

Herbal medicines used in the treatment of malaria in Uganda: A case study of Budiope County

by

John R.S. Tabuti Ph.D.

Ethnobotanist/Senior Lecturer

Department of Botany, Makerere University

P.O. Box 7062, Kampala, Uganda.

jtabuti@botany.mak.ac.ug

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ABSTRACT

Malaria is the single most important cause of ill health, death and poverty in Sub-Saharan Africa. The management of malaria is complicated because the parasites that cause malaria are resistant to most of the safest and cheapest first line treatments developed so far.

This project was undertaken with two specific objectives: to document herbal medicines used in the treatment of malaria and to document existing knowledge, attitudes and practices related to malaria recognition, control and treatment. The study was carried out in the rural villages of Buseete and Busambira in Kinambogo Parish in Kamuli district of Eastern Uganda. Data was collected through a survey comprising semi-structured interviews with key informants and individuals, and a guided open- and close-ended questionnaire. The questionnaire was administered to 66 respondents (34 male and 32 female).

I found that people had a good understanding of malaria, could recognize it and distinguish it from other fever types by symptoms. Although some ambiguities existed, people knew that malaria is spread by mosquitoes. Malaria prevalence was high and was reported to attack individuals an average of six times a year. Conditions favoring the breeding for mosquitoes were evident in all homesteads. These included dense bush and close proximity to wetlands. Respondents reported different ways of avoiding mosquito bites including the use of mosquito nets, destruction of bush around homesteads, and burning of plant parts to generate smoke. Preferred practices of malaria treatment appeared to be biased towards the Allopathic Medicine system. Respondents claimed that they had bought paracetamol, and fansidar or chloroquine to treat themselves during their most recent malaria attack. The reason given for this preference for allopathic medicine was ignorance of the traditional knowledge necessary to exploit plants for the treatment of malaria (About 50% of the respondents, mostly men, claimed ignorance). Knowledge of treatment using herbal medicines (HMs) was almost exclusively restricted to women. A second reason for this preference was the belief that allopathic medicines were superior to herbal medicines in the treatment of malaria. Some respondents (38%), on the other hand, stated a preference for herbal medicines. They reported that their preference was motivated by the free and ready access to the required plants.

Twenty seven species distributed between 24 genera and 16 families were reportedly used in herbal preparations for the treatment of malaria. The most frequently mentioned species were *Vernonia amygdalina* Delile, *Momordica foetida* Schumach., *Zanthoxylum chalybeum* Engl., *Lantana camara* L. and *Mangifera indica* L. Drugs from these plants were prepared as water extracts and made from single species. The drugs were administered in variable doses and over varied time periods. I propose that the most frequently mentioned species should be considered for further research to evaluate their efficacy and safety.

I. INTRODUCTION

Malaria is the single most important cause of ill health, death and poverty in Sub-Saharan Africa (Sachs and Malaney 2002; Kilama, 2005; United Nations, 2005). The disease is believed to be a major obstruction to social and economic development in Africa. It causes enormous misery and suffering through the pain of fevers and the anguish of bereavement. It is estimated that there are as many as 300 million acute cases of malaria worldwide each year, resulting in one million deaths. Ninety percent of these deaths occur in Sub-Saharan Africa, and most of victims are children aged less than five years (World Health Organization, 2004). Malaria accounts for 40% of public health expenditure. The disease not only results in lost life and lost productivity because of illness and premature deaths, but it also hinders children in their schooling and social development both through absence from school and permanent neurological or other damage associated with severe episodes of the disease.

In Uganda, malaria is the most common disease and kills the most people (Batega, 2004; Malaria Control Programme, 2005). It is the most frequent cause of attendance at health facilities accounting for 25 – 40% of out-patient attendances, 20% of in-patient admissions and 9 – 14% of in-patient deaths. Children aged five years and below, and pregnant women are the most affected; more than 200 children die daily from the disease (Malaria Control Programme, 2005; Ministry of Health, 2006). In children it does not only lead to illness and death but also has long term consequences on their development through low birth weight, chronic anaemia, reduced growth and in some cases severe mental retardation. In pregnancy, malaria may cause maternal anaemia, premature births, low-weight babies (which is the principal contributor to infant mortality) and still births. The disease is responsible for nearly 60% of miscarriages.

The disease also contributes to poverty. First of all, many productive days are lost through sickness or tending sick relatives. Secondly the cost of treatment or barriers to mosquito bites, such as insecticides or mosquito nets is high for the average Ugandan. The average cost of treating a single malaria episode is estimated at UGX 1420 (1 USD = UGX 1850). Indeed, a poor family can spend up to 25% of its income on malaria treatment and prevention (Ministry of Health, 2006).

Four major problems are associated with the management of malaria. The most important problem is that the parasites which cause malaria are resistant to or are developing resistance to the most widely available, affordable and safest first line treatments such as chloroquine and fansidar (Kilama 2005; Sendagire et al., 2005). Secondly, the overall control of the mosquitoes which transmits malaria is made difficult by their resistance to a wide range of insecticides. The third, which is a new and rapidly developing problem, is the widespread production of fake antimalarial drugs. For example, in mainland Southeast Asia 38% and 53% of “artesunate” blister packs sampled contained no active ingredient (Newton et al., 2006). Lastly, many countries in Africa lack the necessary infrastructure and resources to manage and control malaria (World Health Organization, 2004).

Owing to the widespread suffering and death caused by malaria and the failure of the safest and most affordable antimalarials to treat the disease because of drug resistance, there is an urgent need to develop new drugs or vaccines for the treatment, management, prevention and control of malaria (Kilama 2005; Waako et al. 2005). This project was undertaken to document traditional knowledge about malaria including traditional treatments, existing malaria treatment and control practices with emphasis on the traditional methods and attitudes about malaria treatment. The project contributes to Millennium Development Goal “6” of combating HIV/AIDS, malaria and other diseases.

II. STUDY AREA AND METHOD

Study area

This study was conducted in Busambira and Buseete villages in Kinambogo Parish found in Budiope County (Figure 1), Kamuli District. It is located 180 km from Kampala the capital city of Uganda, between $1^{\circ} 17' - 1^{\circ} 25' N$; $33^{\circ} 08' - 33^{\circ} 20' E$ at an altitude of about 1075 m asl. The parish has a total area of 57 km². The vegetation consists of thickets that were formally woodlands degraded (Figure 2), bushlands, woodlands and grasslands. The dominant land use is subsistence crop agriculture.

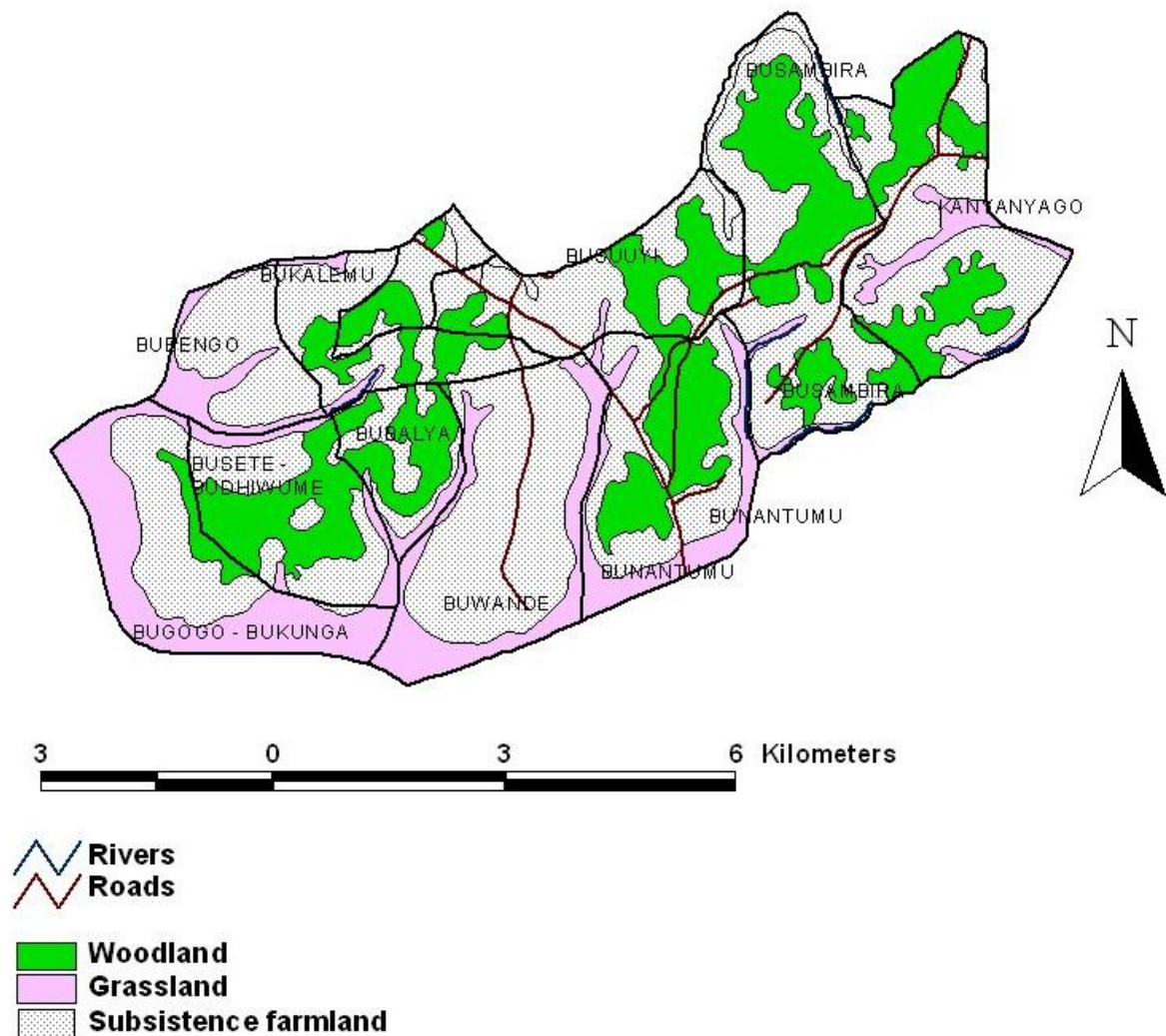


Figure 1. Map of Kinambogo Parish

The community of Kinambogo parish has close to 5200 people (91 people per km²). Of these 22% are children aged less than five years (Uganda Bureau of Statistics, un-published data). The study area is typical of other rural villages in Kamuli. The community is rural and depends on crop agriculture as its major source of livelihood. Most community members depend on subsistence farming for their livelihoods. The people are predominantly Basoga

by tribe and the main language spoken is Lusoga. The community is largely Christian (78%), Muslims constitute 13%. Buyende Sub-county has four health care centers. Two of these are owned by religious groups: Wesunire Mission Hospital and Wesunire Family Life and Education Program. The rest, Buyende and Wesunire, are public. The health units are accessible to all.



Figure 2 Thickets form part of the existing vegetation

Methods

This study was conducted between June – September 2006. A survey employing semi-structured interviews and a guided open- and close-ended questionnaire was conducted to collect the data. The interviews were conducted using a checklist of questions and were held with individuals and local area leaders (Figure 3; Annex 1). Two group discussions with community members, one in each of the study villages, complemented the interview and questionnaire survey. Participants in the group discussions were identified by the local area leaders. Traditional Medicine Practitioners were not included in the study because we were informed that no one consults them for the treatment of malaria. The questionnaire include questions on demography such as sex, age, tribe, religion, education; knowledge and attitudes about malaria such as: local names of malaria, perceptions of differences between fevers, causes of malaria, known signs and symptoms of malaria; practices for treating and preventing malaria including details of harvesting, preparation, application and dosage of malaria herbal medicines (Annex 2). The questionnaire was translated into Lusoga, the principal language spoken in the study area. We had planned to investigate the marketing of herbal medicines for the treatment of malaria; but this idea was dropped after we learned that there is no marketing of such products within the study area.



Figure 3 The author conducting an interview. In the background a typical house is shown.

The desired sample size for the questionnaire survey was determined to be 61 respondents by assuming that 80% of the community had good knowledge regarding malaria and its treatment; a desired confidence interval of 95%; and a relative error of estimation of 10%. Respondents were selected using the multistage random sampling method as follows. Buyende sub-county, the primary sampling unit, was randomly selected from among the seven sub-counties of Budiope County. From within Buyende sub-county, one parish (Kinambogo) was selected. In turn two villages Buseete and Busambira were selected from Kinambogo parish. Thirty two households were randomly selected from each village by consulting the household registers. From among the selected households, a random sample of 16 households was picked from which men were to be interviewed while the remainder constituted the women respondents. In this way 29 respondents were interviewed in Busambira LC I and 37 from Buseete. The sample consisted of 34 male and 32 female respondents. Two guides identified with the help of the local leader were hired in each village. The tasks for the guides were to locate and introduce us to the selected respondents. Additionally, observations on issues relevant to the study objectives, such as attributes of housing, drug preparation, and vegetation types, were also made.

All plant material mentioned by respondents in the study was identified in the field. A voucher specimen of each species was collected for confirmation (Figure 4) and is deposited at Makerere University Herbarium. Species nomenclature follows the Flora for Tropical East Africa. Ethical approval for this study was given by the National Council of Science and Technology Ref. HS 144. A written informed consent was obtained from the community representatives (Annex 3). The research objectives and methods were explained to

respondents before every interview. At the end of the study, the findings were presented to and discussed with the community in a workshop (Figure 5).



Figure 4 The author pressing voucher plant specimens



Figure 5 Feedback workshop with participants of Buseete village

Questionnaire survey data was entered in Excel spreadsheets. It was checked and edited for errors, and coded as described in Sarantakos (2005, p364). Thereafter, it was summarized using SPSS and reported in figures and tables. Interview data was studied and the responses were grouped into classes expressing similar ideas. The interview data helped to complement and explain the questionnaire data.

III. RESULTS

Respondents' socio-economic characteristics

Most respondents interviewed in this study lived in households headed by males; belonged to the Basoga ethnic group; and had attained little (primary or secondary level) or no formal education (Table 1). Furthermore, respondents belonged to the mainstream religions and were mostly Christians. Their main source of livelihood was peasant crop agriculture. Some engaged in livestock herding as a secondary source of income. Respondents had, on average, four young dependants (1 – 15 years; S.D. \pm 2) and one elderly dependant (> 60 years).

Table 1. Demographic characteristics of respondents (n= 66)

Characteristic	%	Characteristic	%
Household Head		Primary job	
Male	92	Peasant crop agriculture	90
Female	8	Herder	6
Tribe		Trader	2
Musoga	67	None	2
Mulalo ¹	25	Secondary job (n= 18)	
Itesoit	6	Herder	33
Mukenye	2	Peasant crop agriculture	11
Formal Education		Builder	11
None	43	Trader	11
Primary	46	Artisan	6
Secondary	11	Beer seller	6
Religion		Motorcycle taxi	6
Catholic	46	Cattle trader	6
Anglican	29	Cook	6
Muslim	12	LC I council member	6
Pentecostal ²	9		
Seventh Day Adventist	3		

¹ Mulalo is generic and refers to people who originate from Western Uganda. Those who have emigrated to the study area included immigrants belonging to the Banyoro and Banyarwanda tribes. In the study the specific tribes were not asked, because it was assumed that this could have antagonized the respondents.

² Fundamentalist belief

Common household assets included chickens, a bicycle, goats, a radio, cows, dogs and pigs (Figure 6). Most households had grass-thatched huts constructed using mud (Table 2). Many of the houses lacked windows while some had a hole provided to make a window but had no shutter. At night the hole was covered by a piece of cloth or woven mat.

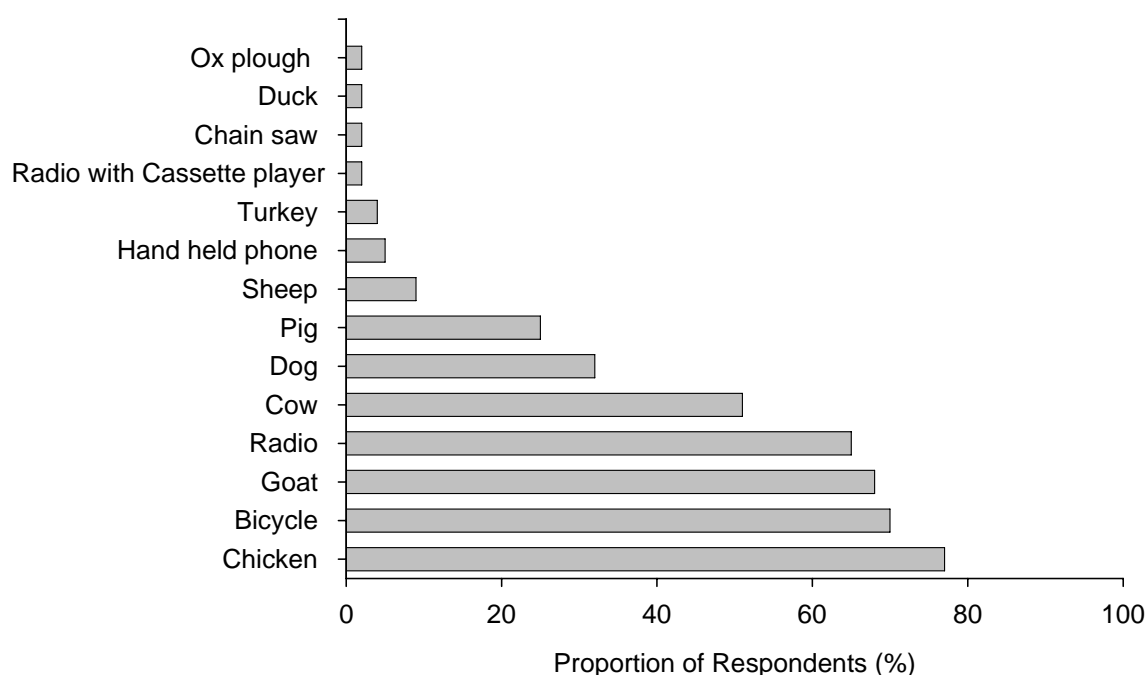


Figure 6. Common household assets: showing percentage of respondents stating ownership for the different assets (n= 66).

Table 2 Attributes of houses owned by respondents. Shown are the absolute number of respondents.

Attributes	Wall		
	Brick	Mud	Wooden
Grass roof			
Wooden window	2	9	1
Tin window	1	3	
No window	1	22	
No shutter in window	1	10	1
Iron Roof			
Wooden window	10		2
No window		1	
No shutter in window	2		

Mosquito breeding conditions

Conditions likely to favor the breeding of mosquitoes were observed in all homesteads. That is, all homesteads had large plants within 3-5 m of the house as well as pits in the compound. In addition, livestock enclosures (kralls) were within 50m of most homes (Table 3). Furthermore a good number of homesteads were in close proximity to wetlands and/or open wells.

Table 3. Attributes likely to favor the breeding of mosquito around homesteads

Attribute	%
Distance away from krall	
within 50m	67
½ km	1
More than one km	32
Distance away from wetland	
½ km	38
1 km	29
More than one km	33
Distance away from open well	
½ km	30
1 km	24
More than one km	46

Malaria Morbidity

Respondents reported suffering between 1 – 30 malaria episodes a year with a mean of six malaria attacks (Figure 7a). At the time this study was conducted 34% of the respondents were suffering from the disease; 31% had suffered an attack in the past one month (Figure 7b).

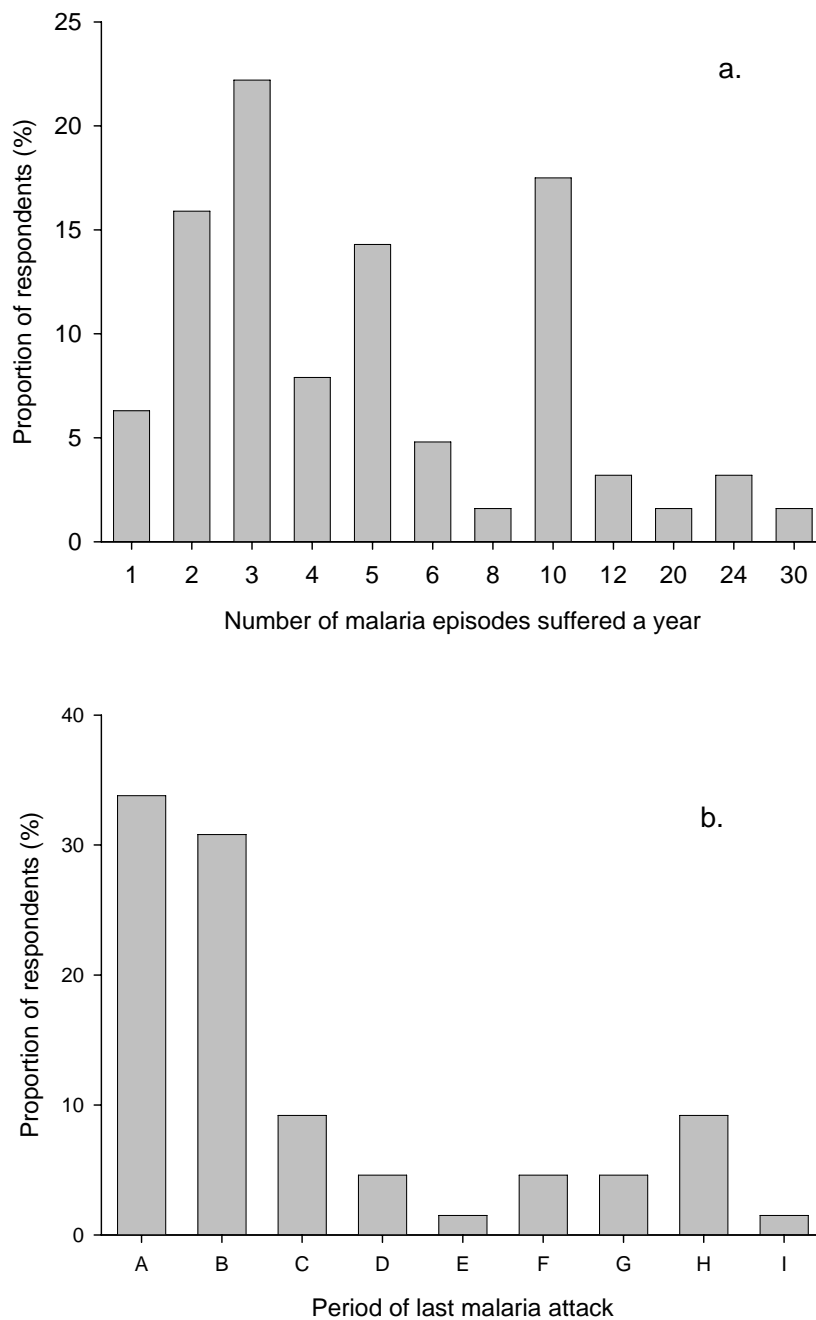


Figure 7. (a) Number of malaria episodes suffered by respondents (mean 6.17 ± 0.73 SEM). (b) period of last malaria episode reported by respondents (A= currently suffering, B = One month ago, C = Two months ago, D = Three months ago, E = Four months ago, F= Five months ago, G = Six months ago, H= More than eight months ago, I = More than a year ago).

Malaria recognition and causes of malaria

Respondents were well aware of malaria and could readily distinguish it from other fevers on the basis of recognised signs and symptoms. These include raised body temperature (hot

skin), feeling chill, joint pains, weakness, headache, lethargy, sneezing, loss of appetite, coughing, flu like symptoms and vomiting (Table 4).

Table 4. Malaria symptoms mentioned by respondents (n= 66)

Symptom	%
Fever	97
Feel chill	86
Joint pain	85
Weakness	83
Headache	83
Lethargy	82
Sneezing	82
Loss of appetite	80
Coughing	77
Flu like symptoms	61
Vomit	61
Sore throat	58
Redness of eyes	58
Shivering	55
Abdominal pain	53
Diarrhea	52
Goose pimples	49
Anxiety	47
Sores in mouth	46
Palpitations (<i>ntununsi</i>)	46
Chest pain	6
Irritability especially in babies	6
Drowsiness	5
Teary eyes	5
Anemia	3
Itching	3
pain in eye	3
Skin rash	3
Backache	2
Dehydration	2
Difficult breathing	2
Blocked nose in babies	2
Nightmares	2
Sourness in mouth	2
Sweating	2
Thirst	2

Most people knew that mosquitoes transmit malaria (Table 5); only three people did not mention malaria at all. But, many people also thought that keeping a dirty homestead or drinking dirty water led to malaria. A smaller number of respondents believed that having dense bush or pools of stagnant water close to the homestead also promoted malaria.

Table 5. Factors reported to be responsible for causing malaria

	%
Mosquitoes	96
Dirty homestead	71
Drinking dirty water	62
Dense bush	29
Pools of stagnant water	11
Swamps	9
Cold breeze	6
Broken vessels/holes	5
Working or playing under rain	5
New season foods e.g. mangoes	6
Sleeping during daytime	2
Dust	2
Poor sleeping facilities	2
Sharing eating utensils	2
Smoking tobacco	2

[†] includes human droppings (n= 3)

Malaria control and treatment

A variety of strategies are employed by respondents to stop mosquito bites. These included the burning of logs and plants such as *Albizia coriaria* or cow dung to generate smoke; filling up pits in the compound or removing material likely to promote the breeding of mosquitoes; and closing windows and doors before nightfall (Table 6). Respondents also claimed that they destroy bushes from around the homestead. But this was not observed in the study, and bush was always present and close to the homestead. Respondents also claimed the use of mosquito nets and mosquito repellants like i.e. mosquito coils.

Table 6. Practices employed to guard against mosquito bites and/or to protect households against malaria

Practice	%
Use mosquito net	77
Clear bushes close to homesteads	76
Burn mosquito coil	71
Clean houses free from dirt	70
Burn plants to create smoke to chase mosquitoes ¹	67
Clean utensils	64
Close houses early in the evening	61
Fill pits and get rid of tins broken pots where mosquitoes can harbor	64
Construct bathroom far from house	58
Clear rubbish	58
Burn logs to create smoke ²	58
Burn cow-dung	56

Cover pit latrine	55
Cover drinking water	52
Have clean drinking water	50
Plaster walls	50
Use twigs of <i>Ficus exasperata</i> as insect brush	39
Construct houses/huts without ventilation	38
Plant neem tree	36
Plant night rose	35
Indoor residual spraying with cotton insecticide	5
Cover body	3
Do nothing	3
Plant Moringa	3
Household insecticide	3
Limit consumption of new season food	2

¹ these include *Lantana camara* (Kapanga), *Cupressus lusitanica* Mill. (X-mas tree), *Albizia coriaria* Oliv. (musita), Pawpaw leaves.

² some burn saw dust or millet husks

Treatment seeking behavior

It appears that people prefer the Allopathic Medicine (AM) system for the treatment of suspected malaria. When respondents were asked how they had treated themselves the last time they suffered from malaria, they stated that they had bought drugs from the available drug shops (self medication with allopathic medicines) (Figure 8).

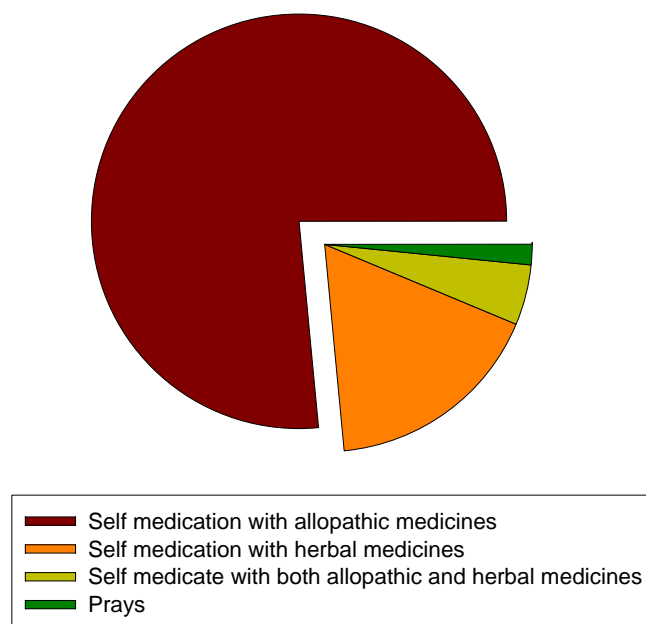


Figure 8. Treatment used during the last malaria attack.

The drugs they commonly buy are paracetamol and fansidar or chloroquine. A variety of reasons were stated by these respondents why they preferred allopathic medicine over traditional medicine (TM). The principle reason given was lack of relevant traditional knowledge to exploit herbal medicines (HMs) for the treatment of malaria or because they believed allopathic medicines to be more effective (Figure 9a).

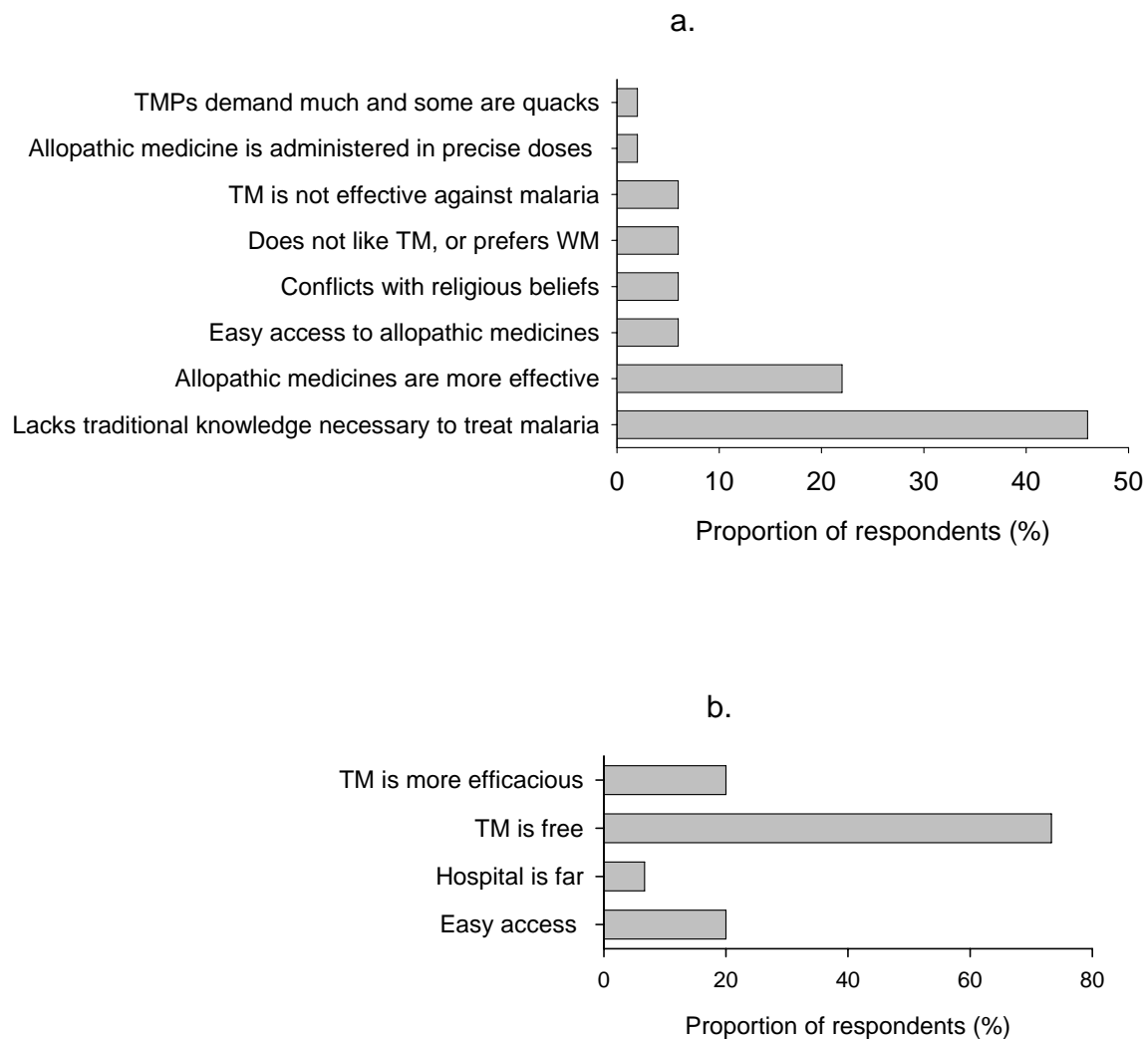


Figure 9. (a) Reason why WM is preferred over TM (n= 48). (b) Reason why TM is preferred over WM (n= 18)

Some community members stated a preference to self medication with herbal medicines (HMs). Their attitudes were determined mainly by the fact that HMs were free, were readily accessible and/or were also more effective than allopathic medicines (Figure 9b).

Respondents claimed that they do not consult Traditional Medicine Practitioners for the treatment of malaria because they know how to prepare the necessary herbal medicines themselves. The respondents also stated that they share information on malaria treatment

among themselves. Respondents reported that if the first line of treatment was not effective, then the preferred option was to visit an Allopathic Medicine Practitioner (AMP) (Figure 10).

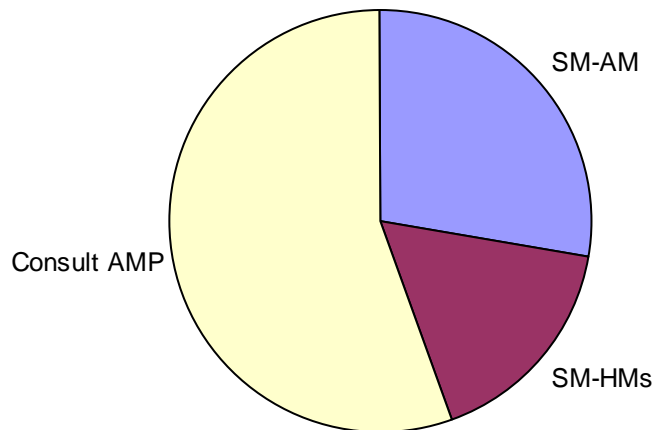


Figure 10. Preferred second line treatment for malaria (n= 36). SM-AM = Self medicate with allopathic medicines; SM-HMs = Self medicate with herbal medicines; AMP = Allopathic Medicine Practitioner.

Traditional knowledge of Herbal medicines

Only 33 people demonstrated knowledge about herbal medicines, by mentioning at least one concoction made from plants. Gender and religious beliefs appeared to influence this knowledge: almost all women knew some plants used to treat malaria (Table 7). Conversely almost all men were ignorant. All the six respondents belonging to the Pentecostal church claimed to have no knowledge of how to use HMP.

Table 7. Influence of sex and religion on possession or lack of knowledge to treat malaria using herbal medicines

	SEX	RELIGION					Total
		Catholic	Anglican	Pentecostal	Muslim	SDA	
Possess knowledge	Male	2	5		1	1	9
	female	14	6		3		23
Lack knowledge	Male	11	5	3	4	1	24
	Female	3	3	3			9

Harvesting, processing and administration of herbal medicines

Twenty seven species spread between 24 genera and 16 families were reportedly used in herbal preparations for the treatment of malaria. Most of these are woody plants (shrubs and trees; n= 17). Leaves are the parts commonly used in the preparations (n= 20 plants; Table 8). Respondents reported that plant parts for use are collected as and when they are needed, and that there were no specific times for collecting. Furthermore, there are no rituals performed during the process of collecting or processing HMs. During the harvesting process, twigs of the preferred plants are broken; then a handful of young leaves are selected (Figure 11). Roots or bark are dug up or cut off the stem, respectively.



Figure 11 Preparing *Vernonia amygdalina* material for water extract

Herbal medicines were prepared mainly as water extracts based on single plant species for oral intake (Table 9). Some were prepared as decoctions. A few preparations consisted of mixtures processed from *Vernonia amygdalina* and *Momordica foetida*; *M. foetida* + *Cannabis* sp. + *Chenopodium opulifolium*; or *Mangifera indica* and *Tamarindus indica*. The appropriate plant parts are cleaned of debris. The extracts are processed from leaves; these

are crushed and squeezed in a small amount of water until they form froth (Figure 12). Large leaf particles are removed and water added to the solution to make a volume of 500 ml. Elsewhere, a mixture of an appropriate amount of leaves, sometimes of bark or roots, from a variety of plant species are boiled in water and used as steam baths.

Doses were found to be variable and were determined according to the age of the patient. They varied between 100 – 500ml for adults; 100 – 250 for older children (more than 5 years); and 1 – 3 tablespoons for children younger than 5 years. The drugs were taken 1 – 3 times a day for a period of 1 – 3 days or until the patient's condition has improved. Prepared medicines were never kept and all that remained after use would be discarded. There was no need to keep any because the plants from which they are produced are readily available.

Most respondents who use TM indicated that it was effective. However, three of the respondents stated that they used it only as a first aid (e.g. to lower body temperature) in readiness to acquiring WM. No side effects with HMs were reported.



Figure 12. Water extract made from *Vernonia amygdalina*

Table 8. Plants commonly used for the treatment of malaria

Species; family; local name; Specimen no. ¹	Habit ²	Status ³	Habitat ⁴	Part used ⁶	No. ⁷
<i>Vernonia amygdalina</i> Delile; Asteraceae; Lubilili; JRST 566, 585	S	We	Rs, Cf	L	33
<i>Momordica foetida</i> Schumach.; Cucurbitaceae; Luiwula; JRST 567	C	We	Rs, Hg	L	12
<i>Zanthoxylum chalybeum</i> Engl.; Rutaceae; Mutala irungu; JRST 563	T	Wi	Bu	R	9
<i>Lantana camara</i> L.; Verbenaceae; Kapanga; JRST 568	S	We	E	L	9
<i>Mangifera indica</i> L.; Anacardiaceae; Muyembe; JRST 582	T	SW	Hg ⁵	L (most), Bk	7
<i>Chenopodium ambrosioides</i> L.; Chenopodiaceae; Kawuna wuna; JRST 562, 569	W	Wi		L	6
<i>Chenopodium opulifolium</i> Koch & Ziz; Chenopodiaceae; Namuvu; JRST 561	W	Wi	Hg	L	5
<i>Azadirachta indica</i> A. Juss.; Meliaceae; Neem; JRST 581	T	Cv	Cp	L	4
<i>Moringa oleifera</i> Lam.; Moringaceae; Moringa; JRST 560	T	Cv	Cp	L	2
<i>Leonotis nepetifolia</i> (L.) Ait.f.; Lamiaceae; Susuni; JRST 564	W	Wi	Rs, Cf	L	2
<i>Combretum molle</i> G. Don; Combretaceae; Ndaha; JRST 570	T	Wi	Bu, PCf	L	2
<i>Coffea canephora</i> Froehner; Rubiaceae; Mwanyi; JRST 580	S	Cv	Hg ⁵	L	1
<i>Citrus sinensis</i> (L.) Osb.; Rutaceae; Mucungwa; JRST 579	S	SW		L	1
<i>Conyza sumatrensis</i> (Retz.) E.H. Walker; Asteraceae; Kati kati; JRST 584	W	Wi		L	1
<i>Jatropha curcas</i> L.; Euphorbiaceae; Kirowa; JRST 578	S	Cv	Bm	L	1
<i>Kalanchoë densiflora</i> Rolfe; Crassulaceae; Kisanasana; JRST 577	H	Cv		L	1
<i>Flueggea virosa</i> (Willd.) Voigt; Euphorbiaceae; lukandwa; JRST 565	S	Wi	Bu, Rs	R	1
<i>Talinum portulacifolium</i> (Forssk.) Asch. ex Schweinf.; Portulacaceae; Mpozia; JRST 576	H	Wi	Rs, Cp	L	1
<i>Ocimum gratissimum</i> L.; Lamiaceae; Mujaja ; JRST 555	W	SW	Bu, Hg	L	1
<i>Albizia zygia</i> (DC.) Macbr.; Fabaceae – Mimosoïdeae; Mulongo; JRST 558	T	Wi		Bk	1
<i>Carissa edulis</i> (Forssk.) Vahl; Apocynaceae; Muyunza; JRST 572	T			R	1
<i>Acacia seyal</i> Del. var. <i>Fistula</i> (Schweinf.) Oliv. Fabaceae—Mimosoïdeae; Mweramaino; JRST 571	T			R	1
<i>Tamarindus indica</i> L.; Fabaceae – Caesalpinioïdeae; Nkoge; JRST 575	T	SW		Bk	1
<i>Cajanus cajan</i> (L.) Millsp.; Fabaceae; Nkolimbo; JRST 557	W	Cv	Hg	L	1
<i>Allium cepa</i> L.; Alliaceae; Onion	H	Cv	Hg	Bu	1
<i>Melia azedarach</i> L.; Meliaceae; Lira; JRST 574	T	Cv/SW		L	1
<i>Harrisonia abyssinica</i> Oliv.; Simaroubaceae; Lushaike; JRST 556	S	Wi	Bu, Rs	L	1

¹ JRST refers to collection numbers

² C = climber, H= herb, S = shrub, T = tree, W = woody herb

³ Cv = cultivated, We = weed, Wi = wild, SW = semi-wild

⁴ Bm = boundary marker, Bu = bush, Cf = Crop-field, Cp = compound, E = everywhere, Hg = Home garden, PCf= protected in cropfield, Rs = roadside,

⁵ Also found in a variety of habitats including compounds, roadsides, crop fields, abandoned crop fields (fallows)

⁶ Bk = bark, Bu = bulb, L = leaf, R = root

⁷ Sometimes bark and leaf used

⁸ Number of respondents mentioning use of the species for malaria treatment

Table 9. Common concoctions for the treatment of malaria, showing species, part used, preparation and route of administration. Most concoctions consist of single species except *M. foetida*, *Azadirachta indica*, *C. Opulifolium*.

Species	Part used ¹	Preparation	Administration
<i>Zanthoxylum chalybeum</i>	R	Decoction	Oral
<i>Vernonia amygdalina</i>	L	Water extract	Oral (rarely bathed)
<i>Momordica foetida</i>	L	Water extract ²	Oral
<i>Chenopodium opulifolium</i>	L	Water extract/decoction	Oral/bathe
<i>M. foetida</i> , <i>Azadirachta indica</i> , <i>C. opulifolium</i>	L	Decoction	Oral
<i>A. indica</i>	L		Oral

¹ L = leaf, R = root

² some two respondents said decoction

IV. DISCUSSION

Community Knowledge about Malaria

The community of Kinambogo had good knowledge about malaria and could readily distinguish it from other fever types on the basis of signs and symptoms.

Respondents mentioned the widely accepted malaria symptoms of fever, headache, vomiting and flu-like symptoms (Gessler et al., 1995b; Ahorlu et al, 1997; Purcell, 2004; Malaria Control Programme, 2005). Besides knowing what malaria was, the people also knew the contributory factors to malaria prevalence. In the majority of cases they stated that malaria was caused by mosquitoes, and that mosquitoes favor bush and stagnant water. According to Batega (2004), knowledge about malaria has steadily improved in Uganda, but some misconceptions still remain about the causes of malaria and symptoms of severe malaria. Such ambiguities in malaria symptoms and causative factors were also documented in this study (Tables 4 – 6).

Prevalence of Malaria

Malaria prevalence was high in the study community and corresponded with the national average of six episodes a year. At the time of the study 34% of the respondents were suffering from the disease. A high prevalence such as the one observed in this study may have a significant impact on the well being and economic potential of the community. A single malaria episode may result in the loss of 5 – 20 days of productive labor (Ministry of Health, 2006). This means, therefore, that 10 to 40 days are lost every year for an average sized family of six members with two adults. This for obvious reasons leads to lowered income earnings.

Among children, the suffering from malaria causes absence from school and lethargy when in class leading to poorer academic performance which may, in turn, lead to long term social consequences. Besides the above indirect social and economic costs, there is the direct cost of treating malaria or purchasing material to stop mosquito bites e.g. mosquito nets. The estimated cost for treating a single malaria episode is put at UGX 1420. For a family of six people suffering an average of six episodes a year, this translates into a total cost of UGX 50,000/= every year. This is equivalent to 4% of the annual household income in Kamuli District (UBOS).

The suffering from malaria and its contribution to poverty is likely to continue in the foreseeable future for three reasons. First, the disease is resistant to the most affordable, available and safe antimalarial drugs (Kilama, 2005; Sendagire et al., 2005). Out of concern for this resistance, the Ministry of Health of Uganda recently adopted the Artemisinin-based Combination Therapies (ACTs) Coartem® and Lumefantrine as the first line medicine for the treatment of uncomplicated malaria following the recommendation by the World Health Organization (MCP, 2005). Coartem® was introduced in Uganda only this year, its efficacy and performance remain to be evaluated. Secondly the conditions in Kinambogo as elsewhere in Uganda are ideal for the breeding and survival of mosquitoes. In this study it was observed that homesteads were surrounded by lush bush and the landscape had several bogs. The flight range of the mosquito *Plasmodium falciparum* is 3 km and all homes within this distance from bogs can be attacked by this mosquito (Ghebreyesus et al. 1999). The government of Uganda intends to start indoor residue spraying using the controversial pesticide DDT. DDT was sanctioned around

September 2006 for use by the World Health Organization (World Health Organization, 2006). Lastly, the infrastructure for managing malaria in Uganda as elsewhere in Africa is still weak (World Health Organization, 2004). According to respondents the few Health Care centers available to the community of Kinambogo have poorly qualified staff.

Herbal Medicines used to treat Malaria

The immense suffering and economic costs observed here and which has been described for most of the malaria endemic areas (World Health Organization, 2004) calls for extensive research and development of effective and safe antimalarials. Within a context of growing antimalarial resistance and the difficulties for households to afford and access effective antimalarials, development and promotion of phytomedicines may be the sustainable solution to malaria treatment. This focus is justified because herbal medicines are widely believed to be safe and also efficacious. Many drugs used in allopathic medicine have been derived from higher plants using leads from traditional knowledge (Farnsworth, 1990; Fabricant and Farnsworth, 2001; van Wyk and Wink, 2004). Examples of some of the most successful antimalarial agents developed from plants relying on traditional knowledge leads include quinolines and endoperoxides/artemisinin derivatives (Orwa, 2002; Waako et al., 2005).

In this study 27 species used for the treatment of malaria were documented. No side effects were reported by respondents who had used these herbal medicines. The three most commonly mentioned species were *Vernonia amygdalina*, *Momordica foetida* and *Zanthoxylum chalybeum*. The above three species have been reported in other studies for treatment of malaria (Waako et al., 2005; Tona et al., 2004; Asase et al., 2005; Gessler, 1995a) and would warrant further study to validate their claimed therapeutic properties. The doses which are widely varied would also require investigations to standardize them. These validations may be done through simple observations of the response of people taking the herbal medicines. Commonly a history of prolonged safe and apparently successful traditional use of herbal medicines provides the initial critical information for wider acceptance (Orwa, 2002; van Wyk and Wink, 2004). Promising herbal medicines identified in this way can then be subjected to phytochemical analysis and clinical trials to confirm further their efficacy and safety, and also determine recommended doses (World Health Organization, 2000).

Such validation may help to not only identify safe and efficacious antimalarials, but may also increase confidence in the use of herbal medicines. According to the World Health Organization (1987; 2000), if the claimed therapeutic effects of herbal medicines can be confirmed, then a higher level of confidence may be created among users leading to wider acceptance. From results of the present study this appears highly relevant because some respondents indicated a low level of confidence in the efficacy of HMs for the treatment of malaria. Validation of the efficacy and safety of herbal medicines can beside the above mentioned values also help create a herbal medicine market, with possibilities of adding value to medicinal plants.

Traditional Knowledge associated to malaria treatment

The exploitation of HMs is largely dependant on local Traditional Knowledges. Traditional Knowledge relevant to the treatment of malaria was found to be low and may be declining among the community because only 50% of the respondents claimed knowledge of how to treat malaria; this knowledge was almost exclusively restricted to women. This skewed knowledge was explained in one of the Focus Group Discussions, to be due to the fact that it was women who were responsible for the health care of family members, especially children. There is general consensus that TK must be conserved because of its vital role for human wellbeing. It is often argued, that, if TK is lost, exploitation of plants among other things will become difficult if not impossible. Some of the reasons TK leads are considered reliable is that indigenous communities through a period of long experimentation with herbal medicines, are likely to have discarded preparations with low efficacy or acute toxicity, and retained those that are effective and tolerably safe (Balick, 1990; Cox 1990; van Wyk and Wink, 2004).

CONCLUSIONS AND RECOMMENDATIONS

The community of Kinambogo had good knowledge about malaria. People's health seeking behavior was predisposed towards the Allopathic Medicine system either because they believed that Allopathic Medicine was more effective than Herbal Medicine or because they did not know which plants to use to treat malaria. The above notwithstanding, community members – mostly women – exploited 27 plants to prepare antimalarial herbal medicines. Three of these *Vernonia amygdalina*, *Momordica foetida* and *Zanthoxylum chalybeum* have been reported in other studies and warrant further investigation to validate their efficacy and safety. It is recommended further, that studies to standardize doses should be carried out.

Traditional Knowledge relevant for the treatment of malaria using plants is not well distributed and is mostly held by women. It may appear, therefore, as if this knowledge is weakening. There is a need to continue documenting traditional treatments of malaria countrywide before they are lost.

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REFERENCES

- Ahorlu C.K., Dunyo S. K., Afari E. A., Koram Kwadwo A. and Nkrumah F. K., 1997. Malaria-related beliefs and behaviour in southern Ghana: implications for treatment, prevention and control. *Tropical Medicine and International Health*, 2 (5): 488–499
- Asase, A., Oteng-Yeboaha A. A., Odamttena G. T., and Simmonds M. S. J., 2005. Ethnobotanical study of some Ghanaian anti-malarial plants *Journal of Ethnopharmacology* 99:273-279.
- Audibert, M., Mathonnat J. and Henry M. C., 2003. Malaria and property accumulation in rice production systems in the savannah zone of Côte d'Ivoire. *Tropical Medicine and International Health* 8:471-483.
- Balick M. J., 1990. Ethnobotany and the identification of therapeutic agents from the rainforest. In *Bioactive compounds from plants*. CIBA Foundation Symposium 154, p 22-39. John Wiley & Sons.
- Batega, D.W., 2004. Knowledge Attitudes and Practices About Malaria Treatment and Prevention In Uganda: A Literature Review. Ministry of Health, Uganda. http://www.health.go.ug/mcp/malaria_com.html accessed 7/25/2006 5:10:29 PM
- Buchanan, B. B., Grissem, W. and Jones, R.L., 2000. *Biochemistry & Molecular Biology of Plants*. American society of Plant Physiologists, Rockville, Maryland, USA.
- Cox, P.A. 1990. Ethnopharmacology and the search for new drugs. In *Bioactive compounds from plants*. CIBA Foundation Symposium 154, p 40-55. John Wiley & Sons.
- Fabricant D. S. and Farnsworth N. R., 2001. The Value of Plants Used in Traditional Medicine for Drug Discovery *Environmental Health Perspectives* 109, 69-75
- Farnsworth N.R., 1990. The role of ethnopharmacology in drug development. In *Bioactive compounds from plants*. CIBA Foundation Symposium 154, p 2-21. John Wiley & Sons.
- Gessler, M. C., Msuya, D. E., Nkunya, M. H. H., Mwasumbi, L. B., Schär, A., Heinrich, M. and Tanner, M. 1995a. Traditional healers in Tanzania: the treatment of malaria with plant remedies. *Journal of Ethnopharmacology* 48:131-144.
- Gessler, M. C., Msuya, D. E., Nkunya, M. H. H., Schär, A., Heinrich, M. and Tanner, M. 1995b. Traditional healers in Tanzania: the perception of malaria and its causes. *Journal of Ethnopharmacology* 48:119-130.
- Ghebreyesus T.A., Haile M., Witten K.H., Getachew A., Yohannes A.M., Yohannes M., Teklehaimanot H.D., Lindsay S.W. and Byass P. 1999. Incidence of malaria among children living near dams in northern Ethiopia: community based incidence survey. *BMJ*, 319:663-666
- Kilama W. L., 2005. Ethical perspective on malaria research for Africa. *Acta Tropica* 95:276-284.

- Malaria Control Programme, 2005. Management of Uncomplicated Malaria: A Practical Guide for Health Workers, 3rd Edition. Malaria Control Programme, Ministry of Health (Uganda). <http://www.health.go.ug/mcp/mt.html>
- Ministry of Health, 2006. The Burden of Malaria in Uganda. Why all should join hands in the fight against malaria. <http://www.health.go.ug/malaria.htm> accessed 06/07/2006 09:33.
- Newton, P. N., McGready R., Fernandez F., Green M. D., Sunjio M., Bruneton C., Phanouvong S., Millet P., Whitty C. J. M., Talisuna A. O., Proux S., Christophel E. M., Malenga G., Singhasivanon P., Bojang K., Kaur H., Palmer K., Day N. P. J., Greenwood B. M., Nosten F. and White N. J., 2006. Manslaughter by Fake Artesunate in Asia: Will Africa Be Next? *PLoS Medicine* 3:752-755.
- Nuwaha F., 2002. People's perception of malaria in Mbarara, Uganda. *Tropical Medicine and International Health* 7(5): 462-470
- Okokon, J. E., and Onah M. I. 2004. Pharmacological studies on root extract of *Vernonia amygdalina*. *Nigerian Journal of Natural Products and Medicine* 8:59-61.
- Orwa J. A. 2002. Herbal Medicine in Kenya: Evidence of Safety and Efficacy. *East African Medical Journal*, 341 – 342
- Purcell K., 2004. WHO Approves Artemisinin for Malaria in Africa. *HerbalGram*, 64: 19-20
- Rhee, M., Sissoko M., Perry S., Dicko A., Mcfarland W. and Doumbo O., 2005. Malaria Prevention Practices in Mopti Region, Mali. *East African Medical Journal* 82:396-402.
- Sachs J. and Malaney P., 2002 The economic and social burden of malaria. *Nature* 415, 680-685
- Sendagire, H., Kaddumukasa M., Dorothy N., Aguttu C., Nassejje M., Pettersson M., Swedberg G. and Kironde F., 2005. Rapid increase in resistance of *Plasmodium falciparum* to chloroquine-Fansidar in Uganda and the potential of amodiaquine-Fansidar as a better alternative. *Acta Tropica* 95:172-182.
- Uganda Bureau of Statistics, 2002. Iganga, Kamuli and Mbale Districts: Socio Economic Conditions based on the 1999/2000 Uganda National Household Survey, Vol II. Uganda Bureau of Statistics, Entebbe, Uganda.
- United Nations, 2005. The Millennium Development Goals Report 2005. United Nations.
- van Wyk, B-E and Wink, M. 2004. Medicinal plants of the world: an illustrated scientific guide to important medicinal plants and their uses. Timber press, Portland, Oregon, USA. pp 480.
- Waako, P. J., Gumede B., Smith P. and Folb P. I., 2005. The in vitro and in vivo antimalarial activity of *Cardiospermum halicacabum* L. and *Momordica foetida* Schumch. *Et Thonn. Journal of Ethnopharmacology* 99:137-143.
- Willcox, M. L., 1999. A clinical trial of 'AM', a Ugandan herbal remedy for malaria. *Journal of Public Health Medicine* 21:318-324.

Willcox, M. L. and Bodeker G., 2004. Traditional herbal medicines for malaria. *BMJ* 329:1156-1159.

World Health Organization, 2003. The Africa Malaria Report 2003. WHO/CDS/MAL/2003.1093, World Health Organization/UNICEF.

World Health Organization, 2006. WHO gives indoor use of DDT a clean bill of health for controlling malaria. World Health Organization. <http://www.who.int/mediacentre/news/releases/2006/pr50/en/index.html> (accessed October 5, 2006 09:33)

World Health Organization, 2000. General guidelines for methodologies on research and evaluation of traditional medicine. Geneva: WHO/EDM/TRM/2000.1.

World Health Organization, 1987. Report of the second meeting of Directors of WHO collaborating centres for traditional medicine. Geneva: WHO/TRM/88.1.

ANNEXES

Annex 1: List of Participants

Name	Sex	Village
Alex Wakabi	Male	Busambira ¹
Budala Sebwato	Male	Busambira ¹
Efulance Mukyala	Female	Busambira ¹
Franco Mukungu	Male	Busambira ¹
Grace Waiswa	Male	Busambira ¹
Helen Mwoyo	Female	Busambira ¹
Leo Kisu	Male	Busambira ¹
Moses Pande	Male	Busambira ¹
Swaibu Magolo	Male	Busambira ¹
Tanansi Isabirye	Male	Busambira ²
Yoweri Mwase	Male	Busambira ²
Dennis Ody	Male	Buseete ¹
Emmanuel Waibaka	Male	Buseete ¹
Esther Namukose	Female	Buseete ¹
Farook Binsega	Male	Buseete ¹
George Bwamiki	Male	Buseete ¹
Hasifa Tabusibwa	Female	Buseete ¹
Immaculate Nakijuuka	Female	Buseete ¹
John Bosco Kaheru	Male	Buseete ¹
Mohamed Traru	Male	Buseete ¹
Robert Mwamba	Male	Buseete ¹
Saimon Barilaine	Male	Buseete ¹
Samuel Mugulusi	Male	Buseete ³
Sosi Lusala	Male	Buseete ¹
Sulaiman Isingoma	Male	Buseete ¹
Trasicious S. Kayondo	Male	Buseete ¹
Twaha Onyindo	Male	Buseete ¹
Yowab Kirya	Male	Buseete ¹
Franco Mukungu	Male	Busambira ⁴
George Bwamiki	Male	Buseete ⁵
Robert Mayengo	Male	Busambira ⁶
Francis Tibanunuka	Male	Ikanda ⁷
Babaze Elizabeth	Female	Busambira
Babigumira	Female	Busambira
Babigumira Zainabu	Female	Busambira
Kakazi Juliet	Female	Busambira
Mukyala Efulansi	Female	Busambira
Mukyala Harriet	Female	Busambira
Nairuba Aidah	Female	Busambira
Nairuba Sarah	Female	Busambira
Nakiryia Sarah	Female	Busambira
Nanangwe Monica	Female	Busambira
Nanangwe Teo	Female	Busambira
Nangobi Ruth	Female	Busambira
Nassaazi Hajira	Female	Busambira
Bakaki Milton	Male	Busambira
Balaba Benard	Male	Busambira
Dhikusoka Raphael	Male	Busambira
Kalyemela Henry	Male	Busambira

Name	Sex	Village
Kisamo Patrick	Male	Busambira
Kulaba Nathan	Male	Busambira
Manyi Moses	Male	Busambira
Mayengo Robert	Male	Busambira
Mayengo Tom	Male	Busambira
Mugungu Sulayi	Male	Busambira
Mukasa Charles	Male	Busambira
Musungule James	Male	Busambira
Ndimukika Moses	Male	Busambira
Pande Moses	Male	Busambira
Swaga George	Male	Busambira
Tabingwa James	Male	Busambira
Babaze Annet	Female	Buseete
Balinabyo Jesca	Female	Buseete
Buliro Margret	Female	Buseete
Katembe Sarah	Female	Buseete
Kayanga Betty	Female	Buseete
Kutala Justine	Female	Buseete
Mugulusi Margret	Female	Buseete
Mukyala Jane	Female	Buseete
Mutalage Irene	Female	Buseete
Nabirye Rebecca	Female	Buseete
Nalugonda Annet	Female	Buseete
Nampiina Tabitha	Female	Buseete
Namukose Veronica	Female	Buseete
Namuli Juliet	Female	Buseete
Namulondo Sarah	Female	Buseete
Namwase Eseza	Female	Buseete
Nanangwe Rose	Female	Buseete
Nankoma Hadija	Female	Buseete
Talimukaza Sylvia	Female	Buseete
Bwanga Wilson	Male	Buseete
Eryanu David	Male	Buseete
Gubi Robert	Male	Buseete
Gwayo Martin	Male	Buseete
Kagoda Fred	Male	Buseete
Kasozi William	Male	Buseete
Katabarwa Moses	Male	Buseete
Kibiina Wilson	Male	Buseete
Kintu Buluhani	Male	Buseete
Kyawe Nathan	Male	Buseete
Mawerere Evalantini	Male	Buseete
Mawerere Hasan	Male	Buseete
Mugabo Martin	Male	Buseete
Mugulusi Stephen	Male	Buseete
Nadhoni Peter	Male	Buseete
Okello Joseph	Male	Buseete
Omoko James	Male	Buseete
Onyido Twaha	Male	Buseete
Huzaifa Mawalele	Male	Buseete ¹
Peterson Bateganya	Male	Buseete ¹
Mariam Nakato	Female	Buseete ¹
Eseza Bogere	Female	Buseete ¹

Name	Sex	Village
Martin Mugabo	Male	Buseete ¹
Jessica Balinabyo	Female	Buseete ¹

Notes

¹ participated in Focus Group Discussion

² Individual interview respondent

³ Guide

⁴ LCI Chairman Busambira

⁵ LCI Chairman Buseete, Guide

⁶ LCII Secretary

⁷ LCIII Chairperson - Buyende