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Contribution of Wild and Semi-Wild Food Plants to Overall Household Diet in Bunyoro-Kitara Kingdom, Uganda

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Abstract: The contribution of Wild and Semi-wild Food Plants (WSWFPs) to overall household diet was assessed in Mutunda and Kiryandongo, sub-counties of Bunyoro-Kitara Kingdom, Uganda. The assessments were made using a combination of methods namely: household using semi-structured questionnaires and Focus Group Discussions (FGDs). A total of 385 households from the two sub-counties were selected for household survey following the method described by Krejcie and Morgan. Each informant was asked to list, the preferred WSWFPs consumed in the area and to estimate the amount harvested by members of his or her household in the previous 12 months period. In addition, they were asked to report whether or not WSWFPs were used by members of the household during the previous 12 months period. They were also asked to report whether or not the WSWFPs was given away and/or received by members of the household during the previous 12 months period. In addition, they were asked to estimate how long in a year their household members depend on WSWFPs. FGDs were held to construct seasonal calendar of availability of different WSWFPs consumed in the area. Contribution of WSWFPs to household diet was computed using two generic types of measures-mean per capita harvest and mean per capita use (consumption). The durations upon which households depend on WSWFPs was computed and presented in a chart. About 62 WSWFPs belonging to 31 botanical families were reported as commonly being consumed in the study area. Their consumption comprised a major part (7-9 months) of the dietary intake of the poor households. Many are almost available throughout the year for gathering with exception of a few species that are gathered mainly in the rainy or dry seasons. Mean per capita harvests varied substantially by species as high as 31.59 g day^{-1} in *Amaranthus dubius* to about 0.04 g day^{-1} as in *Lantana camara*. Like mean per capita harvest, mean per capita consumption also varied from one species to another. Mean per capita consumption of some the WSWFPs such as *Hyptis spicigera* (107.02 g day^{-1}) and *Borassus aethiopum* (91.82 g day^{-1}) were higher than the reported vegetable and fruit per capita consumption of 79.45 g day^{-1} in sub-Saharan Africa although, much although much lower than the world average of 205.48 g consumed per person per day. There is a need for policy-makers and technocrats both at the local (counties, sub-counties, parishes, villages) and national levels (e.g., Ministry of Agriculture, Animal Industry and Fisheries) to create policies by-laws or any other avenues for mainstreaming, the management of some of the WSWFPs with high per capita harvest and per capita consumption rates into the existing, the farming systems and/or any the programs (e.g., Plan for Modernisation of Agriculture) aimed at addressing household poverty and food insecurity. While wild foods cannot entirely bridge, the existing supply and demand gaps of poor household food requirements without them, the gaps would be much wider.

Key words: Wild food plants, semi-cultivated food plants, per capita harvest, per capita consumption

INTRODUCTION

Since time immemorial, Wild and Semi-wild Food Plants (WSWFPs) have sustained human populations in each of the inhabited continents (Grivetti and Ogle, 2000). The agricultural revolution that began >10,000 years ago, created a dramatic shift in the human food supply (Isaac, 1970; Heiser, 1973; Grivetti, 1980). One result was a

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significant reduction in dietary diversity. As humans focussed more on domesticated cultivars and gave less attention to wild species, plants that once offered important flavour and texture satisfaction and supplied essential nutrients to the diet declined in popularity.

In recent centuries, food security has come to depend on a small handful of widely cultivated species. Over 50% of the world's daily requirement of proteins and calories comes from three crops-wheat, maize and rice (Jaenicke and Hoschle-Zeledon, 2006) twelve species contribute 80% of total dietary energy intake-eight cereals (barley, maize, millet, rice, rye, sorghum, sugar cane and wheat) and four tubers (cassava, potato, sweet potato and yam) (Grivetti and Ogle, 2000). By contrast, wild foods provide a greater dietary diversity to those who rely on them. Ethnobotanical surveys of wild plants indicate that >7000 species have been used for human food at some stage in human history (Grivetti and Ogle, 2000; Milleniumosystem Assessment (MEA), 2005). Some indigenous communities use >200 (Kuhnlein *et al*., 2009) in India, 600 plant species are known to have food value (Rathore, 2009).

This focus on few cultivated species, poses two significant problems. First, nutritional reliance on few species, paradoxically, places humans at evolutionary risks as seen if a cereal-specific rust or smut evolved that attacked these critical foodstuffs. The result would be global famine of incomprehensible scale and human catastrophe. The second problem is the decline in knowledge. By focussing on domesticated cultivars, the collective skills needed to identify and prepare WSWFPs has declined precipitously. Since, species that contained energy and micronutrients became peripheral or were abandoned, humans sometimes have starved in the midst of wild food plenty (Grivetti, 1978).

The nutritional anthropologist Ann Fleuret who conducted fieldwork in Tanzania in the 1970s stated that nutrition studies have not seriously considered the role of wild plants in local diets (Anne, 1979). While her comments still apply today, dietary assessment studies completed, since her perceptive comment illustrate that wild edible plants provide important nutrients to infants and children, pregnant and lactating women, the elderly and indigenous societies globally. In study, conducted in an isolated Australian Aboriginal community, researchers found extensive use of edible wild foods and essentially no malnutrition (O'Dea *et al*., 1988).

In Bangladesh, dietary patterns of women and young children were balanced using dark green leaves as major sources for pro-vitamin A and the researchers concluded that traditional diets, high in edible plants should be protected and promoted (Zeitlin *et al*., 1992).

Analysis of national household data in Brazil revealed that wild fruits had high caratenoid and vitamin A values but were ignored in nutrition education (Shrimpton, 1989). Study conducted in Papua New Guinea, revealed that edible wild plants were nutritionally significant in the local diet and were important sources for Fe intake (Hongo *et al*., 1989).

A number of studies of this type have been conducted in Africa. In Gambia, WSWFPs were important during pregnancy and lactation, especially leaf sauces prepared from edible species and researchers found no evidence of Vitamin A deficiency (Villard and Bates, 1987). In Mali, WSWFPs were critically important to diet in both rural and urban settings (Nordeide *et al*., 1994, 1996). In Eastern Niger >80 WSWFPs were regularly used by 93% of the household and contributed substantial amounts of Cu, Fe, Mg and Zn to the diet. Furthermore, these plants were frequently sold for extra income. Swaziland has been the focus of research on edible plants for >50 years and edible wild fruits and vegetables are commonly eaten throughout the year and contribute significant amounts of Fe, carotenoids and vitamin C to the diets of children and adults (Beemer, 1939; Jones, 1963; Ogle and Grivetti, 1985 a-d; Huss-Ashmore and Curry, 1991). In Uganda, a number of WSWFPs have reportedly gathered for household consumption or for sale in different part of the country (Katende *et al*., 1999; Rubaihayo *et al*., 2003; Tabuti *et al*., 2004; Musinguzi *et al*., 2006, Tabuti, 2007; Agea, 2010; Agea *et al*., 2011). The present study therefore, attempted to estimate the contribution of these WSWFPs to overall household diet in the Bunyoro-Kitara Kingdom, Uganda in terms of the per capita harvest and consumption rates as well as on the monthly level of dependency on these plants.

MATERIALS AND METHODS

Data collection: The study was conducted in Mutunda and Kiryandongo, sub-counties of Kibanda county 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 three parishes (Kakwokwo, Diima and Nyamahasa) of Mutunda sub-county and from

Table 1: Required sample size at the 5% confidence interval given a finite population (N = Population size and n = Sample size)

N-n	N-n	N-n	N-n	N-n
10-10	100-80	280-162	800-260	2800-338
15-14	110-86	290-165	850-265	3000-341
20-19	120-92	300-169	900-269	3500-346
25-24	130-97	320-175	950-274	4000-351
30-28	140-103	340-181	1000-278	4500-354
35-32	150-108	360-186	1100-285	5000-357
40-36	160-113	380-191	1200-291	6000-361
45-40	170-118	400-196	1300-297	7000-364
50-44	180-123	420-201	1400-302	8000-367
55-48	190-127	440-205	1500-306	9000-368
60-52	200-132	460-210	1600-310	10000-370
65-56	210-136	480-241	1700-313	15000-375
70-59	220-140	500-217	1800-317	20000-377
75-63	230-144	550-226	1900-320	30000-379
80-66	240-148	600-234	2000-322	40000-380
85-70	250-152	650-242	2200-327	50000-381
90-73	260-155	700-248	2400-331	75000-382
95-76	270-159	750-254	2600-335	100000-384

Krejcie and Morgan (1970)

four parishes (Kitwara, Kyankende, Kichwabugingo and Kikube) of Kiryandongo sub-countries 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 into Table 1 at level N = 9,000. The sample size in this example is 368. Table 1 which is applicable to any population of a defined (finite) size is based on a formula:

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

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 Kiryadongo 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.

An approach similar to that followed by Padoch (1988) and Hedge *et al.* (1996) was adopted during interviews about WSWFPs gathered. Each informant was asked to list, the preferred WSWFPs consumed in the area. To assess the contribution of WSWFPs to overall household diet each informant was asked to estimate the amount of WSWFPs harvested by members of his or her household in the previous 12 months period.

In addition, they were asked to report whether or not WSWFPs were used by members of the household during the previous 12 months period. Informants were also asked to report whether or not the WSWFPs was given away and/or received by members of the household during the previous 12 months period. By asking about resources received, households who consumed but did not harvest a resource can be identified (Wolfe and Utermohle, 2000). Informants were also asked to estimate how long in a year, their household members often depend on WSWFPs. This estimate was gathered in form of frequency (1-3, 3-6, 7-9 and 10-12 months). Focus group, discussions were held to construct seasonal calendar on availability of different WSWFPs consumed in the area. Key informants were selected among the study community to corroborate household survey data.

Data analysis: Contribution of WSWFPs to household diet was computed using two generic types of measures-mean per capita harvest and mean per capita use (consumption) (Wolfe and Utermohle, 2000). Mean per capita harvest is a statistical measure of the amounts of WSWFPs harvested annually by households for subsistence use, expressed on a per person basis (g day^{-1}). It is calculated by dividing the total harvest of a resource category by the total number of people in the surveyed households within the community. Mean per capita harvest, assumes that wild resource harvests are equally distributed for consumption among all community residents (Wolfe and Utermohle, 2000). An average family size of seven people was used in determining the total number of people in the surveyed households of the studied community.

Mean per capita use is a statistical measure of the amounts of wild foods used annually within households that reported using wild foods, expressed on a per person basis (g day^{-1}). It is calculated by dividing the entire community's mean per capita harvest of a resource category by the proportion or the percent proportion of households using the resource (Wolfe and Utermohle, 2000). Mean per capita use assumes that only persons living in households that reported using the wild food consume, the wild food harvest in a community. It assumes that there is no consumption of a wild food by members of households that reported not using the wild food (Wolfe and Utermohle, 2000). The duration in terms of months upon which households depend on WSWFPs was computed and presented in a chart.

RESULTS

Household profile: The household profiles of the respondents are shown in Table 2. Many (59%) respondents were female. Sex segregation is heavily skewed towards women, essentially because some of the male household heads preferred that the questionnaire be administered to their wives (spouses) than themselves. While, it may be argued that this skewness might have influenced the outcome of the findings in this study, it should be understood that the households interviewed were selected randomly. Respondents' ages ranged from 16-68 years although, many (54.5%) respondents were >36 years old. Most (68.3%) respondents were married. About 51.4 and 31.7% of the respondents had reached primary and secondary education levels, respectively. Most (63.6%) surveyed households had >6 members and the average family size was seven people. The majority (84.4%) of respondents were subsistence farmers growing mainly food crops such as maize, cassava, groundnuts, finger millet, sorghum, beans, simsim (sesame), peas, groundnuts, sweet potatoes, cowpeas and bananas. Most (81.9%) did not have sufficient year-round food for their household members.

Although, the majority (81%) of the respondents owned land, the size of the land holding was generally small. Most (60.3%) families had only 0.81-1.62 ha (2-4 acres) of land. More than a half (53.2%) of respondents had annual cash income ranging from UGX 200,000-400,000 (≈USD 100-200). Only 34% of the respondents had annual cash income greater than UGX 400,000 (USD 200). The majority (86.5%) of respondents derived their cash income from on-farm activities. The rest (13.5%) ventured mainly into off-farm activities such as gathering WSWFPs, sale of charcoal and firewood. All respondents reported that their households do eat WSWFPs.

Contribution of the WSWFPs to household diet in the Kingdom: The contribution of the WSWFPs to household diet in the Kingdom were expressed in terms of mean per capita harvest (g day^{-1}), mean per capita use (consumption) and monthly dependencies. A total of 62 WSWFPs belonging to 31 botanical families were reportedly as gathered for consumption in the study area.

Table 2: Household profiles of the respondents

Variables	Response (%)
Sex	
Male	41.0
Female	59.0
Age	
<18	6.8
18-36	38.7
>36	54.5
Marital status	
Single	12.5
Married	68.3
Divorced/separated	5.5
Widow/widower	14.0
Education level	
No formal education	9.4
Primary	51.4
Secondary	31.7
Tertiary	7.5
Major occupation	
Subsistence farming	84.4
Civil work (councillors, teachers, midwives)	6.8
Boda-boda cyclists	3.6
Student (vocational, college and secondary school)	2.9
Others (housewives, market vendor, firewood and charcoal trade)	2.3
Land ownership	
Own land	81.0
Does not own land	19.0
If own land, size of the land owned in acres (hectare)	
<2 acres (0.81 ha)	10.9
2-4 acres (0.81-1.62 ha)	60.3
>4 acres (1.62 ha)	28.8
Family size	
<3 people	13.0
3-6 people	23.4
>6 people	63.6
Food sufficiency in the household	
Sufficient	10.9
Not sufficient	89.1
Annual cash income (UGX)*	
<200.000 (≈USD 100)	12.7
200,000-400,000 (≈USD 100-200)	53.2
>400,000 (≈USD 200)	34.0
Main sources of cash incomes	
On-farm	86.5
Off-farm	13.5
Household ever eaten WSWFPs	
Yes	100.0
No	0.0

* USD1 = 2010 Uganda shilling (UGX)

Mean per capita harvest of WSWFPs: Mean per capita harvest of WSWFPs varied widely among the species harvested. However, *Amaranthus dubius* (31.59 g day^{-1}), *Borassus aethiopum* (28.14 g day^{-1}), *Amaranthus spinosus* (27.23 g day^{-1}), *Dioscorea minutiflora* (16.06 g day^{-1}), *Cleome gynandra* (14.74 g day^{-1}), *Acalypha bipartite* (14.07 g day^{-1}), *Hibiscus sabdariffa* (13.79 g day^{-1}), *Hyptis spicigera* (12.51 g day^{-1}) and *Asystasia gangetica* (11.69 g day^{-1}) had the highest percent contribution to total mean per capita harvest (Table 3). Species such as *Lantana camara*, *Vangueria apiculata*, *Imperata cylindrica*, *Rhus*

Table 3: Mean per capita harvest and mean per capita use of WSWFPs in Bunyoro-Kitara Kingdom (wet weight)

WSWFPs	Percentage of households				Mean per capita harvest (g day^{-1})	%[a]	Mean per capita use (g day^{-1})
	Harvesting	Using	Giving	Receiving			
All resources (WSWFPs)	-	-	88.7	90.3	402.90	100.00	1471.88
Hyptis spicigera Lam.	6.2	11.7	6.2	6.2	12.51	3.10	107.02
Borassus aethiopum Mart.	24.9	30.6	23.9	28.8	28.14	6.98	91.82
Dioscorea minutiflora Engl.	13.0	20.5	12.7	10.6	16.06	3.99	78.27
Amaranthus dubius Mart. ex Thell.	73.5	73.8	61.0	48.8	31.59	7.84	42.83
Amaranthus lividus L.	15.3	16.1	10.6	12.5	6.78	1.68	42.12
Acalypha bipartite Müll. Arg.	33.2	36.9	28.1	34.0	14.07	3.49	38.16
Amaranthus spinosus L.	71.4	71.4	58.2	57.1	27.23	6.76	38.13
Amaranthus hybridus ssp., *cruentus* (L.) Thell.	17.4	18.4	14.5	17.1	6.55	1.62	35.50
Abrus precatorius L.	5.2	6.0	3.9	5.2	2.12	0.53	35.49
Amaranthus graecizans L.	19.2	20.3	18.2	13.8	7.08	1.76	34.93
Solanum lycopersicum L.	13.2	16.6	12.5	13.5	5.62	1.39	33.79
Aframomum alboviolaceum (Ridley) K. Schum	27.5	31.4	26.8	29.4	10.44	2.59	33.22
Cleome gynandra L.	43.9	45.2	40.8	33.0	14.74	3.66	32.60
Basella alba L.	29.6	33.8	26.5	29.1	10.89	2.70	32.26
Canarium schweinfurthii Engl.	22.3	24.7	22.1	22.6	7.95	1.97	32.22
Asystasia gangetica (L.) T. Anders.	33.5	39.2	24.9	35.8	11.69	2.90	29.80
Asystasia mysorensis (Roth) T. Anders.	33.5	37.1	26.8	31.2	11.05	2.74	29.75
Erucastrum arabicum Fisch. and C.A. Mey.	7.5	8.6	3.9	1.8	2.49	0.62	29.07
Phaseolus lunatus L.	12.2	14.3	11.2	5.7	4.03	1.00	28.20
Urtica massaica Mildbr.	2.3	2.9	2.3	2.1	0.80	0.20	27.83
Hibiscus sabdariffa L.	45.7	51.9	43.9	43.1	13.79	3.42	26.55
Aframomum angustifolium (Sonnerat) K. Schum.	39.0	43.6	36.9	38.2	11.58	2.87	26.54
Crassocephalum crepidioides (Benth.) S. Moore	7.8	7.8	0.0	1.6	1.99	0.49	25.51
Oxygonum sinuatum (Hochst. and Steud ex Meisn) Dammer	19.0	21.8	17.4	13.0	5.54	1.37	25.39
Crotalaria ochroleuca G. Don	39.7	47.8	36.1	42.3	10.71	2.66	22.40
Hibiscus acetosella Welw. ex Hiern	36.1	44.7	31.7	35.8	9.91	2.46	22.19
Cleome hirta (Klotzsch) Oliv.	27.8	31.2	23.4	23.9	6.89	1.71	22.11
Corchorus tridens L.	35.1	36.6	32.2	29.6	7.89	1.96	21.56
Corchorus trilocularis L.	30.4	34.0	28.6	31.4	6.82	1.69	20.06
Sonchus oleraceus L.	27.5	34.3	22.6	16.4	6.81	1.69	19.87
Sesamum calycinum Welw.	9.6	9.4	4.4	2.6	1.80	0.45	19.27
Senna obtusifolia (L.) Irwin and Barneby	35.1	43.9	17.1	11.9	8.43	2.09	19.20
Solanum anguivi Lam.	12.2	13.0	7.3	3.4	2.48	0.62	19.08
Vigna unguiculata (L.) Walp.	26.8	35.1	23.4	26.0	6.39	1.59	18.23
Phoenix reclinata Jacq.	7.0	8.3	5.7	4.2	1.51	0.37	18.18
Solanum nigrum L.	40.3	49.1	37.1	36.1	8.83	2.19	17.98
Physalis peruviana L.	27.8	34.8	26.8	26.8	6.21	1.54	17.86
Sida alba L.	16.6	18.7	11.7	7.3	3.31	0.82	17.72
Garcinia buchananii Bak.	12.2	15.1	11.2	7.8	2.62	0.65	17.42
Solanum macrocarpon L.	10.6	11.9	6.5	3.9	2.01	0.50	16.86
Vernonia amygdalina Del.	29.6	40.3	21.6	25.5	6.78	1.68	16.85
Bidens pilosa L.	31.9	35.1	9.9	13.0	5.91	1.47	16.85
Ficus sur Forssk.	22.9	28.3	19.7	15.3	4.48	1.11	15.82
Tamarindus indica L.	42.1	69.1	39.7	56.6	9.34	2.32	13.52
Ipomoea eriocarpa R.Br.	8.8	11.4	2.1	3.4	1.54	0.38	13.45
Annona senegalensis Pers.	13.8	16.4	12.2	14.5	2.20	0.55	13.44
Rubus pinnatus Willd.	3.1	3.4	2.1	1.0	0.44	0.11	13.03
Ampelocissus africana (Lour.) Merr.	8.6	10.4	1.3	5.7	1.30	0.32	12.50
Carissa edulis (Forssk.) Vahl	12.5	16.1	8.6	14.5	1.86	0.46	11.52
Mondia whitei (Hook.f.) Skeels	9.4	13.5	9.1	13.0	1.55	0.38	11.48
Vitex doniana Sweet	31.9	50.1	28.8	37.4	4.81	1.19	9.59
Tristemma mauritianum J.F. Gmel.	6.8	6.8	0.0	0.0	0.58	0.14	8.55
Imperata cylindrica (L.) Raeuschel	1.3	1.3	0.0	0.0	0.11	0.03	8.16
Ocimum gratissimum L.	13.2	15.6	10.1	2.9	1.25	0.31	8.01
Cymbopogon citrates (DC.) Stapf	7.0	7.0	2.6	0.0	0.56	0.14	7.94
Oxalis corniculata L.	8.8	8.8	0.0	0.0	0.47	0.12	5.28
Ximenia Americana L.	8.6	13.8	7.5	7.5	0.68	0.17	4.95
Oxalis latifolia Kunth	8.1	8.1	0.0	0.0	0.36	0.09	4.48
Rhus pyroides var. *pyroides* Burch.	8.1	9.4	0.0	1.3	0.27	0.07	2.83
Lantana camara L.	1.6	1.6	0.0	0.0	0.04	0.01	2.72
*Capsicum frutescens*L.	36.1	38.4	3.6	4.4	0.87	0.22	2.28
Vangueria apiculata K. Schum.	2.1	5.5	1.3	4.7	0.10	0.02	1.80

%[a] = Contribution to total per capita harvest

pyroides var. *pyroides*, *Oxalis latifolia*, *Rubus pinnatus* and *Oxalis corniculata* had the least percent (0.01-0.12%) contribution to the total mean per capita harvest. Most of the households shared (gave out or received) part of their harvests with others. In total, 88.7% of the households gave part of their harvest to others while 90.3% received some WSWFPs from other households who harvested the plants. *Amaranthus spinosus*, *Tamarindus indica*, *Amaranthus dubius*, *Hibiscus sabdariffa*, *Crotalaria ochroleuca*, *Aframomum angustifolium*, *Vitex doniana*, *Solanum nigrum*, *Hibiscus acetosella*, *Asystasia gangetica*, *Acalypha bipartite* and *Cleome gynandra* were the most commonly received resources whereas *Amaranthus dubius*, *Amaranthus spinosus*, *Hibiscus sabdariffa*, *Cleome gynandra*, *Tamarindus indica*, *Solanum nigrum*, *Aframomum angustifolium*, *Crotalaria ochroleuca*, *Corchorus tridens*, *Hibiscus acetosella* were the WSWFPs given out by the greatest number of the households (Table 3).

Mean per capita use (consumption) of WSWFPs: All households interviewed reported using WSWFPs in the last 12 months. Like in mean per capita harvest, mean per capital consumption also varied from one species to another. *Hyptis spicigera* (107.02 g day^{-1}), *Borassus aethiopum* (91.82 g day^{-1}), *Dioscorea minutiflora* (78.27 g day^{-1}), *Amaranthus dubius* (42.83 g day^{-1}), *Amaranthus lividus* (42.12 g day^{-1}), *Acalypha bipartite* (38.16 g day^{-1}), *Amaranthus spinosus* (38.13 g day^{-1}), *Amaranthus hybridus* ssp., *cruentus* (35.50 g day^{-1}), *Abrus precatorius* (35.49 g day^{-1}), *Amaranthus graecizans* (34.93 g day^{-1}) and *Solanum lycopersicum* (33.79 g day^{-1}) had the highest mean per capital use (Table 3). Whereas, plants like *Oxalis corniculata*, *Ximenia Americana*, *Oxalis latifolia*, *Rhus pyroides* var. *pyroides*, *Lantana camara*, *Capsicum frutescens* and *Vangueria apiculata* had the lowest mean per capital use ranging from 5.28-1.80 g day^{-1} (Table 3).

Availability calendar and dependency on WSWFPs: In terms of monthly dependency, most of the households were found to rely on WSWFPs for most of the year to meet or supplement their household food requirements (Fig. 1). About 46.8±4.4%, households depend on WSWFPs for 7-9 months while 35.1±4.6% depend on WSWFPs for about 10-12 months which is nearly the whole year round. Very few households reportedly used WSWFPs for <7 months as part of their diet.

During the Focus Group Discussions (FGDs), it was noted that most of WSWFPs were available for harvests and consumption nearly throughout the year. Table 4 shows the seasonal calendar of availability of different WSWFPs commonly consumed in this locality. Most WSWFPs such as *Aframomum angustifolium*, *Cymbopogon citrates*, *Imperata cylindrica*, *Mondia whitei* and *Vernonia amygdalina* were reported to occur

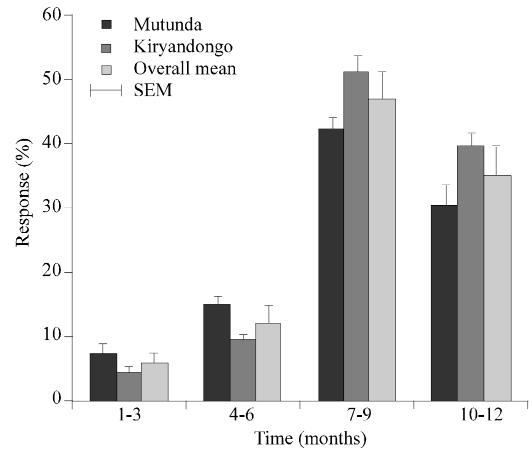

Fig. 1: Household dependence (months per year) on WSWFPs in the Kingdom

year round (January to December) and can be harvested any time. Others such as *Acalypha bipartite*, *Amaranthus dubius*, *Ampelocissus africana*, *Basella alba*, *Bidens pilosa*, *Capsicum frutescens*, *Cleome gynandra*, *Cleome hirta*, *Ocimum gratissimum*, *Phaseolus lunatus*, *Rubus pinnatus*, *Sida alba*, *Solanum macrocarpon* and *Tristemma mauritianum* though available all year round had main (peak) seasons and occasional periods of availability (Table 4).

DISCUSSION

Mean per capita harvest WSWFPs: WSWFPs constitute a major proportion of the household diet of the local people in Bunyoro-Kitara Kingdom. On a per person basis, estimates from this study show that harvests varied substantially by species as high as 31.59 g day^{-1} in *Amaranthus dubius* to about 0.04 g day^{-1} as in *Lantana camara*. The high per capita harvest of most WSWFPs that were reported reflects their importance in the local household economy. Report from the market survey (Agea *et al*., 2010) revealed that most of the WSWFPs with high mean per capita harvests are those that are commonly marketed within the study area.

The marketability potential coupled with a combination of other factors such as perceived relative availability, nutritional benefits, medicinal attributes and taste appreciation partly explain their high per capita harvests. Misra *et al*. (2008) noted that wild food plants frequently harvested in large volumes by the inhabitants of Nanda Devi Biosphere Reserve, India were those that besides, their palatability, medicinal values and abundance in the local environment have high market values. Findings also indicated that some households gave out part of their wild harvests or received from other

Table 4: Seasonal calendar of availability of different WSWFPs in relation to the cropping cycle of conventional food crops in Bunyoro-Kitara kingdom

Cropping cycle of conventional food crops		Dry season 2nd season harvests	1st rainy season Land preparation,crop planting, weeding and crop maturity				Dry season 1st season harvests			2nd rainy season Land preparation, crop planting, weeding and crop maturity			Dry season 2nd season harvests
WSWFPs	Local names	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Abrus precatorius L.	Akarunga	-	-	-	-	a	b	b	b	a	-	-	-
Acalypha bipartite Mull. Arg.	Egoza, Ayuu	a	a	b	b	b	a	a	a	b	b	b	a
Aframomum alboviolaceum (Ridley) K. Schum	Amasaasi, Ocao	a	a	-	-	-	-	-	-	-	-	b	b
Aframomum angustifolium (Sonnerat) K. Schum.	Amatehe, Kongo amor	b	b	b	b	b	b	b	b	b	b	b	b
Amaranthus dubius Mart.. ex Thell	Doodo	a	a	b	b	b	a	a	a	b	b	b	a
Amaranthus graecizans L.	Nyabutongo, Ocoboro	-	a	b	b	b	a	-	a	b	b	b	a
Amaranthus hybridus ssp. *cruentus* (L.) Thell.	Omujuiga	-	a	b	b	b	a	-	a	b	b	b	a
Amaranthus lividus L.	Bwora, Mboog'ennene	-	a	b	b	b	a	-	a	b	b	b	a
Amaranthus spinosus L.	Doodo y'amahwa	-	a	b	b	b	a	-	a	b	b	b	a
Ampelocissus africana (Lour.) Merr.	Anunu, Olok	a	a	b	b	b	a	a	a	b	b	b	a
Annona senegalensis Pers.	Mubengeya, Obwolo	b	a	-	-	-	-	-	-	-	-	a	b
Asystasia gangetica (L.) T. Anders.	Temba, Odipa ikong	-	-	a	b	b	a	-	a	b	b	a	-
Asystasia mysorensis (Roth) T. Anders.	Nyante, Acwewanggweno	-	-	a	b	b	a	-	a	b	b	a	-
Basella alba L.	Enderema	a	a	b	b	b	a	a	a	b	b	b	a
Bidens pilosa L.	Obukurra	a	a	b	b	b	a	a	a	b	b	b	a
Borassus aethiopum Mart.	Ekituugu, Tugo	-	-	-	-	-	-	-	a	b	b	b	a
Canarium schweinfurthii Engl.	Empafu	-	-	-	-	-	-	a	b	b	b	b	a
Capsicum frutescens L.	Kamulari, Alyera	a	a	b	b	b	a	a	a	b	b	b	a
Carissa edulis (Forssk.) Vahl	Omuyonza, Acuga	a	-	-	-	-	-	-	-	-	a	b	b
Cleome gynandra L.	Eyobyo	a	a	b	b	b	a	a	b	b	b	b	a
Cleome hirta (Klotzsch) Oliv.	Akayobyo akasajja	a	a	b	b	b	a	a	b	b	b	b	a
Corchorus tridens L.	Eteke	-	a	b	b	a	-	-	a	b	b	a	-
Corchorus trilocularis L.	Otigo lum	-	a	b	b	a	-	-	a	b	b	a	-
Crassocephalum crepidioides (Benth.) S. Moore	Ekinami	-	-	a	b	b	a	-	-	b	b	a	-
Crotalaria ochroleuca G. Don	Kumuro, Alaju	-	-	a	b	b	a	-	a	b	b	a	-
Cymbopogon citrates (DC.) Stapf	Lemon grass	b	b	b	b	b	b	b	b	b	b	b	b
Dioscorea minutiflora Engl.	Kaama/Ekihama	b	a	-	-	-	-	-	-	-	a	b	b
Erucastrum arabicum Fisch. and C.A. Mey.	Oburobwenaku	-	-	b	b	a	-	-	a	b	b	a	-
Ficus sur Forssk.	Kabalira, Oduru	b	a	-	-	-	-	-	-	-	a	b	b
Garcinia buchananii Bak.	Museka	a	-	-	-	-	-	-	-	-	a	b	b
Hibiscus acetosella	Makawang kulo,	-	-	a	b	b	a	-	a	b	b	a	-
Welw. ex Hiern	Gwanya	-	-	-	-	-	-	-	-	-	-	-	-
Hibiscus sabdariffa L.	Bamya, Ekikenke	-	-	a	b	b	a	-	a	b	b	a	-
Hyptis spicigera Lam.	Amola, Lamola	a*	-	-	-	b	b	a	-	-	-	a*	b*
Imperata cylindrica (L.) Raeuschel	Rusojo	b	b	b	b	b	b	b	b	b	b	b	b
Ipomoea eriocarpa R.Br.	Acatolao, Podowia kuri	-	-	a	b	b	a	-	a	b	b	a	-
Lantana camara L.	Jerenga, Abelwinyo	b	a	-	-	-	-	-	-	-	a	b	b
Mondia whitei (Hook.f.) Skeels	Omurondwa	b	b	b	b	b	b	b	b	b	b	b	b
Ocimum gratissimum L.	Mujaja	a	a	b	b	b	a	a	a	b	b	b	a
Oxalis corniculata L.	Kanyunywa mbuzi	-	-	a	b	b	a	-	a	b	b	a	-
Oxalis latifolia Kunth	Kanyeebwa	-	-	a	b	b	a	-	a	b	b	a	-
Oxygonum sinuatum (Hochst. and Steud. ex Meisn.) Dammer	Kacumita bagenge, Cuguru	-	-	a	b	b	a	-	a	b	b	a	-
Phaseolus lunatus L.	Amaijalero, Okuku	a	a	b	b	b	b	a	a	b	b	b	a
Phoenix reclinata Jacq.	Omukindo	-	-	-	-	b	b	a	-	-	-	a	a
Physalis peruviana L.	Ntuutu	a	-	-	-	b	b	a	a	-	-	a	b
Rhus pyroides var. *pyroides*	Obukanjakanja,	-	-	-	-	a	b	b	-	-	-	a	b
Burch.	Awaca	-	-	-	-	a	b	b	-	-	-	a	b
Rubus pinnatus Willd.	Amakerre	a	a	a	a	b	b	b	b	b	a	a	a
Senna obtusifolia (L.)	Oyado, Luge	-	-	a	b	b	a	-	a	a	a	a	-

Table 4: Continued

		Dry season	1st rainy season				Dry season			2nd rainy season			Dry season
Cropping cycle of conventional food crops		2nd season harvests	Land preparation,crop planting, weeding and crop maturity				1st season harvests			Land preparation, crop planting, weeding and crop maturity			2nd season harvests
WSWFPs	Local names	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Irwin and Barneby													
Sesamum calycinum Welw.	Amacande ga kanyamunya	-	-	-	b	b	a	-	a	a	a	a	-
Sida alba L.	Orucuhya	a	a	b	b	b	a	a	a	b	b	b	a
Solanum anguivi Lam.	Obuhuruhuru, Katukuma	a	-	-	-	b	b	a	-	-	a	b	b
Solanum lycopersicum L.	Bunyanya bunyoro	a	-	-	-	b	b	a	-	-	-	b	b
Solanum macrocarpon L.	Bugorra	a	a	b	b	b	a	a	b	b	b	a	a
Solanum nigrum L.	Enswiga	-	-	a	b	b	a	-	a	b	b	a	-
Sonchus oleraceus L.	Kizimyamucho, Apuruku	-	-	b	b	b	a	-	a	b	b	a	-
Tamarindus indica L.	Mukoge	b	a	-	-	-	-	-	-	-	a	b	b
Tristemma mauritianum J.F. Gmel.	Oburo bw'enkombe	a	a	b	b	b	a	a	b	b	b	b	a
Urtica massaica Mildbr.	Orugenyi, Ekicuraganyi	-	-	b	b	a	-	-	a	b	b	b	-
Vangueria apiculata K. Schum.	Matungunda	-	-	-	a	b	b	a	-	-	-	-	-
Vernonia amygdalina Del.	Kibirizi	b	b	b	b	b	b	b	b	b	b	b	b
Vigna unguiculata (L.) Walp.	Mugobiswa	-	-	a	b	b	a	-	a	b	b	a	-
Vitex doniana Sweet	Muhomozi, Owelo	-	-	a	b	b	b	-	-	-	-	-	-
Ximenia Americana L.	Enseka, Olimo	a	-	-	-	-	-	-	-	-	-	a	b

[b]Main periods of availability; [a]Occasional periods of availability; [*]Periods in which edible seeds are harvested

households. Sharing part of the harvest with other households or neighbours is perceived as a form of social capital and a local survival strategy. One key informant summarised this survival strategy of sharing part of their harvests with neighbouring households as scratch my back and I will scratch yours too. Sharing part of the harvests is not recognised as a social norm but central as a coping mechanism in times of food insecurity.

Elsewhere, food sharing between households has been reported. For instance, Harrigan and Changath (1998) reported the intra-household food sharing among the Dinkas of Sothern Sudan. Here, food sharing was regarded as a social norm and households who do not share part of their harvest with neighbours were often branded as kor (selfish like a lion). A notion that like lions, people who eat alone give nothing to others should expect nothing from other households (Mandalazi and Guerrero, 2008).

Mean per capita use (consumption) of WSWFPs: The present study indicates that WSWFPs play a significant role in household diet. For example, mean per capita consumption of *Hyptis spicigera*, *Borassus aethiopum* and *Dioscorea minutiflora* were higher than the reported vegetable and fruit per capita consumption of 79.45 g day^{-1} in sub-Saharan Africa although much lower than the world average of 205.48 g consumed per person per day (Ruel *et al*., 2005). But generally, the mean per capita consumption of WSWFPs estimated in this study is comparable with the estimated per capita consumption of African leafy vegetables in Uganda and other African nations.

For instance in Senegal and Burkina Faso available estimated per capita consumption of leafy vegetables is 80 g of fresh leaves per day (Dalziel, 1937) while in Mauritania estimates are 65 g day^{-1} in urban areas and 16 g day^{-1} in rural areas (Frankenberger *et al*., 1989). In Uganda, a survey by the Home Economics Department at Bukalasa Agricultural College indicated that average consumption of traditional vegetables was 160 g per head per day during the rainy season when green leafy vegetables are abundant (Goode, 1989).

However, a survey of consumption in urban areas of Uganda, especially among the urban poor indicated the per capita consumption of 12 g day^{-1} (Grant, 1957) indicating that a large proportion of the population probably does not consume adequate amounts of vegetables. Oguntona (1998) reported a mean per capita consumption of 65 g day^{-1} in western Nigeria while in Southeastern Nigeria, Hart *et al.* (2005) reported adult per capita consumption of 59-130 g day^{-1}.

Availability calendar and monthly dependency on WSWFPs: Most of the households in the study area were found to depend heavily on WSWFPs for most part of the year. During the FGDs, it was suggested that WSWFPs are mainly consumed during dry seasons and early in the cropping (rainy) seasons when cultivated food resources are least available. Thus, it is possible to claim that the WSWFPs are often used as a substitute for cultivated species during the lean period of the year. Woodcock (1995) also reported heavy reliance on wild foods by local communities for most part of the year from two case studies conducted in East Usambaras, Tanzania. He attributed heavy reliance on wild food plant resources to lack of access to alternative food sources to the village communities at certain periods of the year. During FGDs, it was apparent that most of the gathered WSWFPs are almost available throughout the year with exception of some few plants that are gathered mostly in the rainy and dry seasons. Although, recently rainfall is very infrequent in the area, its bimodal patterns with peaks around March-May and August-November could partly account for the almost year-round availability of most of the WSWFPs gathered in the study area.

While cultivated food crops are in short supply during the beginning of the rains, many WSWFPs produce leaves and flowers at the onset of the rainy season, the annual hungry period (Harris and Mohammed, 2003) when food granaries are running low and the harvest of the next crop is a long way off, making it possible for households to continuously access leafy vegetables (Mertz *et al*., 2001).

There were suggestions from FGDs that the year-round availability of most WSWFPs in the study areas could be related to their drought tolerance habits. These suggestions concurs with Dzerefos *et al.* (1995) who reported that some wild foods plants such as *Corchorus tridens* are more drought tolerant compared to staple food crops. Similarly, Freiberger *et al.* (1998) reported that most gathered wild food plants are often drought-resistant, providing a buffer against famine as well as supplying calories and nutrients during the dry season and the time before harvest when granaries may have become depleted of staple foods. In a nutshell, the consumption of WSWFPs could be a necessary part of the strategies adopted by poor households in order to survive in a harsh and sometimes unforgiving environment.

CONCLUSION

WSWFPs have long provided poor households a hidden harvest as they have used these plants often gathered from within and around their communities to supplement their daily food requirements. About 62 WSWFPs belonging to 31 botanical families were reported as commonly being consumed in the study area. Their consumption comprised a major part (7-9 months) of the dietary intake of the poor households. Many are almost available throughout the year for gathering with exception of a few species that are gathered mainly in the rainy or dry seasons. Mean per capita harvests varied substantially by species as high as 31.59 g day^{-1} in *Amaranthus dubius* to about 0.04 g day^{-1} as in *Lantana camara*. Like mean per capita harvest, mean per capita consumption also varied from one species to another. Mean per capita consumption of some the WSWFPs such as *Hyptis spicigera* (107.02 g day^{-1}) and *Borassus aethiopum* (91.82 g day^{-1}) were higher than the reported vegetable and fruit per capita consumption of 79.45 g day^{-1} in sub-Saharan Africa although much, lower than the world average of 205.48 g consumed per person per day.

There is therefore, a need for policy-makers and technocrats both at the local (counties, sub-counties, parishes, villages) and national levels (e.g., Ministry of Agriculture, Animal Industry and Fisheries) to create policies by-laws or any other avenues for mainstreaming the management of some of the WSWFPs with high per capita harvest and per capita consumption rates into the existing the farming systems and/or any the programs (e.g., Plan for Modernisation of Agriculture) aimed at addressing household poverty and food insecurity. While, wild foods cannot entirely bridge the existing supply and demand gaps of poor household food requirements without them, the gaps would be much wider.

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