominantly consumed fresh leaves and shoots (97.1±1.2%) followed by the fruits (74.3±1.1%). Other

important plant parts that were reported by respondents as being eaten included leaves with leaf stalks (31.1±4.4%), roots/tubers or rhizomes (25.5±2.1%) and leaves with a few stems (19.3±3.4%). Seeds, leaves with flowers and the whole aerial plant parts though reported

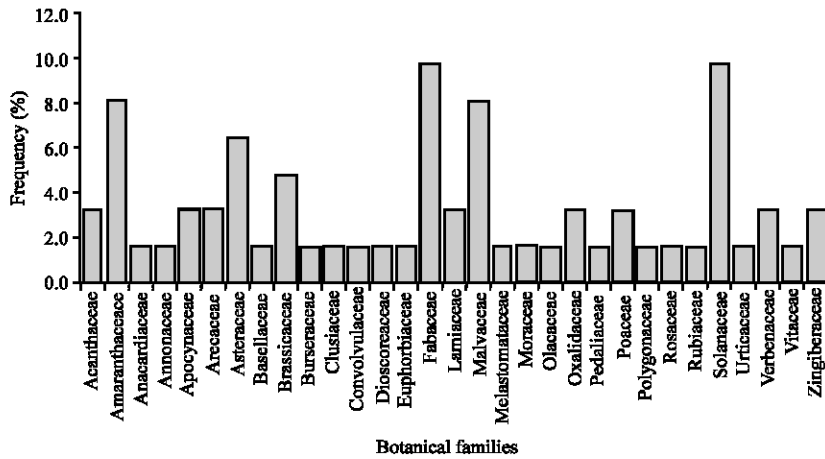


Fig. 1: Botanical families of the 62 WSWFPs reported

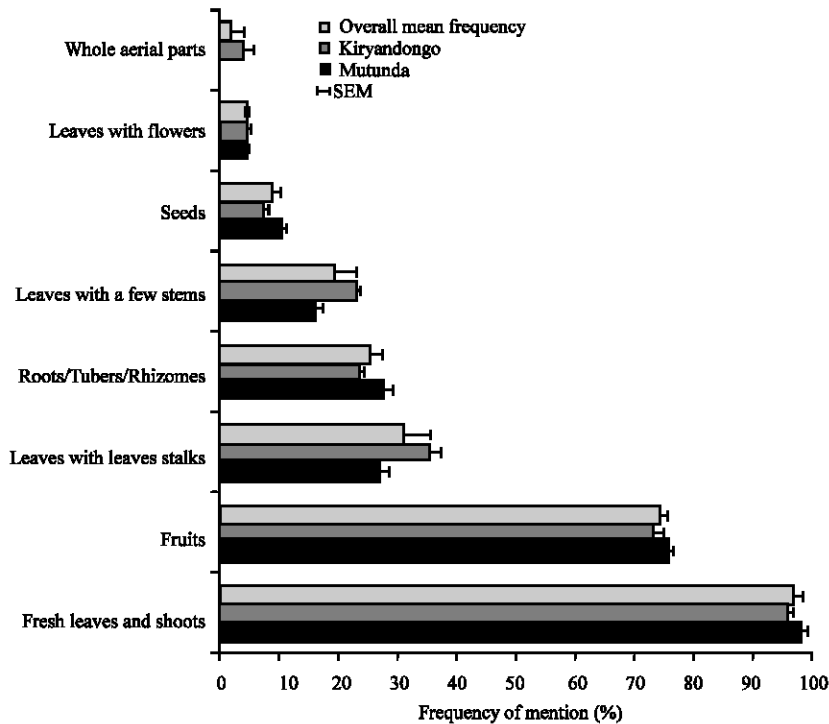


Fig. 2: Parts of WSWFPs commonly consumed in Bunyoro-Kitara kingdom

Table 2: Frequency of citation of WSWFPs consumption patterns in the kingdom

Consumption patterns	Frequency of mention (%)		
	Mutunda (±SEM)	Kiryandongo (±SEM)	Mean (±SEM)
As main sauce after cooking	89.2 (6.3)	83.6 (3.4)	86.4 (2.8)
Raw as snacks	83.0 (4.8)	75.2 (2.9)	79.1 (3.9)
As side dish after cooking	58.2 (4.2)	68.4 (3.5)	63.3 (3.9)
As condiments/spices/appetizers	51.9 (2.5)	42.1 (5.4)	47.0 (4.9)
Wine and porridge component	32.6 (1.8)	12.8 (3.5)	22.7 (9.9)
As juice/beverages	25.7 (2.3)	16.1 (1.9)	20.9 (4.8)
Raw in salads	4.2 (3.7)	10.8 (2.1)	7.5 (3.3)
As potash salt in other foods	6.0 (1.5)	5.6 (2.1)	5.8 (0.2)
As relishes	4.0 (2.0)	0.0	2.0 (2.0)

eaten were not consumed much. WSWFPs were largely consumed as the main sauce after cooking (86.4±2.8%), raw as snacks (79.1±3.9%) and as side dishes after cooking (63.3±3.9%). Other people however, reportedly consumed them as condiments/spices or appetisers, wine and porridge component, juice/beverages, raw in salads, potash salt in other foods and as relishes (Table 2).

Main consumers and gatherers of WSWFPs: The majority (77.0±1.2%) reported that WSWFPs are consumed by all household members (Table 3). Other respondents who differed from those who said that

Table 3: Frequency of mention of the main consumers and gatherers of WSWFPs in the kingdom

Variables	Frequency of mention (%)		
	Mutunda (±SEM)	Kiryandongo (±SEM)	Overallmean (±SEM)
Main consumers			
All household members	78.2 (2.8)	75.8 (2.5)	77.0 (1.2)
Women	23.8 (2.0)	21.6 (2.7)	22.7 (1.1)
Elderly people (old aged)	16.0 (2.0)	14.8 (1.3)	15.4 (0.6)
Children	12.5 (1.7)	14.8 (2.2)	13.7 (1.2)
Men	7.0 (1.8)	6.2 (2.1)	6.6 (0.4)
Main gatherers			
Women	88.4 (4.9)	83.0 (3.8)	85.7 (2.7)
Children	73.5 (4.1)	76.7 (2.4)	75.1 (1.6)
Any household member	14.9 (2.7)	10.1 (2.3)	12.5 (2.4)
Men	12.5 (2.5)	8.3 (2.5)	10.4 (2.1)

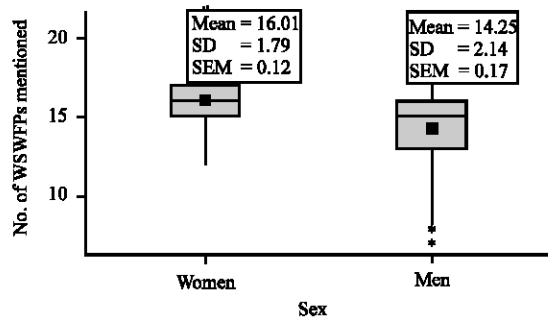


Fig. 3: Box plots showing the variation in number of WSWFPs mentioned by men and women. Means are indicated by solid squares in the respective boxes

WSWFPs are consumed by the entire household, indicated that women (22.7±1.1%), elderly people (old aged) (15.4±0.6%) and children (13.7±1.2%) were the main consumers as opposed to men (6.6±0.4%). Women (85.7±2.7%) and children (75.1±1.6%) constituted the main gatherers (Table 3).

Relationship between sex, age and knowledge of WSWFPs: A two-tailed test comparison of the knowledge of WSWFPs between men and women's respondents showed a significant variation (T = 8.15, p<0.001). This variation was also apparent from Fig. 3 which shows that the mean number of WSWFPs mentioned by women (16±1.79) was relatively higher than those mentioned by men (14±2.14). Linear regression of the respondents ages with knowledge of WSWFPs (number known per person) was found to be significant (T = 17.04, p<0.001, R² = 0.431) (Table 4). The variation was more apparent when the ages of women (T = 19.39, p<0.001, R² = 0.626) and men (T = 10.63, p<0.001, R² = 0.42) were regressed separately with knowledge of WSWFPs (Fig. 4). Besides there was a high positive correlation

Table 4: Simple linear regressions of the knowledge of WSWFPs with the age of respondents

Predictor	Coef	SD	T	p-value
Combined ages				
Constant	10.4659	0.2977	35.16	0.001
Combined ages (x)	0.137449	0.008066	17.04	0.001
	S = 1.585	R ² = 43.1%	R ² (adj) = 43.0%	
Predictor				
Constant	9.5574	0.4748	20.13	0.001
Age of men (m)	0.13482	0.01268	10.63	0.001
	S = 1.616	R ² = 42.0%	R ² (adj) = 41.7%	
Women only				
Constant	10.8717	0.2745	39.60	0.001
Age of women (w)	0.145774	0.007517	19.39	0.001
	S = 1.122	R ² = 62.6%	R ² (adj) = 62.4%	

¹The regression equation is: knowledge of WSWFPs (y) = 10.5+0.137 xMen only; ²the regression equation is: knowledge of WSWFPs (y) = 9.56+0.135 m; ³the regression equation is: knowledge of WSWFPs (y) = 10.9+0.146 w

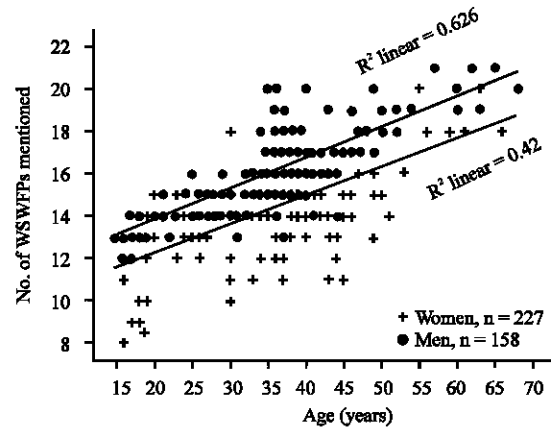


Fig. 4: Linear regression of sex and age versus knowledge of WSWFPs commonly consumed in Bunyoro-Kitara kingdom

between the knowledge of WSWFPs and the ages of the women (r = 0.791, p<0.001, n = 227) than in the case for men (r = 0.648, p<0.001, n = 158).

Growth forms and collection niches of the commonly consumed WSWFPs: The growth forms and the collection niches of all WSWFPs reported in this study are shown in Table 5. Overall, out of the 62 documented WSWFPs, herbs (51.6%) and shrubs (24.2%) constituted the highest numbers (Fig. 5). Trees, vines/climbers and graminoid were few. Collection niches varied greatly depending on the species from forest habitats to around animal enclosures (kraals)/cattle corridors. Forested areas which included forest gaps and margins (77.8±6.9%), woodlands (65.7±2.3%), cultivated farmlands (63.2±2.8%) and grasslands (59.8±4.1%), homegardens/homesteads (55.3±1.2%) and wetlands (50.1±1.3%) were the predominant collection sites for most WSWFPs reported (Table 6). Other collection niches included abandoned

Table 5: Growth forms and collection niches of the commonly consumed WSWFPs in the Buryoro-Kitara kingdom

WSWFPs	Growth forms	Life cycle	Collection niches
<i>Abrus precatorius</i> L.	CL/VI	P	AF, WB, G
<i>Acalypha bipartita</i> Müll. Arg	SH	P	F, WB, G
<i>Aframomum albobolaceum</i> (Ridley) K. Schum	HB	P	G, WB
<i>Aframomum angustifolium</i> (Sonnerat) K. Schum	HB	P	F, SW
<i>Amaranthus dubius</i> Mart. ex Thell	HB	A	WL, AF, AH, CC, RF
<i>Amaranthus graecizans</i> L.	HB	A	CF, WL, AF, AH, RF
<i>Amaranthus hybridus</i> subsp. <i>Cruentus</i> (L.) Thell	HB	A	HG, CF, AF, AH
<i>Amaranthus lividus</i> L.	HB	A	CF, WL, AF, AH, F
<i>Amaranthus spinosus</i> L.	HB	A	CF, WL, AF, AH, AE, CC
<i>Ampelocissus africana</i> (Lour.) Merr	VI/CL	P	WB, G
<i>Annona senegalensis</i> Pers	SH	P	WB, G
<i>Asystasia gangetica</i> (L.) T. Anders	HB	P	CF, F, AF, AH
<i>Asystasia mysorensis</i> (Roth) T. Anders	HB	A	CF, F, AF, AH
<i>Basella alba</i> L.	VI/CL	P	F, SW, FB, WB
<i>Bidens pilosa</i> L.	HB	A	RF, AF, AH, HG, CF
<i>Borassus aethiopum</i> Mart	TR	P	WB
<i>Canarium schweinfurthii</i> Engl	TR	P	F, WB, CF
<i>Capsicum frutescens</i> L.	SH	P	AF, AH, CF, F, FB
<i>Carissa edulis</i> (Forssk.) Vahl	SH	P	WB, AE
<i>Cleome gynandra</i> L.	HB	A	RF, AH, AF, HG
<i>Cleome hirta</i> (Klotzsch) Oliv	HB	A/P	G, WB, RF, AE, HG
<i>Corchorus tridens</i> L.	HB	A	F, HG, CF, WB
<i>Corchorus trilocularis</i> L.	HB	A	F, HG, CF, WB
<i>Crassocephalum crepidioides</i> (Benth.) S. Moore	HB	A	AF, AH, CF, WL
<i>Crotalaria ochroleuca</i> G. Don	HB	A/P	AF, AH, CF, WL, G
<i>Cymbopogon citratus</i> (DC.) Stapf	GR	P	HG
<i>Dioscorea minutiflora</i> Engl.	CL/VI	P	F, WB
<i>Erucastrum arabicum</i> Fisch. and C.A. Mey	HB	A	AF, AH
<i>Ficus sur</i> Forssk	TR	P	F, WB
<i>Garcinia buchananii</i> Bak	TR	P	WB, F, CF
<i>Hibiscus acetosella</i> Welw. ex Hiern	SH	P	G, CC, CF, FB
<i>Hibiscus sabdariffa</i> L.	HB	A	HG, CF
<i>Hypis spicigera</i> Lam	HB	A	AF, G
<i>Imperata cylindrica</i> (L.) Raeuschel	GR	P	G, FB
<i>Ipomoea eriocarpa</i> R. Br	HB	A	WB, RF, AF
<i>Lantana camara</i> L.	SH	P	WL, CC, RF, AF
<i>Mondia whitei</i> (Hook.f.) Skeels	VI/CL	P	F, WB
<i>Ocimum gratissimum</i> L.	SH	P	F, WB, HG
<i>Oxalis corniculata</i> L.	HB	P	CF, AF, AH, RF
<i>Oxalis latifolia</i> Kunth	HB	P	CF, AF, AH, RF
<i>Oxygonum sinuatum</i> (Hochst. and Steud. ex Meisn.) Dammer	HB	A	AF, AH, CF
<i>Phaseolus lunatus</i> L.	VI/CL	A/P	HG, AF, AF, WB
<i>Phoenix reclinata</i> Jacq	TR	P	SW
<i>Physalis peruviana</i> L.	SH	P	G, AF, HG, FB
<i>Rhus pyroides</i> var. <i>pyroides</i> Burch	SH	P	WB, G, FB
<i>Rubus pinnatus</i> Willd	SH	P	WB, F
<i>Senna obtusifolia</i> (L.) Irwin and Barneby	HB	A/P	CF, WL, AF, RF, G, CC
<i>Sesamum calycinum</i> Welw	HB	A/P	CF, WL, AF, RF, G
<i>Sida alba</i> L.	HB	A/P	AF, WB, RF
<i>Solanum anguivi</i> Lam	SH	A/P	F, AF, HG
<i>Solanum lycopersicum</i> L.	HB	A/P	WL, AF, AH, HG
<i>Solanum macrocarpon</i> L.	HB	A/P	WL, AF, HG, FB
<i>Solanum nigrum</i> L.	HB	A/P	F, WB, HG, FB
<i>Sonchus oleraceus</i> L.	HB	A/P	AF, AH, HG, FB
<i>Tamarindus indica</i> L.	TR	P	WB, HG
<i>Tristemma mauritanum</i> J.F. Grmel	HB	P	SW, WB
<i>Urtica massaica</i> Mildbr	HB	P	F, AF, AE, CC
<i>Vangueria apiculata</i> K. Schum	SB	P	WB
<i>Vernonia amygdalina</i> Del	SB	P	WB, F, FB, AF
<i>Vigna unguiculata</i> (L.) Walp	VI/CL	A/P	WB, F, G, FB
<i>Vitex doniana</i> Sweet	TR	P	WB
<i>Ximenia americana</i> L.	SH	P	WB

Growth forms: SH = Shrub; TR = Tree; VI = Vine; CL = Climber; GR = Graminoid; HB = Herb. Life cycles: A = Annual; p = Perennial; A/P = Annual or short-lived perennial; collection niches: F = Forests/forest gaps/forests margins; WB = Woodlands/Bushlands; G = Grasslands; SW = Swampy areas/wetlands; RF = Roadsides/Footpaths; AE = Around animal Enclosures (kraals); CC = Cattle Corridors; CF = Cultivated Farmlands; HG = Homegardens/homesteads; AH = Abandoned Homesteads; AF = Abandoned Farmlands; WL = Wastelands; FB = Farm Borders

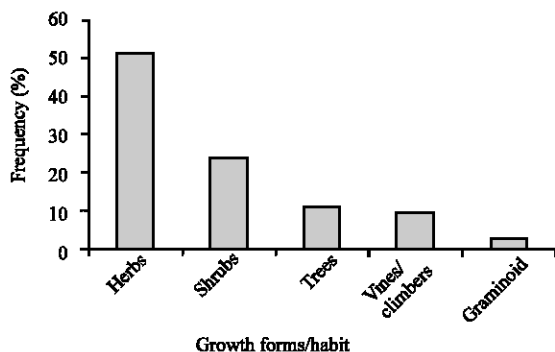


Fig. 5: Growth forms of WSWFPs commonly consumed in the Kingdom expressed as a percentage of 62 WSWFPs reported in the survey

Table 6: Frequency of citation of collection niches of the commonly consumed WSWFPs in Bunyoro-Kitara kingdom

Collection niches	Frequency of citation (%)		
	Mutunda (±SEM)	Kiryandongo (±SEM)	Mean (±SEM)
Forests/forest gaps/forests margins	84.7 (2.0)	70.9 (4.5)	77.8(6.9)
Bushlands/woodlands	63.5 (4.0)	67.9 (2.1)	65.7(2.3)
Cultivated farmlands	60.4 (1.5)	66.0 (3.0)	63.2(2.8)
Grasslands	55.7 (1.4)	63.9 (2.2)	59.8(4.1)
Homegardens/homesteads	56.5 (3.0)	54.1 (1.8)	55.3(1.2)
Swampy areas/wetlands	48.8 (2.4)	51.4 (2.5)	50.1(1.3)
Abandoned homesteads/ abandoned farmlands	38.5 (1.1)	54.7 (2.5)	46.6(8.1)
Wastelands	43.2 (2.0)	36.6 (3.0)	39.9(3.3)
Farm borders	29.0 (4.8)	26.6 (3.0)	27.8(1.2)
Roadsides/footpaths	22.3 (1.4)	24.9 (2.0)	23.6(1.3)
Around animal enclosures (kraals)/cattle corridors	7.3 (1.5)	14.5 (1.9)	10.9(3.6)

homesteads and farmlands, wastelands, farm borders, roadsides or along footpaths as well as areas around animal enclosures (kraals)/cattle corridors.

DISCUSSION

Commonly consumed WSWFPs in the kingdom: A significant number of WSWFPs were documented from the study area. There was large evidence that local communities in this locality very often interact with their environment and make use of these WSWFPs to meet part of their household food requirements.

Anthropologists and nutritionists often argue that contemporary humans are in a genetic sense, still stone agers and therefore, constantly interacting with their environment in quest of meeting their livelihood needs and in most cases still adapted to the pre-agricultural nutritional pattern (Mann, 2004). The number 62 of WSWFPs reportedly consumed in this study is lower than some of those reported from other studies within and outside Uganda. For example, Tabuti *et al.* (2004) reported 105 edible species distributed in 77 genera and 39 families

in Bulamogi country, eastern Uganda and in Rukungiri district of southwestern Uganda, Musinguzi *et al.* (2006) documented a total of 94 indigenous food plants (most of which were WSWFPs) as being consumed by local people. Elsewhere, Ali-Shtayeh *et al.* (2008) recorded 100 wild edible plant species distributed across 70 genera and 26 families in Palestine (Northern West Bank). There could be many possible explanations for these differences. However, the most realistic could be related to the higher data collection intensity employed in these other studies. While in the present study the households and key informants were only one-time interviewees, in others they used multiple interviews. Also, the diversity of WSWFPs in the study area could be lower than in areas where most other studies recorded higher number of edible wild plants.

Jr Bennett (1962) and Salick *et al.* (1999) opined that the diversity of plant resources is often reflected in people's interrelationship with their environment as expressed in the knowledge and use they make of plants. Hence, environments which are more diverse have more richness and abundance of the most useful species than less diverse environments. The results however, compare closely with those of Balemie and Kebebew (2006) and Rashid *et al.* (2008) who recorded a total of 66 WSWFPs belonging to 54 genera and 34 families in Derashe and Kucha districts of Southern Ethiopia and a total of 57 WSWFPs belonging to 33 families used by the Gujjar tribe in Rajouri, Jammu and Kashmir states of India, respectively.

Similarly, in Paphos and Larnaca countryside of Cyprus, Athena *et al.* (2006) reported 78 species of edible wild food plants as being consumed by the local community. Termote *et al.* (2008) also documented a total of 71 wild edible plant species belonging to 38 families and 60 genera as being consumed by the Turumbu people of Tshopo district in DR Congo.

Relationship between sex, age and knowledge of WSWFPs:

The findings from this study suggested that the knowledge of WSWFPs increased with age of the respondents, implying that the younger generation have somewhat little local knowledge of WSWFPs than the elderly people. This could be attributed first to the low interest of the younger generation to learn more about WSWFPs and secondly, to more time spent at school because of the introduced universal primary and secondary education in Uganda that dictates compulsory enrolment of the younger people to schools hence they have little time to interact with their families and the environment to learn more about the WSWFP resources.

A case study by Ladio and Lozada (2004) among the Mapuche community of northwestern Patagonia also

showed that the knowledge of WSWFPs increased with age of the respondents. Elsewhere, age of the respondents has also been shown to be a defining feature of the level of plant-based knowledge and a powerful indicator of the process of ethnobotanical decline over time (Voeks, 2007). Although, the findings from regression analysis suggest that knowledge of WSWFPs possessed by both men and women grows during their lifetimes, it was also apparent that women amass this knowledge more quickly throughout their life-times than men. Irrespective of their ages, women on average knew and reported more WSWFPs than their male counterparts. Luoga also found that women in eastern Tanzania knew more about herbaceous plants than men.

In Northeast Thailand, women were reported to have more knowledge about wild food plants because they are gatherers (Price, 2003; Somnasang *et al.*, 1998). Northeast Thai women and girls are also said to be more likely to identify correctly wild food plants than men and boys (Somnasang, 1996). During the Focus Group Discussions (FGDs) gathering of WSWFPs were reported to be the main work of the women and girls and as such they would tend to interact more with their natural environment and hence, know many different kinds of WSWFPs. Women also tend to learn at an early age before they get married how to find and use WSWFPs. Their teachers are usually their mothers, grandmothers and fellow village women.

Main parts of WSWFPs consumed and consumption patterns: Fresh leaves and shoots and fruits were the most reported plant parts consumed by households in the study area. The preference of fresh leaves and shoots to other plant parts could be due to the fact that they are frequently harvested in relatively large quantity, prepared and eaten often by the entire household members. Meanwhile, the preference for fruits to other plant parts could be attributed mainly to their consumption pattern. Most fruits are often eaten raw as snacks for instance between meals while collecting firewood or herding. Elsewhere, Reddy *et al.* (2007) also reported leaves and fruits as the predominantly consumed parts of the WSWFPs collected by indigenous people in Andhra Pradesh state of India. Termote *et al.* (2008) in their ethnobotanical research on the use and socio-economic value of wild edible plants by the Turumbu people of Tshopo district in DR Congo reported a higher preference of fruits and leaves to other plant parts.

In the present study, WSWFPs were largely consumed as the main sauce and side dishes after cooking, raw as a snack and as condiments (spices) or appetizers. Consumption of these plants as wine and porridge component, juice (beverages), raw in salads,

potash salt in other foods and as relishes were infrequent. Similar pattern of consumption of WSWFPs were also reported by Athena *et al.* (2006) and Dogan *et al.* (2004) in Western and Central Anatolia (Turkey) and Paphos and Larnaca countryside of Cyprus, respectively. The current consumption of WSWFPs as main meal (sauce) in Bunyoro-Kitara kingdom reflects the growing importance of these plants in the household diet of the people. This pattern of consumption was uncommon in the past (Bukenya-Ziraba, 1996) because these WSWFPs were consumed mainly as side dishes or as snacks. But due to recent food crisis caused by recurrent cycles of drought leading to failure of conventional foods crops in this kingdom as in most part of Uganda, many households have switched to consuming WSWFPs as main sauce (meal). One respondent had this to say, researcher had never depended on wild food plants as main meal but because of the severe food shortage due to the yearly droughts, researchers now eat wild foods as the main meal. It is a shame to him but at least he is not alone.

Main consumers and gatherers of WSWFPs in the kingdom: Earlier reports (Goode, 1989) opined women, elderly people and children as the main consumers of the WSWFPs in Uganda. In contrast, the present study indicates that the WSWFPs are now largely being consumed by entire household members—a practice that underscores the importance of these plants in household diet. This shift from women and children as the main consumers of WSWFPs in past to the entire household members today is perhaps due to the frequent severe food shortages being experienced in most part of kingdom where by the little that is harvested from the wild is shared by the whole household members.

It could also be due to the ever-rising food prices in the market beyond the purchasing power of a poor household, leaving them with little choice but to rely on WSWFPs. In the study area, WSWFPs were gathered almost exclusively by women and children. It is only in rare cases such as when herding animals, producing charcoal, looking for construction materials or in search of other off-farm income generating products from nature that men are involved in the collection of WSWFPs (mainly fruits). Collection of other types of WSWFPs is deemed the work of women except in cases where the man is living alone in his house. Even so, some of the men (widowers/bachelors) are reluctant to admit that they gather the leafy WSWFPs by themselves for fear of public disgrace.

When asked, about who gathers the leafy WSWFPs that they cook and eat, they are often quick to point to women well-wishers and relatives who give them a portion

of what they have gathered for their own households. Elsewhere, Vainio-Mattila (2000) reported the collection of wild vegetables as the sole responsibility of women and children among the Sambaa community in the Usambara Mountains of Northeastern Tanzania. Similarly, amongst the Dinka (Monjeng) tribe of Northern Bahr el Ghazal in Southern Sudan, collection of WSWFPs is reported to be dominated by women and children (Gullick, 1999). In Northern Ethiopia, Barnett (2001) also notes that the collection of WSWFPs is undertaken by the women and children. Roles of women and children as far as gathering of the WSWFPs is concerned should therefore not be underestimated.

Growth forms and collection niches of the commonly consumed WSWFPs: Most of the commonly harvested WSWFPs reported in this study were herbs and shrubs. Trees, vines (climbers) and graminoid were few. The high reliance on herbaceous and shrubby WSWFPs could perhaps be related to their diversities in the local environment. Most of them were reported to be growing on-farms as weeds and therefore are easily encountered by the gatherers especially when going about with the routine farm activities.

This finding concurs with Rashid *et al.* (2008) who noted that the Gujjar tribe of Rajouri in Jammu and Kashmir state of India make use of mostly wild herbs for food followed by trees, shrubs and climbers in descending order. According to Wehmeyer *et al.* (1969) and Wehmeyer and Rose (1983), the preference of wild herbaceous edible plants by local communities to other growth forms could be related to their highly perceived nutrient and vitamin values. The present finding, revealed that WSWFPs are collected from a variety of habitats including the forests gaps and margins, grasslands, bushlands (woodlands), wetlands, roadsides (footpaths) and around kraals (animal enclosures) mainly by women and children while going about other chores like searching for firewood and fetching water from the village wells.

Other WSWFPs, especially those that are weedy in nature were gathered mainly from homegardens, cultivated or abandoned farmlands, wastelands and farm borders. This is in agreement with Heywood (1999) and Agea *et al.* (2007) who noted that non-cultivated plants grow spontaneously in self-maintaining populations in many natural and semi-natural ecosystems and that they can even exist independently of human action. Elsewhere, Reddy *et al.* (2007) reported that wild food plants in Andhra Pradesh state of India are often gathered by women from the forests and along the way to forests. Vainio-Mattila (2000) also found that wild green leafy

vegetables consumed by the Sambaa people in Tanzania, most of which were ruderal and weedy were growing by the roadsides and on arable land. In addition, Woodcock (1995) indicated that in Eastern Usambara of Tanzania, wild food plants were collected by village communities from forests, bushlands, secondary forests and fallow shambas. Similarly, Wilken (1970) reported that farmers in Mexico who sell their domesticated produce, rely on wild food plants foraged from disturbed environments for their own survival.

CONCLUSION

About 62 WSWFPs belonging to 31 botanical families were reported as being consumed in the study area. The most frequently mentioned plants were *Amaranthus dubius* Mart. ex Thell, *Amaranthus spinosus* L, *Tamarindus indica* L, *Hibiscus sabdariffa* L and *Vitex doniana* sweet. But in terms of botanical family, members of Solanaceae and Fabaceae families were the most commonly consumed followed by Amaranthaceae, Malvaceae and Asteraceae families, respectively.

Local knowledge of WSWFPs increases with the age of the respondents. Younger people have less knowledge of WSWFPs than their elderly counterparts. Irrespective of their ages, women on average knew and reported more WSWFPs than their male counterparts. Fresh leaves and shoots and fruits were the most predominantly consumed plant parts in the study area. Most WSWFPs were largely consumed as the main sauce and side dishes after cooking, raw as snacks and as condiments (spices or appetizers). Their consumption as wine and porridge component, beverages, raw in salads, potash salts in other foods and as relishes were infrequent. WSWFPs were found almost exclusively consumed by entire household members. Women and children were found to be the primary gatherers. Men only occasionally collected wild fruits. Most gathered WSWFPs were collected from a variety of habitats including the forests gaps and margins, grasslands, woodlands, wetlands, roadsides, around kraals, homegardens, cultivated or abandoned farmlands, wastelands and farm borders. The gathered WSWFPs were predominantly herbs and shrubs. Trees, vines (climbers) and graminoids were few.

RECOMMENDATION

In light of the findings and conclusions above there is an urgent need for research on the possibility of adapting, growing and intentionally managing some of the commonly consumed WSWFPs (e.g., *Hibiscus acetosella* and *Hyptis spicigera*) since a large proportion of these plants were reportedly gathered from out-of-farm niches.

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