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Indigenous Knowledge and Usage of Indigenous Edible and Medicinal Mushrooms Among the Teso People of Eastern Uganda

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Abstract: Indigenous knowledge of wild edible and medicinal mushroom use is linked to local culture and history. It should be regarded as a body of knowledge that has continually developed without the outside interference of formal science. A study therefore was designed to document traditional knowledge including local names, general distribution, seasons, preservation, storage, medicinal and market values of these mushrooms. The field surveys were conducted by adopting predefined questionnaires administered to 120 respondents. The study showed that the Teso people consumed mushrooms for food and medicine and that they have a mushroom heritage which needs adequate documentation. Upto twenty eight species were reported used by the community. Women and children were particularly identified more useful in knowledge about mushrooms than men. They collected preserved and stored mushrooms for future use. Twenty two species were eaten, twelve with medicinal attachment and only two with economic use. The documentation of information on edible and medicinal mushrooms as well as the different social and cultural practices associated with their use in ethno-medicinal practices is a necessity. From such fundamental information, basic and applied research can be carried out to develop artificial cultivation and improve on the use of these mushrooms.

Key words: Indigenous knowledge, edible and medicinal mushrooms, teso people (Uganda)

INTRODUCTION

Wild edible mushrooms have been collected and consumed by people for thousands of years and records reveal edible species associated with people 13000 years age in Chile[1]. But it is in China where the eating of wild fungi is highly notable[2]. Today, incidences of poisoning and deaths are few compared to regular and safe consumption of edible species, but publicity and cultural attitudes continue to instill fear in some societies[1]. Fear of mushroom poisoning may sometimes reach phobic extremes (mycophobic cultures) in contrast to mycophillic societies who enjoy a long history of mushroom use[3]. The fear of mushrooms is commonly found in developed countries and has led to general beliefs that global use of wild edible mushrooms is small scale and restricted to key areas. This is not true since the use of mushrooms is both extensive and intensive though patterns of use do vary[1]. In many cultures, mushrooms are used as flavour and as food on their own, source of income and as medicine therefore contributing to diet, income and human health[1,4]. World over, traditions on mushroom collection do vary although generally now more people gather from the wild than before[1]. This is attributed to a change of attitudes of mycophobic societies. In cultures where people have a love for mushrooms, they have given such names to reflect local beliefs that they are fair substitute for meat[5], a belief that is confirmed by nutritional analyses[1]. It is also common to find local people rejecting some species that are edible and its not easy changing their attitudes despite its widespread and popularity in other areas and some cultures. Here we report findings of a study which was conducted in Eastern Uganda to document the indigenous knowledge about priority mushrooms in the same location.

MATERIALS AND METHODS

Kumi District is located in Eastern Uganda and lies approximately between latitude 1°10' N, 1°35'N,

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longitude 33°30', 34°20'E[6]. It is approximately between 1036 and 1127 m above sea level with highly effective rainfall which is largely bimodal tending to mono-modal. The vegetation is mainly savannah species, thickets, some forest plantations and riparian vegetation with the geology forming the underlying rock being made up of the basement complex.

Sampling procedure: Kumi Sub County was selected based on access four parishes were randomly selected and from which twelve villages were picked randomly. Three villages were picked from each parish. From the twelve villages selected, 120 people (households) were randomly picked, with 10 from each village interviewed to solicit their local knowledge on edible and medicinal mushrooms. Additionally, 20 people (focused group) were interviewed to ascertain seasonal out crop of mushrooms and clearing uncertainty in indigenous nomenclature.

Indigenous knowledge: Local or indigenous knowledge on edible and medicinal mushrooms was solicited using a questionnaire. The questions covered aspects of ecology (seasons of out crop and habitats), attitudes of local people towards wild mushrooms, practices in use and economic potentials of priority edible and medicinal mushroom species. The priority mushrooms were identified by use of scores by the local people. The scoring was done such that the most important edible mushroom was given a score of 5 points, second 4 points, third 3 points, fourth 2 points and fifth 1 point for each respondent and the total score obtained through summing the scores for the ranked mushrooms by all the respondents. To ascertain the order of preference against either meat or cowpea leaves, the scoring was also done for response such that very highly preferred given 5 points, highly preferred 4 points, average 3 points, low 2 points and not important given 0 from each respondent and the total score obtained through summing the scores for the ranked mushrooms by all the respondents. The mushroom with the highest score in both studies was ranked first and the one with the least ranked last. This kind of ranking was also done for the perceived effectiveness of reported medicinal mushrooms.

RESULTS

Seasons and frequency of mushroom collection: Mushrooms have specific seasons when they appear. This though depends on the availability of rains, when the rains delay and the month for which a specific mushroom should appear has past, there is little chance of getting that particular mushroom. As stated by the community, these mushrooms will appear as indicated Table 1a. During this season (March to September) mushrooms are common. Half the total respondents (49.2%) are able to collect up to 10 times during this time while only 1.5% of the respondents are able to collect more than 20 times within this time of the year.

Table 1a: Season and frequency of mushroom collection (N =20)

	Months											
Species	J	F	M	A	M	J	J	A	S	O	N	D
Imaruk (*Termitomyces* sp.)						*	*	*				
Ebekubeku (*Termitomyces* sp.)				*			*					
Eburukunyu (*Agaricus* sp.)							*	*	*			
Eswei (*Termitomyces microcarpus*)			*	*	*	*	*	*				
Odilit/Omajala (*Termitomyces* sp.)		*		*								
Echoroi (*Agaricus* sp.)					*	*						
Opungurei (Not identified)				*	*	*	*	*	*			
Erusurus/Omomei (Not identified)							*	*				
Eguti (*Termitomyces aurantiacus*)				*	*							
Okao (*Agaricus* sp.)	*	*										
Esiara (*Tricholoma* sp.)	*	*	*	*	*	*						
Etimijaka (*Agaricus* sp.)	*	*				*	*					
Ebelekinyom/Abelet (Not identified)	*	*										
			*	*								
Eluwu (Not identified)	*	*	*			*	*					
Otitipu (Not identified)		*	*		*	*						
Esoromatonit (*Termitomyces* sp.)		*	*	*	*	*	*					
Orengen (Not identified)		*	*									
Ochokol (Not identified)			*	*								
Oujoi (*Lepiota* sp.)	*	*	*	*	*	*	*					

Frequency of mushroom collection (N = 120)

				Totals
# /season	<11	11-20	20	
Frequency	59	46	15	120
%	49.2	38.3	12.5	100

*=Indicating months when specific mushrooms appear

Growth habitats of mushrooms: Mushrooms exhibit differences in their growth habitats as reported by all the respondents (100%). Most of the species are those that are associated with termites/termite moulds and swampy areas. Some species exhibit specificity in their growth habitas whereas othes are not limited to one particular growth habitat as shown in Table 1b below.

Types of preferred edible mushrooms: Up to 22 mushroom species were reported collected and consumed by the people of Teso. The families mostly collected in between 6 to 10 different species exhibited by 67.5% of the respondents. The respondents exhibited differences in the preferred mushroom species however these were scored and the order of preference ascertained. Nevertheless some mushroom species were not chosen at all as in Table 2 below. The respondents exhibited differences as to which mushroom species ranks closest to beef however the order was ascertained through scores

Table 1b: Growth habitats of mushrooms (N = 120)

Variable	Frequency	(%)
Differences in habitats		
Yes	120	100
No	0	0

	Mushroom habitats and % response						
Species	Termite mounds	Under big trees	Swampy areas	Dry raised lands	Log/wood	Garden old	kraal
Imaruk (*Termitomyces* sp)	95.0						
Ebekubeku (*Termitomyces* sp)	59.2	0.8	1.7				
Eburukunyu (*Agaricus* sp)	22.5		2.5			1.7	0.8
Eswei (*Termitomyces microcarpus*)	98.3						
Odilit/Omajala (*Termitomyces* sp)	10.8	14.2	2.5	0.8		18.3	
Echoroi (*Agaricus* sp)	17.5		4.2	1.7		0.8	
Opungurei (Not identified)					12.5		
Erusurus (Not identified)	13.4		5	0.8			
Eguti (*Termitomyces aurantiacus*)	0.8	0.8	20.8	15		5	
Okao (*Agaricus* sp)			3.3				
Esiara (*Tricholoma* sp)				0.8			
Etimijaka (*Agaricus* sp)	25		3.3			2.5	
Esoromatonit (*Termitomyces* sp)	1.7						
Otitipu (Not identified)	0.8						
Orengen (Not identified)	0.8	1.7	0.8			4.2	
Ochokol (Not identified)			0.8				
Eluwu (Not identified)	4.2						
Oujoi (*Lepiota* sp)						0.8	1.7
Ebelekinyom (Not identified)	1.7						

Table 2: Types of edible mushrooms collected and peoples' preference (N = 120)

No. of mushroom types collected				
1-5	6-10	>10	Totals	
Frequency	26	81	13	120
(%)	21.7	67.5	10.8	100

	Peoples' taste preference			Prefernce to beef		Prefernce to cow pea leaves	
Species	%	Total score	Rank	Total score	Rank	Total score	Rank
Ebekubeku (*Termitomyces* sp.)	81.7	200	3	258	3	290	3
Ebelekinyom/Abelet *(Not identified)*	4.2	2	18	5	15	15	13
Eburukunyu (*Agaricus* sp.)	45.0	65	7	103	7	122	7
Echoroi (*Agaricus* sp.)	40.8	62	8	101	8	113	8
Eguti (*Termitomyces auranticus*)	55.0	115	5	165	5	191	5
Eluwu (*Not identified*)	10.8	13	12	16	12	19	12
Imaruk (*Termitomyces* sp.)	95.0	539	1	519	1	533	1
Enyinya (*Not identified*)	3.3	-	-	-	-	-	-
Erusurus/Omomei (*Not identified*)	47.5	47	9	81	9	84	9
Esiara (*Tricholoma* sp.)	19.2	2	18	5	15	5	17
Esoromantonit (*Termitomyce* sp.)	10.0	4	14	5	15	7	16
Eswei (*Termitomyces microcarpus*)	99.2	441	2	447	2	510	2
Etimijaka (*Agaricus* sp.)	48.3	79	6	115	6	138	6
Ochokol (*Not identified*)	8.3	3	15	5	15	5	17
Odilit/Omajala (*Termitomyces* sp.)	73.3	143	4	180	4	216	4
Okao (*Agaricus* sp.)	18.3	8	13	12	13	13	14
Emeruka *(*Not identified*)*	1.7	-	-	-	-	-	-
Opungurei (*Not identified*)	44.2	22	10	37	10	43	11
Orengen (*Not identified*)	17.5	18	11	28	11	70	10
Otitipu (*Not identified*)	0.8	1	20	2	19	2	19
Otulelut (*Agaricus* sp.)	4.2	-	-	-	-	-	-
Oujoi/Ouret (*Lepiota* sp.)	25.9	3	15	10	14	10	15

as in Table 2 below. The mushroom that was chosen to be closest to beef was *Termitomyces* sp. (*Imaruk)* and followed by *Termitomyces microcarpus* (*Eswei*). The least considered was a mushroom called Otitipu (Not Identified). Mushrooms were also weighted against vegetables (cow peas leaves) and the respondents Table) exhibited differences as to how mushrooms rank with vegetables (cow peas laeves). However, the order was ascertained through scores.

Preservation and storage of mushrooms: All the households visited were preserving mushrooms (100%) with sun drying being the most widely practiced method of preservation followed by roasting with percentages of 98.3 and 42.2%, respectively Table 3. The least popular method was keeping in cool places constituting only 2.5%. The preserved mushrooms were reported stored mostly in small pots, guards and polythene bags represented by 56.7, 52.5 and 50%, respectively.

Table 3: Preservation and storage of mushrooms (N = 120)

Variable	Frequency	(%)
Preservation of mushrooms		
Yes	120	100.0
No	0	0.0
Methods/modes of preservation		
Sun drying	118	98.3
Baking/roasting	53	44.2
Breaking into smaller pieces for air-drying	5	4.2
Boiling	4	3.3
Keep in a cool place	3	2.5
Storage of preserved mushrooms		
Using polythene bags	60	50.0
Using Empty tins	35	29.2
Small pots	68	56.7
Guards	63	52.5
Others (granary, sauce pans, Plates)	11	9.2

Table 4: Domestication/growing of mushrooms (N = 120)

Variable	Frequency	(%)
Knowledge of mushroom farming		N = 120
Yes	36	30
No 84	70	
Involvement in mushroom cultivation		
		(n = 36)
Yes	00	0
No 36	100	
Reasons hindering cultivation		
		(n = 36)
Lack of technical knowledge involved	35	97
Lack of planting materials	18	50
Lack of capital	3	8
Fear of initial investment/risk	7	19
Availability of wild mushrooms	1	3
Lack of interest	3	8

Domestication/growing of mushrooms: Mushroom cultivation is a very new field as 70% of the repondents had never had of the technology before. All the repondents who had heard of the technology have never practiced. They attributed this mostly to a lack of technical skills involved (97%) and lack of planting materials (50%) and other reasons as shown in Table 4 below.

Other uses of mushrooms: Mushrooms were reported to be used either for income generation or medicinal purposes as stated by 80.8% of the respondents as in Table 5 below. Only two species were commonly reported for income generation compared to twelve used for medicine containing both the edible and inedible species. Only four ailments were reported to be treated using mushrooms with measles toping (72.5%) followed by body pains (5.8%). These mushrooms can be either administered alone or used as supplements as reported by 69.2 and 5% of the respondents, respectively. The respondents' perception of the effectiveness of these mushroom species in treating the stated ailments varied and therefore scores were used to determine the rankings as shown in Table 5 below. The highest ranked edible mushroom was *Termitomyces microcarpus* (Eswei) followed by *Termitomyces* sp. (Imaruk).

Table 5: Other uses of mushrooms (N = 120)

Variable			Frequency	(%)
Other mushroom uses				
Yes			97	80.8
No			23	19.2
Income generation				
Imaruk (*Termitomyces* sp)				
500 = /mushroom			19	15.8
1000 = /mushroom			11	9.2
1500 = /mushroom			4	3.3
Eswei (Termitomyces microcarpus)				
100 = /heap			19	15.8
200 = /heap			11	9.2
300 = /heap			4	3.3
Perceived effectiveness in treating illness				
Medicinal purposes	Total scores	Rank		
Ekodokodoi (*Acacia senegal*)*	250	1	57	47.5
Ekulong (*Combretum collinum*)*	8	9	3	2.5
Egassia (*Senna spectabilis*)*	245	2	55	45.8
Eswei (*Termitomyces microcarpus*)	156	3	39	32.5
Echomai (Not identified)*	45	5	11	9.2
Egirigiroi (Not identified)*	24	6	5	4.2
Ereirei (*Trema orientalis*)*	4	12	1	0.8
Opungurei (Not identified)	8	9	2	1.7
Echoroi (*Agaricas* sp)	14	7	3	2.5
Imaruk (*Termitomyces* sp)	81	4	18	15.0
Ebekubeku (*Termitomyces* sp)	9	8	2	1.7
Eburukunyu (*Agaricus* sp)	5	11	1	0.8
Ailments/illness treated				
Measles			87	72.5
Cough			6	5.0
Stomach disorder			5	4.2
Body pain like chest pain			7	5.8
Mode of application				
Alone			83	69.2
As supplement			6	5.0

* = mushrooms growing on the stems of these tree species and inedible

DISCUSSION

From the study the Teso people appear to be largely inclined to mushrooms as indicated by the number of different mushrooms consumed and/or used for other purposes by each family. On the whole it was found that there were 22 different species of mushrooms collected

and consumed as food or medicine and additional 6 different species used solely as medicine making a total of 28 different species. The number of mushroom species used by the Teso people is similar to the findings elsewhere[7], who found 38 mushroom species being used among the tribe of Igbo in Nigeria. It should however be noted that the number of species used here is not based on taxonomic units but on the local identification by the local community. The number of species eaten is sometimes a fraction of what is available as indicated by eaten species of Armania[1]. The reason for this pattern is not always clear but there is a trend of less frequent use as people move away from the land. An example[1] is given of people living in towns of Malawi, who lose the strong local traditions that local communities maintain. However, it could also be that some people may consider edible species of mushroom as poisonous as shown by some people of Tanzania who consider boletus as poisonous and yet it is not[5].

Mushroom collection appeared to be gender related; men seemed not to make deliberate efforts to go searching for mushrooms. Some of the men interviewed gave an impression that gathering mushrooms from the wild is a work for women and children. This gender related situation is in line with the findings of among the Igbo people of Nigeria[7] and among collectors in Malawi and Tanzania[8]. The Teso people when harvesting species that come in large quantities (*Termitomyces microcarpus*) may collect alongside neighbours. This is a common practice and a sign of togetherness and good neighbourliness.

The importance of wild edible mushrooms from a development perspective is defined by comparison with other sources of food. According to the FAO[1], use and benefits of wild edible mushroom will always be compared with available options. Table 2 give summaries of the order of each mushroom as could be used as a substitute for beef and vegetables (cow pea leaves), respectively, which are delicacies among the people of Teso. This gives mushrooms a double score and therefore a delicacy in itself amongst the Teso people.

There was evidence of the use of some mushroom species in ethno medicine among the Teso people. The Table 5 shows the ailments reported to be treated by some mushroom species. Most of the mushroom species reported for medicinal activities are identified locally with their association to particular tree species. They are normally found growing on either the roots or the tree stumps. In administering inedible species, the patient is covered with say a blanket and only smoke from these species introduced to the patient. This is mostly done for cases of measles and body pains. The effectiveness of these mushroom species varied as believed by the community who used it. The ranking of effectiveness was therefore based on the local community perceptions.

The study also indicated that some people take to the sale of mushroom as an avenue to supplement their income during the periods when mushrooms appear Table 5. However good sales are realized early or late in the seasons when mushrooms are fewer prompting the mushroom prices to go up. This activity was mostly done by the elderly who took the most trouble to go hunting for these mushrooms for commercial purposes. This could be an indication that there will be an appreciable market for indigenous edible mushrooms if cultivated.

The main methods of preserving mushrooms appeared to be sun drying and baking. This was not surprising because the two methods are what the local people traditionally use to preserve most other food items. This is also in line with the reports in Nigeria[7] where similar situations were found among the Igbo people. Other lesser-used methods of preservation were air drying, boiling and keeping in cool places for example under water pots. The preserved edible mushrooms were then stored mostly in polythene bags, guards and small pots. The other methods of storage included use of empty tins and others (granaries, sauce pans and plate)

Free access may lead to commercial harvesting which may otherwise lead to unsustainable harvests due to poor collection regulations. Conservationists should therefore be concerned with amount collected and harmful picking methods although annual yields are heavily influenced by available rainfall and ambient temperature at key times of the year[9]. Over harvesting is a commonly and genuinely expressed concern for both commercial and subsistence collections. This may not yet be the case in Teso since most families (about 90%) do not frequently go for mushroom hunting during the mushroom seasons Table 1a. When over harvesting becomes a problem, an approach that protects the natural resource while allowing a fair and equitable access to collectors is needed such that the seasons Table 1a as indicated by the local community is not subject to this bad practice.

All the respondents interviewed appreciated the fact that mushrooms of different species could have a specific growth habitat. The number of species growing on termite moulds showed this. Other species were mostly found in swampy areas and or under big trees as shown by responses in Table 1b. Dry raised land, cultivated areas, decaying wood and old kraals also provided good growing places for these wild edible mushrooms.

It was observed that there was a potential willingness to adopt simple production technology. In addition mushrooms that could substitute for meat in daily diets

Imaruk (Termitomyces sp.) could also be readily accepted. In this connection, resource poor farmers could be taught simple and appropriate low technology for producing some of these socio-economically important indigenous mushrooms. This would increase the protein intake and revenue generation capacity. This prospect is in line with reports in Tanzania[10]. where it was found that the reasons given for not cultivating mushrooms were technology or finance related.

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