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Community knowledge of traditional mosquito repellent plants in Kolla Temben District, Tigray, Northern Ethiopia

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Insect repellents have been used to reduce human-vector contact for long periods of time in different parts of the world. Thus, the aim of this study was to assess the knowledge of traditional mosquito repellent plants among inhabitants of Kolla Temben district, Ethiopia. Two hundred and forty households were selected for an ethnobotanical survey using stratified, systematic random sampling. One adult leader from each household was interviewed on her or his knowledge about traditional mosquito repellent plants. The ethnobotanical survey was carried out from January - March, 2010. Data analysis was carried out using SPSS, version 16. The level of significance was determined using 95% confidence interval. Ninety-five percent of the respondents had knowledge regarding traditional mosquito repellent plants. Application of smoke by burning (73%) the parts plants was the most common practice among the inhabitants. There was no significant association between knowledge of traditional mosquito repellent plants with age (p = 0.402), sex (p = 0.067) or educational status (p = 0.052) of the respondents. Moreover, the survey revealed that the most commonly known traditional mosquito repellent plants were *Otostegia integrifolia* (41.7%), *Silene macroserene* (24.6%,) (*Olea europeae* (22.5%), *Melia azedarach* (17.5%), *Calpurnia aurea* (9.6%), *Dodonaea angustifolia* (8.7%), *Eucalyptus globulus* (8.3%), Ere (*Aloe* spp) 6.7% and Sasa (*Otostegia fruticosa*) 2.5%. These preliminary findings suggested that the studied community has potentially important knowledge about traditional mosquito repellent plants. Therefore, further study on conserving the knowledge and evaluating the efficacy of the plants must be done.

Key words: Ethno botanical survey, Mosquito repellent plants, knowledge, Kolla Temben.

INTRODUCTION

Insect transmitted diseases have caused many human and animal diseases. Among the important vector transmitted disease malaria causes huge morbidity and mortality. Among the public health problems in developing countries malaria, causes by far the largest worldwide disease burden particularly in Sub-Sahran Africa including Ethiopia (WHO, 2008). The greatest burden of malaria occurs across sub-Saharan Africa and it is estimated to cause approximately 250 million cases and nearly one million deaths each year (WHO, 2008). Vector control is a serious concern in developing countries like Ethiopia. Every year a large part of the population is affected by malaria. Currently the situation malaria is getting worse partly due to development of *Plasmodium* parasites resistance against anti-malarial drugs and mosquito resistance to insecticides, increasing problems of toxicity to non-target organisms and lack of effective control measures (Balkew et al., 2006; Kiran

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and Devi, 2007). Moreover, there is no single effective method of malaria control in areas with high transmission rates. Even the most efficient widely used pyrethroid-treated bed nets have proven difficult to implement on sustainable basis because of problems related to availability, knowledge on proper usage, cost and insecticide resistance (Balkew, et al., 2003; Kweka et al., 2008; Baume et al., 2009; Tomas et al., 2011).

All aforementioned problems urge scientists to look for other alternative vector strategies such as repellents. The use of plants as traditional protectants of humans from insect bite is an old practice used throughout the world. However, the use of insecticidal plants has more likely declined since the advent of synthetic chemicals. Associated ethno botanical information on the uses of plants may also be under threat due to reliance on commercial products, leading to a breakdown in the dissemination of local knowledge between generations (Golob et al., 2002; Ivbijaro, 1990).

Insect repellents have been used to reduce human-vector contact for long periods of time (Skumark et al., 1991). Insect repellents play an important role in protecting man from the bites of insects (Aklilu et al., 2002; Rajkumar and Jebaneson, 2005, 2007). The most commonly used compound used for this purpose is DEET, N.N-Diethyl-m-methylbenzamide. The synthetic repellent chemical has been used by millions of people over the past several decades. However, the existing repellents are expensive for the people living in rural malaria endemic areas of the country. Therefore, having information on other potential repellents is vital. Furthermore, community knowledge can be used to guide efficacy test on applicable plants. Therefore, development of other alternative repellent option against mosquito which is less toxic and biodegradable is a timely issue. Plants with mosquito repellent or insecticidal potency may play a role in preserving the two most powerful and most broadly applied interventions: impregnated bed nets and indoor residual spray, by reducing mosquito bites during early evening (Magesa and Kamugisha, 2006; Pennetier et al., 2007).

In this context, traditional knowledge of mosquito repellent plants is very important. However, little effort has been made to understand traditional mosquito repellent plants in Ethiopia. Therefore, the purpose of the present study was to assess the community knowledge about the plants used as mosquito repellents in Northern Ethiopia.

MATERIALS AND METHODS

Description of survey area

The study was undertaken in Kolla Temben district , 95 km away from Mekelle capital city of Tigray, North of Ethiopia (Figure 1), located at an altitude between 1600 to 2000 m above sea level. The study area includes four sub districts known as Begasheka (1747 m.a.s.l, 13 37.640 N and 038 55.734 E), Getkimlesley (1840 m.a.s.l., 13 38.345 N and 038 57.615 E), Werkamba (1885 m.a.s.l., 13 43.895 N and 039 00.91 E) and Ataklti (1992 m.a.s.l., 13 41.031 N and 038 57.375 E). These districts were considered for this study based on malaria endemicity and accessibility. Most of the inhabitants are farmers who live in ‘hidmos’: stone and mud walled house with flat roofs of wattle and earth; ‘Gojos’: wood and mud walled house with grass roofs; and stone and mud walled house with iron roofs. The people’s livelihood is entirely dependent on agriculture. The predominant crops grown in the area were *Zea mays, Eragrostis tef* and sorghum *spp*. Rainfall occurs mainly from June to August with a distinct peak in July.

Study design

A cross-sectional descriptive study was carried out to assess the knowledge of traditional mosquito repellent plants among the selected inhabitants of Begasheka, Getkimlesley, Werkamba and Ataklti, Central Tigray, Ethiopia. Prior to the ethno botanical survey the study was approved by Abbiyi Addi health bureau and verbal consent was obtained prior to interviewing the respondents. Survey was carried out during the period of January to March 2010. To ensure the representation of the population, each sub-district was divided in a three stratum and 20 households were selected randomly from each sub-district. A total of 240 households, 60 households from each sub-district were considered for this study. The sample size was constrained by the cost of the project.

Interview

Interview questionnaire was carried out using sampled households. The adult household head from each house was interviewed about her or his knowledge about traditional mosquito repellent plants. The objective of the study was introduced to the community via health workers of the villages. Pre-testing of the questionnaire was carried prior to the actual data collection to minimize bias.

Ethno botanical data collection

The ethno botanical survey was carried out from January to March, 2010. The main questions focused on knowledge of insect repellent plants, name of plants used/known, method of application and parts of plant materials used. Plants were collected from the surroundings of the study area by the interviewers, pressed, identified and deposited at the National Herbarium of the Biology Department of Addis Ababa University. Identification of specimens was made with the help of herbarium materials, experts and taxonomic keys in the Flora of Ethiopia and Eritrea (Hedberg and Edwards, 1989, 1995; Edwards et al., 1995, 1997, 2000; Hedberg et al., 2003, 2004).

Data analysis

The data were entered in Microsoft Exel data sheets, cross checked and transferred, and analyzed using SPSS for windows version 16. Chi-square test was used to determine statistical significance.

RESULTS

Socio-demographic characteristics

The socio-demographic characteristics of the interviewed inhabitants of the study area are given in Table 1. In the

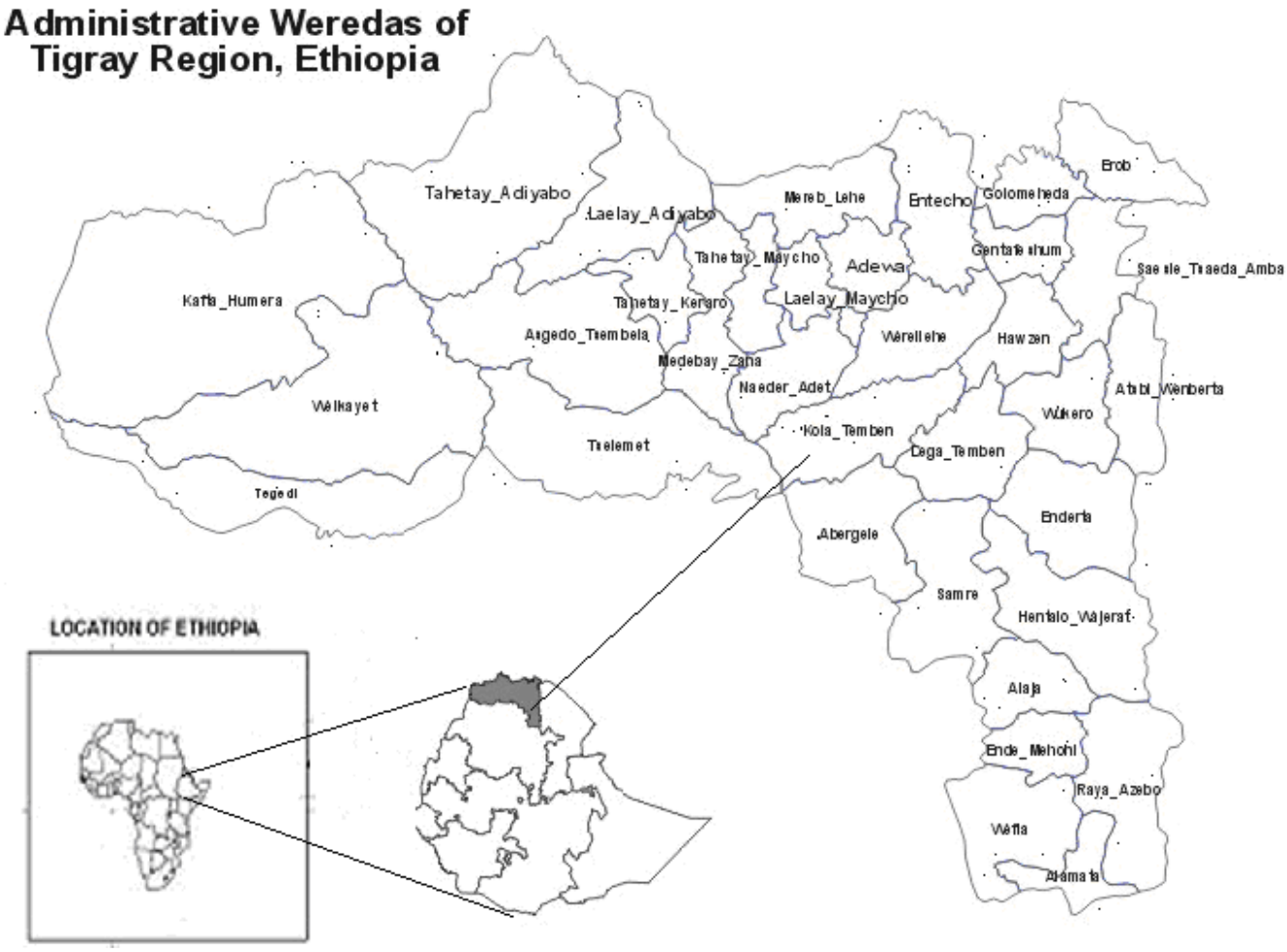

Figure 1. Map of Kolla Temben district showing the study area.

present survey, male respondents constituted 56% and female were 44%. Total household members ranged from 2 to 8 and the mean per house was 4.14. Most of the respondents were illiterate (87%). Age of the respondents ranged from 20 to greater than 70 years. In general, 95.4% respondents had knowledge about mosquito repellent plants.

Knowledge of mosquito repellent plants

The ethno botanical survey result illustrated that about 11 types of various traditional mosquito repellent plants have been used by the local communities to avoid the malaria vector mosquito. The most commonly known mosquito repellent plant in the study area was Chiendog (*O. integrifolia* Benth) 41.7%, Saerosaero (*S. macroserene* L.) 24.6%, Awlie (*O. europeae* L.) 22.5%, Neem (*Melia azedarach* L) 17.5%, Hitsawts (*C. aurea* Benth) 9.6%, Tahsos (*Dodonaea angustifolia* L.) 8.8%, Tsaeda kelamitos (*Eucalyptus globulus* Labill) 8.3%, Ere (*Aloe* spp) 6.7% and Sasa (*O. fruticosa*) 2.5%. The most commonly known mosquito repellent plants to the survey respondents are shown in Table 2.

Method of application and plant part used

Different methods of application are common by the local community to use the plants to repel mosquitoes. The most common method of application (73%) was smoking by burning the particular plant part. Other types of applications were macerating with water and spraying (8.7%), putting fresh leaves inside the house (3.4%), and rubbing the fresh leaf part onto the skin/cloth (1.3%).

Moreover, the local communities also indicated they used two methods of application alternatively, such as smoking and macerating (9.6%) and smoking and laying (3.77%) (Table 3). *O. integrifolia* Benth plants were used as a common custom in avoiding mosquito by smoking. With respect to the parts of the plant used for avoiding mosquitoes, the present study indicated the local community preferred to use the stem part of the plants, 41.6%, followed by the leaf, 38.4%. The p-value for age,

Table 1. Socio-demographic characteristics of respondents.

Evaluated factors	Assessed variable	No. of respondents (%)
Sex of household heads	Male	134 (56)
	Female	106 (44)
No. of occupants	Mean per house	4.14
Educational status	Illiterate	209 (87)
	1-6 grades	21 (8.5)
	7-8 grades	3 (1.3)
	9-12 grade	7 (2.9)
Age of respondents	20-30	16 (6.8)
	31-40	31 (12.9)
	41-50	45 (18.8)
	51-60	51 (21.3)
	61-70	60 (25)
	>70	36 (15)
Knowledge of mosquito repellent plants	Yes	229 (95.4)
	No	11 (4.6)

Table 2. Types of repellent plants used by the community.

Most commonly known repellent plants	Number of respondents	%
Chiendog (*Otostegia integrifolia* Benth)	100	41.7
Saerosaero (*Silene macroserene* L.)	59	24.6
Awlie (*Olea europeae* L.)	54	22.5
Neem (*Melia azedarach* L)	42	17.5
Hitsawts (*Calpurnia aurea* Benth)	23	9.6
Tahsos (*Dodonaea angustifolia* L.)	21	8.8
Nech bahirzaf (*Eucalyptus globulus* Labill)	20	8.3
Ere (*Aloe* spp.)	16	6.7
Sasa (*Otostegia fruticosa*)	6	2.5

educational status and sex of the respondents were 0.402, 0.052 and 0.067, respectively. The ethno botanical survey indicated that there was no significant relationship between the knowledge of mosquito repellent plants versus age, educational status and sex of the respondents.

DISCUSSION

This study was carried out to assess knowledge associated with traditional use of mosquito repellent plants in the Central Zone of Tigray, Northern Ethiopia. The present study demonstrates that the local inhabitants have knowledge concerning what they perceive as mosquito repellent plants. This is one of the major malaria endemic areas in Kolla Temben and the community was frequently exposed to malaria. Moreover, use of repellent plants was high among the local communities, where access to other alternative control options was less. The level of knowledge of the community is similar to a study done in other parts of the country, in which 97.2% of the community had knowledge and usage of mosquito repellent plants (Karunamoorthi et al., 2009). On the other hand, the majority (82.1%) of the local community believes plant repellents repel mosquito, while 10.9% believes the repellents kill and repel, 2.2% believes repellents kill and 2.2% believes repellents avoid malaria transmission. However, currently the practice of usage is very poor. This is probably due to access to health center, free distribution of impregnated bed nets and problem of accessibility of most of the mosquito repellent plants in the study area.

The extracts from plant materials can be useful as

Table 3. Method of application and parts of plants used by the community to repel mosquitoes.

Variables	% of respondents
Methods of application	
Smoking	167 (73)
Macerated with water	20 (8.7)
Laying part of plant	8 (3.5)
Rubbing fresh part	3 (1.3)
Smoking and macerated	22 (9.6)
Smoking and laying	9 (3.8)
Parts of plant used to repel mosquitoes	
Stem	41.6
Leaf	38.4
Root	14.2
Whole plant	3.4
Bark	2.4

repellents and insecticides (Odalo et al., 2005). Plant products have been used in many parts of the world for killing or repelling mosquitoes either as extracts or as whole plants (Peterson and Coats, 2001). Use of plants traditionally against biting insects is a common practice in Africa (Waka et al., 2004; Seyoum et al., 2003). The result of this study also indicated that the majority (73%) of local community members use smoking of the plant part by burning to repel mosquitoes. Similar results have been reported in previous studies carried out in Ethiopia and Tanzania indicating most of the local communities apply smoke to drive away mosquito (Karunamoorthi et al., 2009a; Kweka et al., 2008). In addition, the results also indicated that other types of application such as macerating the plant, laying the leaves of plants inside the house and rubbing onto cloths/skin are important.

Numerous studies conducted in Africa found that burned plant materials effectively repel mosquitoes. Karunamoorthi et al. (2008) demonstrated that *S. macroserene, O. integrifolia* and *O. europeae* have shown 93.6%, 90.1% and 79.8% repellent efficiency, respectively. In West Ethiopia, the juice of crushed leaves and bark of *C. aurea* is used for tick control (Zorloni et al., 2010). *O. integrifolia was* reported to be used against the flea (Waka et al*.,* 2004). In the present survey, the chi-square test results show no significant relationship in knowledge of traditional mosquito repellent plants between sex, educational status and age of respondents. This suggested that the adult community members have knowledge of mosquito repellent plants regardless of age, sex and education status. The present study indicated that knowledge of traditional mosquito repellents is common in Ethiopia.

Conclusion

Our ancestors exclusively depended on the use of plant-derived products to repel or kill mosquitoes and other biting insects. Efforts should be made to promote the use of traditional mosquito repellent plants and maintain the ethno botanical knowledge of the inhabitants. Moreover, efficacy of these repellent plants should be evaluated.

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