# Assessment of knowledge and usage custom of traditional insect/mosquito repellent plants in Addis Zemen Town, South Gonder, North Western Ethiopia

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## ARTICLE INFO

## ABSTRACT

*Aim of the study:* A cross-sectional descriptive study was carried out to assess the knowledge and usage custom of traditional insect/mosquitoes repellent plants among the inhabitants in Addis Zemen Town, Ethiopia.

*Materials and methods:* Stratified, systematic random sampling was used for selection of 393 households from the total of 5161 households. One adult from each household was interviewed. The ethnobotanical survey was carried out during the period February 2007 to March 2007. Data analysis was carried out using SPSS, version 9.0. Range and mean were analysed and appropriate tables, graphs and percentage were displayed. Level of significance also determined by using 95% of confidence intervals and *p*-value.

*Results:* Overall, 97.2% of the respondents had ample knowledge and usage custom concerning traditional insect/mosquito repellent plants. Application of smoke (91.55%) was one of the most commonly well-known methods amongst local community by burning the plant parts such as leaves, stems and roots. Leaves were used by 90.2% for the application smoke. Knowledge and usage custom of traditional insect/mosquito repellent plants had significantly associated with sex ($p = 0.013$) and lower income of respondents ($p = 0.002$). In spite of this, knowledge and usage custom had no significant association with age and educational status. Furthermore, the survey also indicated that most commonly known traditional insect/mosquito repellent plants were Woira[*1] (*Olea europaea*) 44%, Tinjut* (*Ostostegia integrifolia*) 39%, Neem* (*Azadirachta indica*) 14.1%, Wogert* (*Silene macroserene*) 1.4%, and Kebercho* (*Echinops* sp.) 1.1%.

*Conclusions:* Indigenous traditional insect/mosquito repellent plants have been used by local hamlet since ancient times for various medicinal purposes. Besides, they are not toxic like existing modern synthetic chemical repellents. Therefore, the traditional use of repellent plants should be encouraged and promoted among the local community.

## 1. Introduction

Insect-transmitted diseases impose an enormous burden on the world's population in terms of loss of life (millions of deaths per year) and morbidity. These diseases are also responsible for huge economic losses, both in terms of health-care costs and lost productivity, mostly in countries that can least afford them (Marcelo Jacobs-Lorena and Anthony, 2002). Globally, the malaria situation is serious and still deterioting. Malaria predominantly affects the poor and underprivileged. About 90% of all malaria deaths in the world today occur in Africa and south of the Sahara. An estimated 1 million people in Africa die from malaria each year and most of these are children under 5 years old (WHO, 2002).

Malaria is one of the leading causes of morbidity and mortality in Ethiopia. In Ethiopia about three quarter of the land is malarious and 65% of the populations live in this area. About 64% (48 million) of the total population resides in areas where malaria could occur in epidemic form. Only 1.5% (about 1 million) of the total population is living in highly endemic western low lands (MOH, 2000). Of all the vector-borne diseases, malaria causes by far the largest worldwide disease burden, largely because of its huge impact in rural Africa (Curtis, 2004).

Repellents have an important place in protecting man from the bites of insect pests (Kalyanasundaram, 1991). Repellents of plant origin do not pose hazards of toxicity to human and domestic animals and are easily biodegradable (Sharma et al., 1993; Sharma and Ansari, 1994). The plant products have been used traditionally to repel or kill the mosquitoes in many parts of the world (Novak, 1985). The repellent properties of plants to mosquitoes and other pest insects were well known before the advent of synthetic chemicals. In southern India, leaves of *Vitex negundo* are burned to repel mosquitoes from houses (Curtis et al., 1989).

Smoke is a common method of repelling biting insects that is used throughout the world. Fresh or dried plants are frequently

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added to fires to enhance the repellent properties of the smoke. Other methods are hanging the plants around the house or sprinkling leaves on the floor (Sangat-Roemantyo, 1990). The burning of some herbs such as *Artemisia* (Astraceae) and *Calmus* species in rural areas in china is used to keep away mosquitoes and protect cattle from blood sucking insects (Hwang et al., 1985).

Smoke produced by burning of dried leaves of *Azadirachta indica* has been used for the protection against mosquitoes since ancient times (Sukumar et al., 1991). There are many reports by ethnobotanists of plants which are used by villagers as repellents on the skin or to prevent biting insects from entering rooms. It is often suggested that these are a virtually cost-free means of controlling insect-borne disease (Curtis, 2004). Smoke is still the most widely used means of repelling mosquitoes utilised throughout the rural tropics (Palsson and Jaenson, 1999a).

The use of traditional repellents is widespread among the different cultures and communities of Africa and beyond. Although, synthetic repellents have been studied extensively, little effort has been made to investigate and promote the traditional use of plant-derived natural repellents (Seyoum et al., 2002).

Information regarding the links between socioeconomic factors, knowledge and usage custom of traditional insect/mosquito repellent plants, remarkably among unprivileged section of the society in Africa particularly in Ethiopia, is limited. Therefore, this study was carried out to assess the knowledge and usage custom of traditional insect/mosquito repellent plants among the households inhabitants of Addis Zemen Town, Ethiopia.

## 2. Objectives

The aim of this study was to assess the knowledge and usage custom of traditional insect/mosquito repellent plants among the local households inhabitants of Addis Zemen Town, South Gonder, North Western Ethiopia.

## 3. Materials and methods

### 3.1. Study area

Addis Zemen is located 645 km away from Addis Ababa, the federal capital city and 85 km North Eastern of Bhair Dar, the capital of Amhara regional state, Ethiopia. The town altitude about 1850 m above the sea level and annual temperature ranges from 13 °C to 24 °C. Estimated total number of households and population were 5161 and 20,408, respectively. Houses constructed with mud and wood roofed with corrugated iron sheets. During the period of the study, there were three private drug shops, one health centre and two private clinics.

Malaria is one of the leading causes of morbidity and mortality in the study area. Because of prolonged period of exposure to malaria, the residents traditionally apply several types of insect/mosquito repellent plants to drive away insect/mosquito bites. Town is situated nearby mountainous forest area. Therefore, knowledge and usage custom regarding traditional insect/mosquito repellent plants among inhabitants were extremely high, besides easy availability, accessibility and affordability.

### 3.2. Source population and study population

The source population was all households established in Addis Zemen Town, Ethiopia. The study population was the households/residents those selected by systematic sampling technique. The people work mainly as informal, marginal and unskilled workers. Predominant activities of the community were trade, agricultural farming, governmental and nongovernmental employees.

### 3.3. Study design

A cross-sectional descriptive study was carried out to assess the knowledge and usage custom of traditional insect/mosquitoes repellent plants among the inhabitants in Addis Zemen Town, Ethiopia. The ethnobotonical survey was carried out during the period February 2007 to March 2007. Stratified, systematic random sampling was used for selection of 393 households from the total of 5161 households. The study was launched via a meeting with community leaders and community health promoters.

### 3.4. Interview

The interview was undertaken in sampled households. One adult from each household specifically head of the households were interviewed to assess the knowledge and usage custom of traditional insect/mosquitoes repellent plants. To minimize bias information and variables the questioner prepared in English language translates into native local language Amharic to make it easy to understand and to administer for interviewer and interviewee.

### 3.5. Data collection

The data was collected by using pre-test structured questionnaire. A team of well-trained and closely supervised local interviewers conducted the household survey using a pre-tested questionnaire to interview the head of each household. Interviewer collected socio-demographic and ethnobotonical data. Investigator revisits the households, if any mistake in the previously filled questionnaires. Ahead of data collection, at each household the aim of the study was clearly explained and informed consent was obtained from chosen household representatives. Data analysis was carried out using SPSS, version 9.0. Range and mean were analysed and appropriate tables, graphs and percentage were displayed. Level of significance also determined by using 95% of confidence intervals and *p*-value.

The authors also made observations in the field on the general habitats and the traditional repellent plants collected by accompanying traditional users, translators and field assistants. The collected voucher specimens were pressed, numbered, dried, identified and deposited at Jimma University Regional Herbarium and The National Herbarium (ETH) in 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; Friis, 1992; Edwards et al., 1995, 1997, 2000; Hedberg et al., 2003, 2004).

## 4. Results

From the total of 393 sample households 388 household representatives were interviewed during the survey, making the response rate about 98.7% from the estimated households.

### 4.1. Socio-demographic characteristics

Sociodemographic characteristics of respondents are shown in Table 1. In the present survey, female respondents constituted 66.4% and male were 37.6%. Age of the respondents was ranging from 14 to 84 years and the mean age was 40.7 years. Just less than half respondents were illiterate (44.32%) and remaining were categorized into 1–8th grade, 9–10th grade, 10–12th grade and higher education represent (33.76%), (9.02%), (6.18%) and (6.7%) were respectively. 62.6%, 22.9% and 14.5% of respondents average monthly income ≤100, 100–300, and >300 Ethiopian Birr were

**Table 1**
Study of respondents with sex, age, educational status, average monthly income and knowledge of insect repellent plants in Addis Zemen Town, South Gonder, North Western Ethiopia.

| Variables | No. of respondents | % of respondents |
|---|---|---|
| Sex of the respondents | | |
| Male | 146 | 37.6 |
| Female | 242 | 62.4 |
| Age of the respondents | | |
| <20 years | 26 | 6.7 |
| 20–39 years | 189 | 49.3 |
| 40–59 years | 137 | 35.7 |
| >60 years | 31 | 8.3 |
| Educational status | | |
| Illiterate | 172 | 44.32 |
| 1–8th grade | 131 | 33.76 |
| 9–10th grade | 35 | 9.02 |
| 10+1, 10+2, 11 and 12th grade | 24 | 6.18 |
| Higher education | 26 | 6.7 |
| Average monthly income of the respondents | | |
| ≤100 Ethiopian Birr | 224 | 62.6 |
| 101–300 Ethiopian Birr | 82 | 22.9 |
| >300 Ethiopian Birr | 52 | 14.5 |
| Knowledge of repellents | | |
| Yes | 377 | 97.2 |
| No | 11 | 2.8 |

**Table 2**
Types of repellent plants used by the community, accessibility, affordability and method of application in Addis Zemen Town, South Gonder, North Western Ethiopia.

| Variables | % of respondents |
|---|---|
| Types of repellent plants | |
| Woira* (*Olea europaea* L.) | 37.04 |
| Tinjut* (*Otostegia integrifolia* Benth.) | 45.72 |
| Neem* (*Azadirachta indica* A. Juss.) | 7.05 |
| Wogert* (*Silene macroserene* L.) | 1.62 |
| Kebercho* (*Echinops* sp. L.) | 1.22 |
| Waginos* (*Brucea antidysenterica* Lam.) | 1.22 |
| Eucalyptus* (*Eucalyptus camaldulensis* L.) | 1.22 |
| Ades* (*Myrtus communis* L.) | 0.94 |
| Others | 3.93 |
| Accessibility of the insect/mosquito repellents | |
| Yes | 96.27 |
| No | 3.73 |
| Affordability | |
| Yes | 99.42 |
| No | 0.58 |
| Methods of application | |
| Smoking | 91.5 |
| Hanging of the plant parts | 7.53 |
| Spray the crushed leaf suspension | 0.86 |
| Lying the part of plant | 0.11 |

respectively (1$ = 9.70 Eth. Birr). Overall, 97.2% respondents had adequate knowledge and usage custom regarding insect/mosquito repellent plants (Table 1).

## 5. Ethnobotonical survey

### 5.1. Knowledge

The present ethnobotonical survey results reveal that about 15 types of various traditional repellent plants have been found and used by the local inhabitants in order to avoid insect/mosquito bites. The local inhabitants most commonly known repellents plants were Tinjut* (*Ostostegia integrifolia* Benth.) 45.72%, Woira* (*Olea europaea* L.) 37.04%, Neem* (*Azadirachta indica* A. Juss.) 7.05%, Wogert* (*Silene macroserene* L.) 1.6%, Kebercho* (*Echinops* sp. L.) 1.22%, Waginos* (*Brucea antidysenterica* Lam.) 1.22%, Eucalyptus* (*Eucalyptus camaldulensis* L.) 1.22% and Ades* (*Myrtus communis* L.) 0.94%. The subsequent seven repellent plants were used by the local inhabitants less than 1.0%, they were Gemmero* (*Capparis tomentosa* Lam.), Tej-sar* (*Cymbopogen citrates* stapf.), Ats-faris* (*Datura stramonium* L.), Endode* (*Phytolacca dodecandra* L'Her.), Azo-hareg* (*Clematis hirsuta* Guill. and Perr.), Berberra* (*Millettia ferruginea* (Hochst.) and Gullo* (*Ricinus communis* L.) The respondents most commonly known repellent plants are shown in Table 2.

In addition, the survey also indicated that nearly almost all respondents had easy accessibility (96.27%) and affordability (99.42%) of insect/mosquito repellent plants (Table 2). There are various types of method adapted by the local community to repel the insects/mosquitoes. Application of smoke by burning the plant parts was one of the most common practices among the inhabitants, thus accounts 91.5%. Other types of applications were spraying the extracts by crushing of grinding the repellent plant parts 7.53%, hanging and sprinkling the repellent plant leaves on the floor accounts 0.86% and 0.11%, respectively (Table 2).

### 5.2. Usage custom

Among the respondents leaf of repellent plants was one of the commonly and extensively used plant parts to repel the insects and mosquitoes. It comprise nearly 90.19% followed by root of plant 2.99%, flower 2.39% and remaining parts of repellent plants used less than 1% (Table 3). Almost 36.57% respondents believe that they are applying plant repellents to avoid mosquitoes bite, while 24.46% of respondents applying in order to avoid mosquitoes and other flies, 24.94% of respondents applying to repel all types of insects, mosquitoes and cockroaches, mosquitoes, cockroaches and other flies, flies, bedbugs, fleas and bedbugs and flies 5.51%, 5.63%, 1.31%, 0.83%, 0.46% and 0.23% were respectively (Table 3).

The *p*-value for age, educational status and sex of the respondents were ($p = 0.563$), ($p = 0.890$) and ($p = 0.175$), respectively. The ethnobotonical survey indicated that there is no close significant relationship between the age, educational status and sex of respondents with knowledge of repellent plant (Table 4).

Insect repellent plants knowledge usage custom is significantly associated with sex ($p = 0.013$) and average monthly income ($p = 0.002$) of the respondents. However, the present survey found that there is no significant relationship between the age of respon-

**Table 3**
Parts of repellent plants used by the community repel different types of insects and mosquito in Addis Zemen Town, South Gonder, North Western Ethiopia.

| Variables | % of respondents |
|---|---|
| Parts of plant used to repel insects/mosquitoes | |
| Leaf | 90.19 |
| Flower | 2.39 |
| Root | 2.99 |
| Stem | 0.35 |
| Parks | 0.47 |
| Seed | 0.17 |
| Flower and leaf | 3.22 |
| Leaf and root | 0.22 |
| Types insect repel by repellents | |
| Mosquitoes | 36.57 |
| Mosquitoes and other flies | 24.46 |
| Mosquitoes, cockroaches and other flies | 5.63 |
| Mosquitoes and cockroaches | 5.51 |
| Flies | 1.31 |
| Bedbugs | 0.83 |
| Flea and bedbugs | 0.46 |
| Flea | 0.23 |
| All types of insects | 24.94 |

**Table 4**
Repellent usage custom of respondents in relation to age, educational status and sex in Addis Zemen Town, South Gonder, North Western Ethiopia.

| Age, educational status and sex | Knowledge towards repellent plants | | | p-Value |
|---|---|---|---|---|
| | Total | Yes | No | |
| Age | | | | |
| <20 years | 26 | 26 | 0 | 0.563 |
| 20–39 years | 188 | 182 | 6 | |
| 40–59 years | 137 | 132 | 5 | |
| >+60 years | 31 | 31 | 0 | |
| Educational status | | | | |
| Illiterate | 168 | 168 | 5 | 0.890 |
| Literate | 219 | 213 | 6 | |
| Sex | | | | |
| Male | 146 | 144 | 2 | 0.175 |
| Female | 241 | 232 | 9 | |

dents and insect repellent plants and usage custom and knowledge (Table 5).

## 6. Conclusion and discussion

Malaria is one of the major causes of morbidity and mortality in the developing countries like Ethiopia. We carried out this study in order to assess knowledge and usage custom associated with traditional use of insect/mosquito repellent plants, especially among the poorest section of the society in Addis Zemen town, Ethiopia. The people interviewed in Addis Zemen town had adequate knowledge and usage custom nearly 97.2% concerning repellent plants. This is probably because they were previously more exposed to malaria frequently and residing adjacent to mountainous area.

Among poorer section of the society cannot afford modern synthetic chemical personal protection methods. The present survey demonstrated that respondents had excellent accessibility (96.27%) and affordability (99.42%) of repellent plants (Table 2). Application of smoke by burning the plant parts was one of the common practice among the inhabitants, thus accounts 91.5%. Similar findings have been reported in previous studies, fumigants are commonly used to drive mosquitoes from houses throughout Southeast Asia: including 25% of mobile populations interviewed in Thailand and Cambodia (Butraporn et al., 1995), 32% of households in rural Myanmar (Kwat-Kwat-Swe and Pearson, 2004), and 17% of households in south-western China (Moore, 2005). However, present survey shows high percentage (91.5%) of household respondents applies smoke to drive away insects/mosquitoes (Table 2).

**Table 5**
Usage of repellent plants to drive away insects/mosquitoes in relation to age, average monthly income and sex of respondents in Addis Zemen Town, South Gonder, North Western Ethiopia.

| Age, average monthly income and sex of respondents | Usage custom of repellents | | | p-Value |
|---|---|---|---|---|
| | Total | Yes | No | |
| Age | | | | |
| <20 years | 26 | 16 | 10 | 0.099 |
| 20–39 years | 184 | 83 | 101 | |
| 40–59 years | 133 | 63 | 70 | |
| >+60 years | 31 | 9 | 22 | |
| Average monthly income of respondents | | | | |
| <100 Ethiopian Birr | 219 | 111 | 108 | 0.002 |
| 101–300 Ethiopian Birr | 80 | 26 | 54 | |
| >300 Ethiopian Birr | 50 | 16 | 31 | |
| Sex | | | | |
| Male | 146 | 144 | 2 | 0.013 |
| Female | 241 | 232 | 9 | |

The results additionally indicated that other types of applications like spraying the extracts by crushing of grinding the repellent plant parts 7.53%, hanging and sprinkling the leaves of repellent plant on the floor accounts 0.86% and 0.11%, respectively (Table 2). Natural fumigants are extensively used, and less commonly, plants are hung around the home or rubbed onto the skin. A study indicated that the effect of fresh leaves and shoots of *Ocimum forskolei* hanging on walls at the head and foot of beds was tested in Eritrea against *Anopheles arabiensis* and 53% reduction in mean number of mosquitoes per house was achieved (Maedot Waka et al., 2004).

There are several studies particularly in Africa found that burned plant materials effective to drive away mosquitoes. Thirteen percent of rural Zimbabweans using plants and 15% using coils (Lukwa et al., 1999). Thirty-nine percent of Malawians burn wood dung or leaves (Ziba et al., 1994). Up to 100% of Kenyans burned plants to repel mosquitoes (Seyoum et al., 2002), and in Guinea Bissau 55% of people burned plants or hung them in the home to repel mosquitoes (Palsson and Jaenson, 1999). In our present survey, knowledge and usage custom regarding traditional insect repellent plants was significantly associated with sex ($p = 0.013$) and average monthly income ($p = 0.002$) of the respondents. However, the present survey also found that there is no significant relationship ($p = 0.099$) between the age of respondents and knowledge and usage custom concerning insect repellent plants (Table 5).

Our ancestors exclusively depended on the use of plant-derived products to repel/kill mosquitoes and other blood sucking insects. Modern synthetic chemicals could provide immediate results for the control of insects/mosquitoes; on the contrary they bring irreversible environmental hazard, severe side effects and pernicious toxicity to human being and beneficial organisms. Therefore, right now use of eco-friendly and cost-free plant based products for the control of insects/mosquitoes is inevitable. Efforts should be made to promote the use of easy accessible and affordable traditional insect/mosquito repellent plants.

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