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Traditional healers in Tanzania: the treatment of malaria with plant remedies

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Abstract

In order to collect ethnobotanical information about antimalarial plants which is essential for the further evaluation of the efficacy of plants as antimalarial remedies, we investigated the management of malaria with traditional herbal remedies, including the use, preparation and administration, by traditional healers in Tanzania. Interviews with traditional healers were conducted in different rural and urban places in Tanzania: in the Kilombero valley (Kilombero/Ulanga District), on the main island of Ukerewe (Ukerewe District), in the region near Bukoba town (Bukoba District), and in the settlement of Dar es Salaam (largest city in Tanzania). The results of the study show that all traditional healers treat malaria with herbal remedies consisting of one to five different plants. The list of plants which they use for antimalarial treatment contains a large number of species from different families. Multiple citations of plants by different healers were rare. Most of the respondents attributed to the plants mentioned, or to the remedies made from them, specific effects and sometimes side effects, explaining and illustrating their use or non-use for different patients or manifestations of the disease/illness.

Keywords: Traditional healers; Traditional medicine; Antimalarial plants; Traditional remedies; Malaria; Antimalarials; Preparation of remedy; Dosage; Administration; Pharmacological effects

1. Introduction

In countries like Tanzania a growing interest exists in using traditional and indigenous health care resources. Governmental policies aim at guaranteeing recognition of the importance of herbs, and their preservation as part of the country's resources, and also stress the passing on of knowledge about the use of plants to the younger generation to guard it against loss of such information. Furthermore is has been announced that the collaboration of traditional healers is sought to

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explore the possibility of using ancestral medicines in modern practice and for the development of new drugs (Temba, 1991). In this context the evaluation of the efficacy and safety of traditional remedies represents a priority. Plant remedies which are safe may be considered by health authorities as a promising approach in combatting diseases at the primary health care level (Akerele, 1993; Sofowora, 1993). Much information about possible effects and the safety of traditional remedies may already be gained from ethnobotanical and ethnomedicinal approaches (Vogel, 1991; Cox and Balick, 1994).

The use of indigenous plants plays an important role in the treatment of a variety of disorders and is reflected by intensive ethnobotanical studies (Haerdi, 1964; Hedberg et al., 1982; Chhabra et al., 1987). However, few data are available to assess the extent to which plant remedies are still used in the traditional treatment of malaria, and what concepts underlie the preparation of a remedy specifically used for malaria patients.

In this study we aimed at obtaining specific information about which plants and plant parts are used for antimalarial remedies, how the plant material is collected and processed to remedies, and finally how the remedies are administered, and to whom. In order to collect such information, interviews with traditional healers were conducted in different rural and urban areas in Tanzania.

2. Materials and methods

2.1. Study areas

Kilombero- and Ulanga District: Both districts are located along the Kilombero valley, approximately 320 km inland from the coast. The valley (270 m above sea level) which is 250 km long is framed on three sides by mountain ranges. The extension of the valley can be up to 60 km wide. The grassland changes with altitude towards the hills to tree savanna and evergreen mountain forest at higher levels. The climate is characteristic of the sub-Sahel zone with a long dry season (June–November), a short rainy season (December–January) and a longer rainy season (March–May). The temperatures are tropical, and there is around 1000–2000 mm annual rainfall. The area has a variety of different ethnic groups. It is inhabited mainly by the Ndamba, Mbunga, Pogoro, Bena, Ngindo, Ngoni-Ndendeule and Hehe. The majority of the population are nominally Christian or Muslim. Farming is the main economic activity (Jätzold and Baum, 1968). The study was based in Ifakara, the most important town of this region, and from there several visits to villages in different directions were undertaken.

Ukerewe/Bukoba: The district Ukerewe consists of a number of densely populated islands in the south-eastern part of the Lake Victoria and belongs to the region of Mwanza. Ukerewe, the main island, is 50 km long and 12–23 km wide and lies 1200–1300 m above sea level. The annual rainfall is slightly more than 1000 mm with two rainy seasons: the short one from October until January, and the major one from March up to May. The population lives mainly from the income of agriculture and fishing. Among the different ethnic groups are the Jita; Kerewe, Ruri, Sukuma, Zinza and Haya. Studies were undertaken in the town Nansio and in surrounding villages.

The district Bukoba belongs to the region of Kagera and lies on the borders to Uganda, Rwanda and Burundi, on the shore of the Lake Victoria. Interviews and plant collection were made in the neighbourhood of Bukoba town. Annual rainfall is more than 1600 mm. The land is very fertile with big banana plantations. Coffee and fishing are important sources of income. The dominant ethnic group is the Haya. Bukoba belongs to an area which accounts for a high share of the total Tanzanian population and production of marketed food and export crops. (Havnevik et al., 1988; Schär and Mutakyawa, 1988).

Dar es Salaam: Dar es Salaam, the largest and most important city in Tanzania, with an estimated population of nearly two million, lies on the coast of the Indian ocean. The rainy season starts here already in November, with a break in January and February, and continues in March up to May. It has an annual rainfall of 1000–1200 mm. Pull factors of urbanization bring many people from other parts of the country to Dar es Salaam, resulting in an ethnic mix. The original inhabitants of this part of the country are the Zaramo (Swantz, 1990).

2.2. Methods used in the interviews with traditional healers

A semi-structured interview form was used to obtain information from traditional healers on social and demographic variables, and knowledge and concepts related to the treatment of malaria. The questionnaire contained mainly open-ended questions. After careful formulation of the questions, the questionnaire was translated into Kiswahili and then retranslated into English by another person.

Traditional healers (*waganga ya kienyeji, waganga ya jadi*) were identified by convenience sampling, i.e. with the help of colleagues from the University in Dar es Salaam or from the Ifakara center, through recommendations of an ethnologist and private persons living in Tanzania, and most often in rural regions through villagers who were asked about the local traditional healers.

The interviews were conducted by a Tanzanian medical student, in Kiswahili, under the supervision of the principal author. A few times an additional interpreter for a Bantu language was needed. The responses were noted at the interview both in Kiswahili and English, and were recorded on a tape with the permission of the interviewed healers.

The questionnaire addressed the following issues:

(1) demographic profile: age, sex, ethnic group, religion and education of traditional healers;

(2) traditional antimalarial remedies;

— plants used for antimalarial remedies,

— collection, use and storage of plant material,

— preparation, application and dosage of the remedies,

— specific effects and side effects of the plant remedies,

— trying new plant remedies for the treatment of malaria,

— the use of chloroquine.

In total, 25 interviews were conducted. Twelve interviews were carried out in Kilombero and Ulanga Districts, 8 in Ukerewe, 1 in Bukoba and 4 in Dar es Salaam.

2.3. Plant material

Unfortunately it was not possible to get plant material of all the plants mentioned by the traditional healers. Therefore, in this paper we discuss in detail only those plants which could be collected immediately after the interviews and of which herbarium voucher specimens exist.

The herbarium specimens were identified by Mr. L.B. Mwasumbi at the herbarium of the Department of Botany at the University of Dar es Salaam and by Dr. F. Haerdi in Basel. Voucher specimens (collection numbers: Gessler 9–138) are deposited at the herbarium in Dar es Salaam and at the herbarium of the 'Institut für Pharmazeutische Biologie' in Freiburg (Germany).

3. Results and discussion

3.1. Demographic data

The details of the data are listed in Table 1. The age distribution of the 25 traditional healers interviewed shows that they were predominantly older members of the community. The group of interviewed persons had a larger number of males, 21, as compared to 4 females. All in all, 16 different ethnicities were represented in the study. Fourteen of the healers were Christian, 8 were Muslim and 3 said they adhered to no formal religion. As to the level of education, 5 had no school education, 15 had some primary education and 5 had experienced secondary education.

3.2. Plants used for antimalarial remedies

All of the 25 traditional healers reported that they use plant remedies (dawa ya miti) for the treatment of malaria. Each of them gave information about between 1 and 5 plants. Plant species identified with herbarium specimens are listed in Table 2. In Table 3 the identified plants are listed according to their Bantu names.

Most of the plants mentioned (69 in total) were reported only once. *Azadirachta indica* (Mwarobaini), which is a well known folk medicinal plant, was cited by 4 different traditional healers, to be used singly or in combination with other plants. It is a popular belief that Mwarobaini can heal up to 40 different health problems, and it is used all over Africa (Agyepong, 1992; Aikins et al.,1994). *Abrus precatorius* (Orututi), *Cassia aff. abbreviata* (Mlengefu or Mmulimuli), *Cassia didymobotrya*

Table 1
Demographic data of the 25 traditional healers

District	Religion	Sex	Age	Ethnicity	Formal education[a]
Kilombero	Christian	Male	49	Mhehe	None
Kilombero	Christian	Male	53	Mhehe	Standard IV
Kilombero	Christian	Male	30	Mbenamange	Form IV
Kilombero	Muslim	Male	55	Mngoni	Standard VII
Kilombero	Muslim	Male	62	Mngindu	None
Kilombero	Muslim	Male	38	Mpogoro	Standard II
Kilombero	None	Male	49	Mndwewe	Standard IV
Ulanga	Christian	Female	52	Mpogoro	None
Ulanga	Christian	Male	52	Mpogoro	Standard IV
Ulanga	Muslim	Female	37	Mbunga	Standard III
Ulanga	Muslim	Female	55	Mpogoro	None
Ulanga	Muslim	Male	35	Mngindo	Standard II
Ukerewe	Christian	Male	40	Mzinza	Standard IV
Ukerewe	Christian	Male	42	Mhaya	Form VI
Ukerewe	Christian	Male	75	Msukuma	Standard IV
Ukerewe	Christian	Male	71	Mruri	Standard IV
Ukerewe	Christian	Male	53	Mkerewe	Standard VIII
Ukerewe	Christian	Male	56	Mkerewe	Form III
Ukerewe	None	Male	45	Mjita	Form IV
Ukerewe	None	Male	47	Msukuma	None
Bukoba	Christian	Female	42	Mhaya	Standard IV
Dar es Salaam	Christian	Male	46	Msamba	Standard VII
Dar es Salaam	Christian	Male	58	Mbondei	Form VI, university
Dar es Salaam	Muslim	Male	31	Mgindo	Standard VII
Dar es Salaam	Muslim	Male	32	Mzaramo	Standard VII

[a]Standards, primary education; form, secondary education.

(Mchwelambogo) and *Cissampelos mucronata* (Makuta gambewa or Mulibata; Fig. 1) were mentioned 2–3 times. Multiple citations were particularly found within the same study area. There was no definite tendency for the plants mentioned to belong to any particular family.

Roots are the plant part most frequently used, followed by leaves and stem bark. Chhabra et al. (1993) also found in a study in Tanzania that the roots were the most prominent plant part used to prepare remedies.

Some of the healers could attribute different modes of action and different targets for improving the well-being of the patient to different plants they used, or to different remedies consisting of different plants (Table 3 and also section 3.5. 'specific effects and side effects of the plant remedies').

The following examples and notes demonstrate and summarize the manifold utilization and combination of plants for the preparation of antimalarial remedies. However, there is no universal or commonly used procedure. Everything is handled very much on the individual level:

(1) Most often different parts of the same plant are recommended to be used for treating malaria, e.g. the leaves and the roots of *Vepris lanceolata* (Mwingajini; Fig. 2), or the stem bark and the root bark of *Maytenus senegalensis* (Mnyabuliko; Fig. 3). This could be due to certain uniform healing properties shown in taste, odour or medicinal reactions. Some parts are considered to be stronger than others and the selection of the part to be used depends on the condition of a patient.

Another observation made is that the woody parts of a plant are prepared most often for an oral administration and the leaves, or their juices, are rather applied externally.

(2) With some plants, only selected parts of a

Table 2
Scientific names of the plants with herbarium specimen

Family	Plant species	Coll. No.	Bantu name	Antimalarial activity tests		No. of reported used as anti-malarials
				In vitro	In vivo	
Amaranthaceae	*Alternanthera tenella* Colla var. *bettzickiana* (Regel) Veldk.	121	Oburunga	—	—	1
Anacardiaceae	*Pseudospondias microcarpa* (A. Rich.) Engl.	123	Omuziru	—	—	1
Apocynaceae	*Diplorhynchus condylocarpon* (Muell. Arg.) Pichon	105	Mtogo	—	—	1
Bignoniaceae	*Kigelia africana* (Lam.) Benth.	115	Mzungute	(b)	—	1
Chrysobalanaceae	*Parinari excelsa* Sabine	41	Kinazi	(a)	—	1
Caesalpiniaceae	*Cassia aff. abbreviata* Oliv.	61/107	Mlengefu, Mmulimuli	(a)	—	2
Caesalpiniaceae	*Cassia occidentalis* L.	117	Mwitanzoka	(b)	—	1
Caesalpiniaceae	*Cassia didymobotrya* Fres.	113	Mchwelambogo	—	—	3
Caesalpiniaceae	*Cassia obtusifolia* L.	118	Itakiri	—	—	1
Celastraceae	*Maytenus senegalensis* (Lam.) Excell	120	Mnyabuliko	(a)	(c)	1
Cucurbitaceae	*Momordica foetida* Scrum. et Thonn.	51	Lisoyuii	(a)	—	1
Ebenaceae	*Diospyros zombensis* (B.L. Burtt) F. White	53	Nyakatidu	(a)	—	1
Euphorbiaceae	*Drypetes natalensis* (Harv.) Hutch.	124	Omushasha	—	—	1
Fabaceae	*Erythrina sacleuxii* Hua	52	Muhemi	(a)	(c)	1
Fabaceae	*Abrus precatorius* L.	109/112	Orututi	—	—	2
Labiatae	*Hoslundia opposita* Vahl	126	Nzitoima	(b)	—	1
Labiatae	*Ocimum basilicum* L.	110	Nyabahengele	—	—	1
Menispermaceae	*Cissampelos mucronata* A. Rich.	108/127	Makuta gambewa, Mulibata	(a)	(c)	2
Myrtaceae	*Psidium guajava* L.	9	Mpera	(a)	—	1
Myrtaceae	*Syzygium cordatum* Hochst. ex Krauss	125	Mugege	—	—	1
Rubiaceae	*Crossopteryx febrifuga* (G. Don) Benth.	111	Mtundwambezo	(b)	—	1
Rubiaceae	*Psychotria kirkii* Hiern	101	Not known	—	—	1
Rubiaceae	*Gardenia vogelii* Planch.	114	Entarama	—	—	1
Rutaceae	*Vepris lanceolata* (Lam.) G. Don	128	Mwangajini	(a)	(c)	1
Rutaceae	*Zanthoxylum chalybeum* Engl.	119	Ntareyeirungu	(a)	(c)	1
Sterculiaceae	*Dombeya shupangae* K. Schum.	54	Mutowo	(a)	—	1
Umbelliferae	*Steganotaenia araliaceae* Hochst.	116	Mgurukwanoni	—	—	1

(a), In vitro antimalarial activity published in Gessler et al. (1994a); (b), in vitro antimalarial activity published in Weenen et al. (1990); (c), in vivo antimalarial activity published in Gessler et al. (1994b).

Table 3
Antimalarial plants, their combination, preparation and effects

Vernacular name	Plant part	Preparation	Application	Effects[a]	Known severe side effects in overdosage R: reduced dosage
Entarama L: Kikerewe S: *Gardenia vogelii* Planch.	Root bark	Decoction	Orally	Anaemia ↓, appetite ↑, weakness ↓	—
Itakiri L: Kikerewe S: *Cassia obtusifolia* L.	Leaves	Decoction	Orally	Temperature ↓	—
Lisoyuii L: Kihehe S: *Momordica foetida* Schum. et Thonn.	Leaves	Infusion	Orally	Temperature ↓	—
Kinazi L: Kihaya S: *Parinari excelsa* Sabine	Stem bark	Decoction	Orally	Number of parasites ↓	—
Makuta gambewa L: Kipogoro S: *Cissampelos mucronata* A. Rich. M: Optional with Mlengefu	Roots	Decoction or powder	Orally	Temperature ↓	Abortion, R: reduced dosage for pregnant women and children
Mchwelambogo L: Kikerewe S: *Cassia didymobotrya* Fres.	Root bark: Leaves:	Decoction Squeezed juice	Orally	Temperature ↓, condition ↑	—
Mchwelambogo L: Kikerewe S: *Cassia didymobotrya* Fres.	Root bark and leaves	Infusion	Orally	Temperature ↓, headache ↓, condition ↑	R: reduced dosage for pregnant women and children
Mchwelambogo L: Kikerewe S: *Cassia didymobotrya* Fres. M: Mtundwambezo and Orututi	Root bark	Decoction	Orally and inhaled	Appetite ↑, anaemia ↓, number of parasites ↓ temperature ↓,	—
Mgurukwanoni L: Kikerewe S: *Steganotaenia araliaceae* Hochst	Stem bark	Infusion	Orally	Temperature ↓	—
Mlengefu L: Kibenamenga S: *Cassia abbreviata* Oliv. (see also Mmulimuli) M: Optional with Makuta gambewa	Roots	Decoction or powder	Orally	Temperature ↓	Abortion, R: reduced dosage for pregnant women and children
Mmulimuli L: Kihehe S: *Cassia abbreviata* Oliv. M: Optional with Mtogo	Root bark: Leaves:	Decoction Squeezed juice	Orally	Symptom ↓	—
Mnyabuliko L: Kihaya S: *Maytenus senegalensis* (Lam.) Excell	Root and stem bark	Decoction	Orally	Number of parasites ↓	—
Mpera L: Kiswahili S: *Psidium guayava* L M: Mwarobaini	Leaves, root and stem bark	Decoction	Orally	Joint pains ↓	R: reduced dosage for pregnant women and children

Table 3 (continued)

Vernacular name	Plant part	Preparation	Application	Effects[a]	Known severe side effects in overdosage R: reduced dosage
Mtogo L: Kiswahili S: *Diplorhynchus condylocarpon* (Muell. Arg.) Pichon M: Optional with Mmulimuli	Root bark: Leaves:	Decoction Squeezed juice	Orally	Symptoms ↓	—
Mtundwambezo L: Kikerewe S: *Crossopteryx febrifuga* (G. Don) Benth. M: Mchwelambogo, Orututi	Stem bark	Decoction	Orally and inhaled	Appetite ↑, anaemia ↓, number of parasites ↓, temperature ↓	—
Mugege L: Kihaya S: *Syzygium cordatum* Hochst ex Krauss	Root bark	Decoction	Orally	Symptoms ↓	—
Muhemi L: Kihehe S: *Erythrina sacleuxii* Hua M: Mutowo, Mwarobaini, Nyakatidu	Roots and leaves	Infusion or decoction	Orally	Temperature ↓	—
Mulibata L: Kihaya S: *Cissampelos mucronata* A. Rich	Leaves	Decoction	Orally	Diarrhoea ↓, jaundice ↓	—
Mutowo L: Kihaya S: *Dombeya shupangae* K. Schum. M: Muhemi, Mwarobaini, Nyakatidu	Roots and leaves	Infusion or decoction	Orally	Parasites get drunk	—
Mwarobaini L: Kiswahili S: *Azadirachta indica* A. Juss.	Roots, stem bark and leaves	Infusion	Orally	Number of parasites ↓, sedation ↑	Palpitation
Mwarobaini L: Kiswahili S: *Azadirachta indica* A. Juss. M: Muhemi, Mutowo, Nyakatidu	Roots and leaves	Infusion	Orally	Parasites get drunk	Danger of abortion R: reduced dosage for pregnant women and children
Mwarobaini L: Kiswahili S: *Azadirachta indica* A. Juss. M: Mpera	Root and stem bark, leaves	Decoction	Orally	Joint pains ↓	—
Mwarobaini L: Kiswahili S. *Azadirachta indica* A. Juss.	Roots	Decoction	Orally	Number of parasites ↓	—
Mwingajini L: Kizigua S: *Vepris lanceolata* (Lam.) G. Don	Roots and leaves	Decoction	Orally and externally	Temperature ↓	Peptic ulcers, R: reduced dosage for pregnant women and children
Mwitanzoka L: Kikerewe S: *Cassia occidentalis* L.	Leaves	Infusion	Orally	Temperature ↓	—
Mzungute L: Kikerewe S: *Kigelia africana* (Lam.) Benth. M: Optional with Mutowo	Stem bark	Infusion	Orally	Temperature ↓, headache ↓, patient's condition ↑	R: reduced dosage for pregnant women and children

Table 3 (continued)

Vernacular name	Plant part	Preparation	Application	Effects[a]	Known sever side effects in overdosage R: reduced dosage
Ntareyeirungu L: Kihaya S: *Zanthoxylum chalybeum* Engl.	Root and stem bark, leaves	Decoction	Orally	Number of parasites ↓	R: reduced dosage for pregnant women and children
Nyabahengele L: Kikerewe S: *Ocimum basilicum* L. M: Together with tea leaves and sugar	Whole plant	Decoction	Orally and externally	Number of parasites ↓, anaemia ↓, appetite ↑	—
Nyakatidu L: Kihehe S: *Diospyros zombensis* (B.L. Burtt) F. White M: Muhemi, Mutowo, Mwarobaini	Roots and leaves	Infusion or decoction	Orally	Parasites get drunk	—
Nzitoima L: Kihaya S: *Hoslundia opposita* Vahl	Root bark	Decoction	Orally	Number of parasites ↓	—
Oburungu L: Kikerewe S: *Alternanthera tenella* Colla var. *bettzickiana* (Regel) Veldk.	Leaves	Squeezed juice	Orally	Temperature ↓, patient's condition ↑	—
Omushasha L: Kihaya S: *Drypetes natalensis* (Harv.) Hutch.	Stem bark and leaves	Decoction	Orally	Temperature ↓	—
Omuziru L: Kihaya S: *Pseudospondias microcarpa* (A.Rich.) Engl.	Leaves	Squeezed juice	Orally	Symptoms ↓	—
Orututi L: Kikerewe S: *Abrus precatorius* L.	Roots	Decoction	Orally	Appetite ↑, diuretic, number of parasites ↓	—
Orututi L: Kikerewe S: *Abrus precatorius* L. M: Mchwelambogo, Mtundwambezo, Orututi	Root bark	Decoction	Orally and inhaled	Appetite ↑, temperature ↓, anaemia ↑, number of parasites ↓	—
S: *Psychotria kirkii* Hiern	Roots	Decoction	Orally	Temperature ↓, appetite ↑	Abortion, R: reduced dosage for pregnant women and children

L, local language; S, scientific name; R, reduced dosage; M, combined with other plants.
[a]The arrows describe the progress of the symptoms and signs: ↑ increasing, ↓ decreasing.

Fig. 1. *Cissampelos mucronata* (Menispermaceae).

Fig. 3. *Maytenus senegalensis* (Celastraceae).

plant are used, e.g. only the stem bark of *Kigelia africana* (Mzungute), or only the stem bark of *Parinari excesa* (Kinazi). The concentration of the active compounds can vary significantly between different parts of a given plant. In the examples given above, the active compounds are probably concentrated in the plant parts mentioned.

(3) Some plants are considered powerful enough to cure malaria on their own, and are used singly, e.g. *Zanthoxylum chalybeum* (Ntareyeirungu; Fig. 4), or *Cassia obtusfolia* (Itakiri).

(4) Other plants are used only in combination with other plants, e.g. *Psidium guayava* (Mpera) or *Erythrina sacleuxii* (Muhemi). To both certain effects are attributed, like reducing joint pains, or lowering the temperature, respectively. These plants are therefore used in combination with other ones because each is considered to effect only a part of the recovery of the patient. However, in some cases several plants are taken in a mixture because the traditional healers learned it this way. They may not be aware of the reasons for the combination, but just know the total effects of the remedy.

(5) There are plants which are used either in combination with other plants or alone, e.g. *Diplorhynchus condylocarpon* (Mtogo), *Cassia didymobotrya* (Mchwelambogo), or *Cassia aff. abbreviata* (Mmulimuli). These plants are reported to cure the patients in general or to make the symptoms disappear. When the condition of a patient is serious other plants which make the remedy more active can be added.

Some of the plants (Table 2) have been tested for

Fig. 2. *Vepris lanceolata* (Rutaceae).

Fig. 4. *Zanthoxylum chalybeum* (Rutaceae).

antimalarial activity in vitro (Gessler et al., 1994a for details). In general they showed high activities. Among the most active ones, showing 50% growth inhibition of *Plasmodium falciparum* at concentrations (IC_{50}) of (< 1 μg/ml) were fractions of *Cissampelos mucronata* (Makuta gambewa; Fig. 1), *Maytenus senegalensis* (Mnyabuliko; Fig. 3), and *Zanthoxylum chalybeum* (Ntareyeirungu; Fig. 4). In vivo tests with mice indicated, furthermore, that some of the active fractions of plants, such as *Maytenus senegalensis* and *Vepris lanceolata* (Fig. 3) have also a good efficacy under in vivo conditions. However, the cytotoxicity in vitro against human cell lines was in general rather high (Gessler et al., 1994b).

3.3. Collection, use and storage of plant material

Interestingly, only one of the healers mentioned that it is important to collect the plant material at a certain time (dry season) and only four considered the place as an important factor. From other studies, in Ethiopia, it is known that the collection time can be an important issue and some plants are considered only to have their full therapeutic effect if they are collected early in the morning or during a certain season (Abebe, 1984). Swantz (1990) describes for the Zaramo in Dar es Salaam that it is believed that traditional remedies are only effective if the plants are collected in a certain day time or moon cycle.

The healers in the study areas usually do not grow medicinal plants in their gardens or fields; they collect most of their drugs from wild plants found in different places. Sometimes these places are several days' journey away from their homes. In cases where the collecting places are very far away or difficult to get to, they normally do not go more than twice a year. They collect a big stock and dry the material to store it for later use.

Strict use of only fresh or dried plant material was mentioned by only five and six persons, respectively. All the others use both, depending also on the availability of the plants. Much of the plant material (especially root and stem bark) is air-dried and stored over long periods. As storage containers, glass bottles and plastic containers are among the most popular. The traditional calabashes are not very widely used any more.

3.4. Preparation, application and dosage of the remedies

The traditional remedies are very often freshly prepared (to make a personal medicine) specifically for one patient. A remedy can consist of different plant parts (Table 3). Seven of the respondents mentioned using more than one plant for every antimalarial remedy.

The remedies are most often prepared as a decoction or as an infusion, as a powder which is added to the food, or less frequently as pure leaf juice. External application is used in a few cases in addition to the oral application of the same remedy (e.g. leaves or roots of *Vepris lanceolata*, Fig. 2, or the whole plant of *Ocimum basilicum*). Decoctions are prepared by placing the plant material in cold water, bringing it to the boil and simmering it for about 15 min. Infusions are made by adding a small amount of powder into a glass or cup of hot water. There are medicines where an incantation, which conjures up forces into a medicine, is required to give the effect desired. Not everybody is able to prepare a traditional medicine; it needs the power, knowledge and skills of the traditional healer to prepare it properly.

Every healer has his own methods to determine the dosage of the traditional remedies. Very often kitchen utensils like cups, glasses, or spoons are used. The dosage of a remedy depends mainly upon the drug to be administered, the sex and the age. Especially pregnant women and children get different dosages. All of the respondents give smaller dosages to children than to adults. Eleven of the healers treat pregnant women with a lower dose than the one for men, and one administers a lower dosage to all women. The duration of the treatment varies depending on the remedy and the severity of the health condition, normally between 3 and 7 days.

The following example gives an impression of how the preparation and dosage of an antimalarial remedy is done.

The plant material (roots or leaves) of Nyakatidu, Mwarobaini, Muhemi and Mutowo has firstly to be dried and pounded. The powders of each of the plants are then mixed in a ratio of 1:1:1:1. One teaspoon of this mixed powder is put in a half a liter of water until it boils. The resulting

decoction has then to be swallowed. Men and women have to drink 1/2 of a teacup of the decoction 3 times a day, pregnant women get 2 foodspoons and children under 2 months 1 teaspoon of the decoction 3 times a day. The treatment is finished after 3 days.

3.5. Specific effects and side effects of the plant remedies

Only a few healers responded to the question about specific effects of the remedies with a rather unspecific answer, like 'the symptoms of malaria disappear'. This may indicate that the treatment with herbal plants include other aspects in relation to their own medical system which could not be detected with the approach used. The majority of respondents attributed a particular effect to every plant they use, singly or in a mixture (see Table 3). The number of different effects was interestingly high. The most common ones included, in descending frequency, the reduction of temperature, the killing of parasites, the improvement of the appetite and the reduction of anaemia, and the relief of pain. One healer considered that one of his plants was able to stop the multiplication of the parasites.

When asked about side effects only two of the respondents were aware of side effects occurring with their remedies. When asked about what might happen if the patient were to get twice the normal dosage, eighteen admitted that side effects could then be observed (Table 4). However, the healers said that normally side effects should not occur because they supervise the dosage and administration of their remedies, and they also have restrictions on which patients may take a certain kind of drug. A potentially very serious side effect for pregnant women is the risk of abortion. The awareness of this risk is demonstrated by the different dosage schedules used by some of the healers for pregnant women (see section 3.4).

Table 4
Possible side effects of the remedies in case of overdosage (multiple answers possible)

Dizziness	7
Vomiting	6
Abortion	5
Diarrhoea	3
Feeling sleepy	2
Abdominal pains	2
Fast heart-beat	2
Loss of appetite	1
Peptic ulcers	1

3.6. Trying new plant remedies for the treatment

Many healers reported that they get information about new plants from their ancestor spirits during sleep (mentioned 14 times). This often happens in connection with patients for whom the medicinal plants usually used have not been successful. The traditional healers also communicate sometimes with other healers about what they use and how they administer the remedies (mentioned by 11). This information exchange can take place in more or less loosely organized healers' associations, or with close friends. In most cases the collaborating healers do not live in the same village. If they were to practise too close together they would face competition and rivalry. Two healers had been given more medicinal plant knowledge by living family members. Four of the respondents try actively to find new plants for treatment. They experiment with unknown plants, or with plants they have used until now for other ailments. This shows that traditional healers' treatment is not inflexible. New knowledge and practices are searched for, and also continually incorporated. This research into new medicinal plants for traditional healing practices could also be particularly interesting for the treatment of other diseases or symptom complexes like that of AIDS. Very often the healers try the new plants first for their own treatment or use them for family members. Sometimes they also use dogs or chickens to check for any toxic reaction.

3.7. The use of chloroquine

Chloroquine, which was known by all respondents, is a drug which is very often used by the local people for self-treatment and can be bought from shops. It was therefore interesting to know if the traditional healers had come to terms with the use of chloroquine. When asked if they recommend or permit patients to use chloroquine for the treatment of malaria in addition to their tradition-

al remedies, nine answered positively and sixteen negatively.

Among the reasons mentioned to allow parallel use were:

(i) 'there is no interaction between the two' (4),

(ii) 'when the patients come late chloroquine helps to speed up recovery' (3),

(iii) 'the modern and the traditional drug have additional effects' (2) and

(iv) 'did not want to interrupt the already started western treatment' (1).

Among the reasons not to combine chloroquine with their traditional remedies were:

(i) 'fear-that adverse interactions could occur' (12),

(ii) 'it is not good to mix traditional and western remedies' (4),

(iii) 'if you mix them you will not see any more which one is active' (2),

(iv) 'there is no chloroquine available' (2) and

(v) 'there is no sense in using chloroquine because the patients come to seek traditional treatment in cases where chloroquine has failed' (1).

Two traditional healers had actually stopped treating malaria with their own herbal remedies, because they thought that better results could be achieved with chloroquine treatment in the hospital.

However, these different answers show that concepts of 'traditional' treatment may be susceptible to change, and not uniform at all. Traditional antimalarials can be prescribed exclusively, successively or simultaneously with western drugs, depending on the healers' individual opinions and concepts.

4. Conclusion

Western medicine as well as traditional medicine considers that malaria can be managed by chemo-/plant therapy. The traditional healers in our study treat malaria with herbal remedies, each made from 1–5 plants. The different plant species which can be used belong to different plant families. Multiple citations of the same plants were rare and were often found within the same area or restricted mostly to plants which are used widely in folk medicine, not only by healers, such as Mwarobaini (*Azadirachta indica*). The fact that traditional healers use a large number of plants for the treatment of malaria may suggest that the acquisition of knowledge of medicinal plants is a dynamic process. As we can see from the results of the interviews, most of the healers are interested also to try new plants besides the ones they normally use. Usually they test a new remedy, firstly for their own treatment or in animals before they give it to patients.

It is known from other studies with traditional healers (Abebe, 1984; Swantz 1990), that the time of collection of the plant material is often considered to be important, because some plants are thought to have their full effect only if they are collected in a certain season or even at a particular time of day. The responses of the healers interviewed in this study did not reflect this finding. However, four of the respondents considered the place as an important factor in relation to the concentration of the 'active' ingredients in certain plants. This observation matches with the findings of chemical investigations about the concentration of pharmacologically active compounds isolated from the same plant species. It was shown that the activity of extracts or the amount of the active principle can vary significantly within the same plant species growing in different places (Capasso, 1985; Klayman, 1985; Gessler et al., 1994a).

The plant material is often air-dried and stored, sometimes cut into small pieces or further processed to a powder, until it is used for the preparation of the remedy. The decoctions, infusions or leaf juices are seldom prepared in advance, most often they are made specifically for every patient.

It was very interesting to learn that most of the traditional healers are aware on the basis of very careful observation of the improvement of their patients, of certain 'physiological' effects of each of their plants, such as reducing the temperature, killing the 'parasites' or reducing headache or vomiting. Furthermore, they know about adverse effects which can occur when the remedy is taken in an overdose. It is therefore likely that the choice of the remedy, and the different dosage schedules used for different kind of conditions or different kind of patients, such as pregnant women, small children or men, are based on knowledge about

these specific effects and reflect the healer's observation and experience.

Some of the plants mentioned have been tested for antimalarial activity against malarial parasites in vitro and in vivo, and showed promising results (Weenen et al., 1990; Gessler et al., 1994a; Gessler et al., 1994b). This indicates that some traditional remedies probably owe their effectiveness — at least in part — to the presence of a component that can kill the malarial parasite.

Although traditional herbal medicine is still practised throughout all the districts of the present study, it is being replaced in part by western medicine. In treating malaria, commercial pharmaceuticals such as chloroquine are readily available, especially in urban settings. Chloroquine is well known among the local people for the treatment of malaria, but traditional medicine is still sought in cases where chloroquine was not successful in an earlier treatment, or is not available, or where the patients simply prefer traditional remedies. There can be many reasons for this preference, but one common one is that people do not like the side effects of chloroquine. The side effects of chloroquine (itching and vomiting) were found to be among the main reasons for bad compliance in a prophylaxis project for children in North Mara, Tanzania (MacCormack and Lwihula, 1983).

On the other hand, two traditional healers in the Ifakara region have actually stopped treating malaria patients with their own herbal remedies because chloroquine is available most of the time in this region from shops or can be obtained from the hospital. With such developments, important knowledge about fragments of traditional antimalarial treatment may be lost. However, other healers strongly believe that their herbal remedies are better than chloroquine. They very often see cases in which treatment with chloroquine failed. Whether the failure of the treatment was due to resistance problems or due to inappropriate dosages is another question.

On the basis of the knowledge and experience gained in this study, the following suggestion is made for the next steps which could be taken for a further evaluation of how traditional practitioners and their traditional remedies could be incorporated into official health care in Tanzania: Evaluation of the efficacy and effectiveness of traditional remedies not only with laboratory testing but in 'clinical studies'. Results from the in vivo situation are urgently needed, and could be obtained from follow-up studies of patients who are treated with traditional remedies for malaria by traditional healers.

It is hoped that the results of this study will serve as a basis of information for future projects to evaluate the potential of the contribution of traditional healers and their remedies in improving the situation of health care provision in Tanzania.

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