

ORIGINAL ARTICLE

USE OF THE PLANT ARTEMISIA ANNUA AS A NATURAL ANTI-MALARIAL HERB IN ARBAMINCH TOWN

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ABSTRACT

Background: The estimated malaria cases per annum in Ethiopia are about 4-5 million. Chemotherapy is a major element of malaria control. Because the WHO recommended anti-malarial, Artemisinin combination therapy, is expensive and the health service coverage in the country is low, the practical use of this drug for the treatment of malaria will be restricted to the small segment of the population. Therefore, it is high time to look for other cheap and effective alternatives to treat malaria, traditional medicine being one of the areas to be explored.

Objective: To assess the extent of use and perceived effectiveness as well as the adverse effects of the plant *Artemisia Annua* as a natural ant-malarial herb in Arbaminch town.

Methods: A qualitative study involving health workers, users of the herb, natural medicine practitioners, university professors, and a researcher on traditional medicine meant, to explore the use of the plant *Artemisia Annua* as an anti-malarial herb was carried out. Sampling was purposive. In addition, a cross-sectional household survey was conducted to assess malaria-related health seeking behavior. Systematic sampling technique was employed. The study was done in Arbaminch town in 2006.

Results: The qualitative study revealed a high level of acceptance and utilization of the herb. Similarly, the quantitative study showed that 22.4% of malaria cases in the previous year used the herb as a treatment. The outcome of the treatment was effective with a cure rate of 91.8% with no major adverse effect. The treatment modality was clear and well-understood at all levels of the study subjects.

Conclusion: The effectiveness of the herb in treating malaria and the absence of major adverse effects created a high level of utilization. Therefore policy, regulatory mechanisms, and guidelines should be formulated for the use of the herb. Safety, efficacy and quality assessment on the herb should continue. Mechanisms for integrating the herb with modern health care system, should be studied.

INTRODUCTION

Today malaria is the number one killer disease in Sub Saharan Africa. The economic loss due to malaria in Africa is estimated to be 12 billion USD per year inhibiting annual economic growth by as much as 1.3% (1). In Ethiopia, about 75% of the total area is estimated to be malarious with 65% of the total population at risk of having malaria (2). The estimated malaria cases per annum are about 4-5 million (3).

Malaria control has traditionally relied on the control of the anopheline mosquito vector through the removal of breeding sites, use of insecticides, and the prevention of its contact with humans via the use of screens, bed-nets and repellents, along with effective

case management (4). Chemotherapy is, therefore, a major element of malaria control. It has been adopted by WHO as a sustainable and realistic approach for the stated aim of Roll Back Malaria to reduce malaria mortality among African Children by half by the year 2010 (5). Anti-malarial drug resistance is implicated in the increasing frequency and severity of epidemics (6). It is the most likely explanation for the doubling of the malaria attributive child mortality in East and South Africa (7). It is also incriminated as a major contributor to the global resurgence of malaria in the last three decades (8).

In recognition of the problem of drug resistance, the Ministry of Health of the Federal Democratic Republic of Ethiopia endorsed the use of Artemether-lumefantrine as the first-line drug to treat *Plasmodium falciparum* malaria. Artemether-lumefantrine is highly efficacious against the multi-drug resistant *Plasmodium falciparum* (9). This new drug can be

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used only by the small segment of the Ethiopian population for two main reasons. One: The drug is too expensive; evidences show that the Artemisinin combination anti-malarial drugs are at least ten times more costly than the commonly used anti-malarial drugs (10). Two: The health service coverage and utilization in Ethiopia as of 2003/04 has been as low as 64% and 36%, respectively (11). As a result of this and other compounding factors, traditional medicine remains to be the only available health service system for the majority of the population (12, 13). Therefore, it is high time for the poor and less developed countries like Ethiopia to look for cheaper and effective alternatives to treat the drug-resistant *Plasmodium falciparum* malaria, traditional medicine being one of the areas to be explored.

In Africa, up to 80% of the population uses traditional medicine, which is growing rapidly in industrialized countries, too, in the form of complementary or alternative medicine (14). Experience from many countries in South East Asia suggests that the integration of traditional and modern health care systems can solve much of the problems by providing basic health care services for people in developing countries (15,16). Many of the traditionally used medicinal plants contain pharmacologically active compounds that are used in the preparation of both traditional and modern medicines (17, 18).

The plant *Artemisia Annua*, the Chinese herbal remedy used in China for almost 2000 years, has been found to be effective against drug resistant malaria (14). Researchers at the Chinese Institute of Material Medicine found a region of China that reported no malaria cases. Investigation showed that people drank a tea of *Artemisia Annua* at the first sign of malarial symptoms (19). Artemisinin, a compound that has a known anti-malarial effect, and endorsed by WHO as a first-line anti-malarial drug, was isolated from this plant over twenty years ago as part of an initiative to discover novel natural products with anti-malarial activity (20,21).

The plant *Artemisia Annua* was introduced to Ethiopia some years ago by a German NGO which gave some training about the natural medicine to the local people on the highlands of Chench, Gamo Gofa Zone (Keith L, personal communication). It is hoped that this study will help in promoting the positive elements of the plant *Artemisia Annua* in treating malaria and in expanding the utilization of this herb to all malaria endemic regions of the country. It is also hoped that this will initiate the development of safety, efficacy, and quality measures for the proper

use of this plant. Moreover, it may help in integrating the herb with modern health care practices as well as in formulating policy, regulatory mechanisms, and guidelines on its proper use in treating malaria. This study is, therefore, undertaken to explore the extent of use and perceived effectiveness and adverse effects of the plant *Artemisia Annua* as an anti-malarial herb in Arbaminch town.

METHODS

Study Design: A qualitative study was conducted using focus group discussions at community and health facility levels together with an in-depth interview with key informants. Additionally a cross-sectional household survey was conducted in January, 2006 to complement the findings.

Study Population: Users of the plant *Artemisia Annua* for the treatment of malaria and health workers at Arbaminch Hospital and Health Center who were directly involved in the treatment of patients with malaria were the study population for the focus group discussions. University professors, and herbalists in the community who provide the plant *Artemisia Annua* as a natural anti-malarial herb, and a researcher on traditional medicine were the key informants selected purposively in view of their knowledge on the study topic. The cross-sectional survey was conducted with the household heads of the residents of Arbaminch town to determine the health seeking behavior during malarial illness.

Sampling: A purposive sampling was employed to select focus group participants and key informants. By using reputation, comparable and critical case selection techniques, participants who can offer the fullest and most relevant information about the research question under study were selected among users and health workers. Key informants were selected based on their knowledge on the plant. Four focus group discussions (two with users of the herb and two with health workers) involving 29 participants were held. Five key informants were interviewed in-depth. For the cross-sectional survey, the systematic sampling technique was applied and households from each kebele were selected proportionally to the size of households in each kebele with a sampling fraction of 1/32. The required sample size for the household survey was calculated to be 442 considering the following assumptions: 50% proportion, 95% confidence level, 5 % margin of error, plus 15 % allowance for anticipated non-response.

Main Variables of the study: Socio-demographic characteristics of the study participants, treatment type for malaria, *treatment outcome of the herb (efficacy and adverse effect)*, perceived advantages and disadvantages of using the herb, and treatment modality of the herb were examined.

Data Collection: Data were collected using a properly designed topic guide and interview guide for the focus group and the in-depth interview, respectively. The discussion was audio-taped while its content, the emotional reactions, and other important aspects were recorded by a note-taker. A pre-tested questionnaire was used for the cross-sectional survey and an inter view for the data collection.

Data Processing and Analysis: Debriefing was held following each bout of qualitative data collection. Both verbatim transcription and note expansion were carried out. Then the Open Code software was used to import the text from Microsoft word, to assign codes to segments of the text and create and manage categories. Systematic comparisons were made be-

tween groups and individual interviews. Finally the core themes were identified and translation and description of the findings were carried out. For the survey, data entry and analysis was done using the SPSS version 10 statistical software program and findings were described using descriptive statistics.

Ethical Considerations: Letter of ethical approval was obtained from the University of Gondar. The participants of the study were given adequate explanation about the purpose of the study and participation was totally voluntary.

RESULTS

A total of 29 focus group participants, 5 key informants, and 439 household heads in the cross-sectional survey were involved in the study. The response rate in the cross-sectional survey was 99.3%. The mean age of the household heads was 40 years (SD=12.6) and the minimum age was 18 years and the maximum 85 years (table 1).

Table 1: Socio-demographic characteristics of the study subjects in the focus group discussion, In-depth interview and household survey in Arbaminch, 2006

Variables		FGD Participants		Key informants		Head of Households	
		N=29		N=5		N=439	
		N	%	N	%	N	%
Gender:	Male	18	62.1	4	80.0	340	77.4
	Female	11	37.9	1	20.0	99	22.6
Age in years:	18-30	11	37.9	1	20.0	120	7.3
	31-64	18	62.1	4	80.0	297	67.7
	64+	-	-	-	-	22	5.0
Ethnicity:	Gamo	-	-	2	40.0	242	55.1
	Amhara	-	-	3	60.0	82	18.7
	Wolayita	-	-	-	-	66	15.0
	Oromo	-	-	-	-	28	6.4
	Others	-	-	-	-	21	4.8
Religion:	Orthodox	-	-	3	60.0	258	58.8
	Protestant	-	-	2	40.0	158	36.0
	Muslim	-	-	-	-	13	3.0
	Others	-	-	-	-	10	2.3
Education:	Illiterate	2	6.9	-	-	63	14.4
	Read and write	-	-	-	-	42	9.6
	Grade 1-8	3	10.3	-	-	152	34.6
	Grade 9-12	4	13.8	-	-	111	25.3
	Grade >12	20	69.0	5	100.0	71	16.2
Occupation:							
* Employee	Business	21	72.4	3	60.0	215	49.0
	Laborer	-	-	1	20.0	90	20.5
	Pensioned	1	3.4	-	-	54	12.3
	House wife	-	-	-	-	37	8.4
	Farmer	4	13.8	-	-	20	4.6
	Others	-	-	-	-	12	2.7
		3	10.4	1	20.0	11	2.5

* includes all governmental, NGO, and private employees

Current Utilization of Artemisia Annua as an Anti-malarial Herb: All participants among the users group and almost all participants among the health workers group mentioned that the utilization of Artemisia Annua in Arbaminch town and the surrounding areas is huge. Most of them used the herb for the treatment of malaria, and all of them knew some health workers, their own family members, and

neighbors who use the herb for the same purpose. The key informants who were the practitioners of the herb said that the number of the users of the herb was increasing from time to time and that they have treated thousands of malaria cases to date. The household survey revealed that more than a fifth (22.4%) of the malaria cases was treated with the herb Artemisia Annua (Table 2).

Table 2: Malaria cases and type of treatment from a household survey in Arbaminch, 2006

	Treatment Received					
	Anti-malarial Pills		Artemisia Annua		Total Households	
	N	%	N	%	N	%
Reported at least one case of malaria	253	77.6	73	22.4	326	74.3
Didn't report a case of malaria	-	-	-	-	113	25.7
Included in the survey	-	-	-	-	439	100.0

Preparation of the Herb Artemisia Annua for the Treatment of Malaria and its Treatment Modality:

Almost all participants of the qualitative study described the preparation of the herb and the treatment modality as follows. The dry leaf of the plant was crushed into powder and packed in a sachet in an estimated amount of 5gm quantity. Patients were provided with seven pieces of such a pack. One sachet of powder was added into a liter of boiled water and then allowed to brew for 15 minutes, and then poured through a sieve. This tea was be divided into four equal portions and would be taken four times a day before each meal for seven days. Practitioners of the herb stated that the preparation technique and treatment modality was learned in a training program provided by the German NGO. In the cross sectional survey, 100% of the respondents said that the preparation was like herb tea and that the route of administration was oral. Regarding the daily dose, the frequency, and the duration of treatment, 98.6% said 1 liter / day; 83.6% said 4 times /day, and 97.3% said for 7 days.

Outcome of Treatment: All participants of the user group emphasized the super efficacy of Artemisia Annua as a treatment for malaria. All of them took the herb while they were suffering from blood film proven malaria and all of them got cured dramatically. The majority checked their blood film after the treatment and the result turned out negative. All of them passionately talked about the dramatic response and relief they got within the second day of

treatment. They achieved resolution of symptoms and parasite clearance very quickly.

"Despite the proper use of all anti-malarial drugs, my condition was getting worse. It was because I had no choice that I dared to take this herb, but the response was unexpected, dramatic and remarkable," a 48-year old high school teacher said.

"I took fansidar and blood test became positive after days of treatment, and my condition was worsening. I took this herb and got cured immediately. Since then I have taken this herb four times, and it was effective all the time. It clears the parasite in the 2nd day of treatment," said a 36-year old water technician.

Almost all participants of the health workers groups reported witnessing the efficacy of the herb in treating malaria. They saw the effect of the herb in their own families, friends, and neighbors.

"My uncle was severely ill, and his blood test was positive for malaria. Against my will he took Artemisia tea and I found him well in two days from the initiation of treatment. His blood test turned negative, too. While I was wondering about this result, I came across a patient who was admitted to Arbaminch Hospital and treated with quinine. He did not improve with the treatment, so his father started him on Artemisia tea; his blood test soon turned negative," a young druggist from Arbaminch told us.

In addition to the outcome they witnessed on neighbors, family members, and friends, some of the health workers observed that patients who attended the Outpatient Department and were positive for plasmodium falciparum malaria, were treated with this herb. Then, their symptoms resolved, and their blood test became negative.

"I attended a training on natural medicine that was conducted in Arbaminch town by a German NGO. One of the natural medicines thoroughly discussed was Artemisia Annua. During the training six patients from Arbaminch Health Center whose blood test was positive for malaria were provided the herb. A follow up on them showed a complete clinical and parasitological cure," a 35-year old nurse practitioner stated.

Among the key informants, both practitioners stated that the outcome of the herb in treating malaria is wonderful. One of them said that in her two years career as a practitioner, she never encountered a treatment failure.

The other key informant knew that Artemisia Annua was a plant that could treat malaria of all species in other countries, too. The informant however said that there were questions on whether the plant could be effective on races other than black, and whether it would contain its essential substances if grown in a different ecology.

"The Chinese Artemisia is well known for its efficacy, and that it kills all four plasmodium species is well documented. However, the effect of Artemisia Abyssinica is not known though it is found in many parts of the country. The country-side people put sticks of the plant over their ears, but I don't know why they do that. Who knows, it may have some medicinal, immune enhancer, or repellent effect," a university professor commented.

In the cross sectional household survey among those who took Artemisia Annua for the treatment of malaria, 67(91.8%) reported cure, 2(2.7%) reported improvement, and 4(5.5%) reported recurrence. But none reported a complete treatment failure.

Adverse Effects and Comparative Advantages of the Herb: All participants of the user group said that they experienced no adverse effect except the bitter taste, which was one of the reasons for their preferring the herb. Almost the whole health worker group never encountered a case with complications or adverse effects of using the herb. However, one worker said that she witnessed a patient who died in Ar-

baminch Hospital 2 days after the intake of Artemisia. She added that the patient was jaundiced and might have died of drug induced hepatitis. Among the key informants the practitioners of the herb never encountered major adverse effects; however, some of their clients reported the bitterness as a problem. According to the cross-sectional household survey among those who used the herb to treat malaria, 70(95.9%) reported no adverse effect, 3 (4.1%) complained about a mild adverse effect, whereas none reported severe adverse effect or death related to the herb.

All users of the herb talked with love and passion about the comparative advantages they got from the herb. Almost all participants among the users of the herb stated that the herb enhanced strength and gave energy when one felt tired and weak. Both practitioners of the natural medicine said that most of their patients reported that they felt energetic and that they never missed working hours while they were on treatment. Some of them pointed out that they considered the herb as food that a person could take whenever she/he was tired, weak, and without appetite.

"This herb makes you eat more and frequently. I am working in a factory and my salary is small. It was difficult for me to get extra meal for 7 days while I was on treatment." She added with humor, "You know, that was the time I visited most of my friends and relatives," a 20 year old girl pointed out.

Most of them mentioned its economic advantage in various ways. They said it took considerable time to get health service, not less than a day or two. Visiting private doctors was also said to be expensive. The herb, on the other hand, was said to save time, money and working hours.

All users of the herb appreciated the effect of the herb in inducing good sleep. One of the practitioners of the herb also said that it affected most people to comply with the dose schedule because they would fall asleep.

Some of the participants among the users group explained the effect of Artemisia on the enhancement of sexual desire and delayed orgasm. One of the key informants among the practitioners of the herb mentioned this effect as one of the important feedback he obtained from some of his patients.

"I think we have to be open and honest when we forward our views, because this discussion is very im-

portant, as it is going to be an input for a research project. I experienced an enhancement of sexual desire and delayed orgasm. In our 25 years of married life we have used the calendar method as a birth control and successfully managed to have 3 children with good spacing, but we were forced to break the rule when one of us used this herb," a 49-year old teacher revealed.

DISCUSSION

The qualitative study showed that the level of perception and utilization of *Artemisia Annua* as anti-malarial herb in Arbaminch town is high. This finding is supported by the results of the household survey that showed 22.4% of malaria cases in Arbaminch town used the herb to treat the disease in the year 2005. The herb was introduced to the study area which is a zonal capital with one hospital, one health center, and around ten private clinics just recently. Considering that 80% of the population in Africa uses traditional medicine for health care (14), the level of utilization observed in the present study is high. That is because the herb is not traditionally popular. Besides, geographic accessibility to modern health care service is relatively good.

This study has shown that the preparation of the herb for the treatment of malaria and the modes of therapy are well communicated and understood by the study subjects. This is in contrast to previous studies that showed unclear dosage schedules and lack of transparency in the traditional medical practice in Ethiopia (22).

Both the focus group discussions and the in-depth interviews showed that the outcome of treatment of malaria using *Artemisia* tea is effective. This is supported by the household survey that showed a 91.8% cure rate with none of the users of the herb reporting complete treatment failure. It is known that *Artemisia Annua* contains Artemisinin, a compound that has known anti-malarial effect (20). The present finding is in agreement with several clinical trials done on crude *Artemisia* tea. Bukave treated 254 patients with *Artemisia* tea and 93% were healed and the recrudescence rate was 13% (23). Other randomized control trials showed a cure rate of 74% for *Artemisia* tea compared with 95% of quinine (24). Moreover, this study showed a resolution of symptoms and parasitic clearance within 2 days after the initiation of treatment with *Artemisia* tea. It is known that Artemisinin is absorbed faster from the tea preparation than from capsules (25). The maxi-

mum plasma concentrations are found after 30 minutes following intake and Artemisinin content in the blood is high enough after drinking *Artemisia* tea to cure malaria (25).

The qualitative study showed that *Artemisia Annua* tea is a natural medicine without major adverse effect except bitterness. The household survey also showed that 95.9% of the users did not experience any adverse effect with 4.5% reporting mild adverse effect and none severe adverse effect or death related to the herb. This finding is supported by a number of studies. No serious adverse effects have been seen in review of several clinical trials with Artemisinin (26). On other experimental studies side effects were not observed from drinking one liter of *Artemisia* tea per day for two weeks except bitter taste (27).

A patient that developed jaundice on the second day of treatment and died the same day with suspected drug induced hepatitis was mentioned by one of the health workers. However, there was no theoretical or clinical evidence to attribute the morbidity as well as the mortality to the treatment. As long as literature, the response to this study, and the long history of the herb in China and Vietnam are considered, *Artemisia* is unlikely to cause such morbidity and mortality owing to acute toxicity. However, this information has to be considered in further toxicity studies of the plant.

This study has identified some effects of the herb on human physiology. The users of the herb have perceived these effects as additional advantages of the herb for the treatment of malaria. The improvement of appetite, the enhancement of sexual desire and delayed orgasm, and the enhancement of strength and good sleep are the prominent effects of this herb highly pronounced by most users. However, literature doesn't show any supportive evidence for any of the effects that are magnificently experienced by the study subjects. This may be due to some differences on the composition of the plant as a result of different ecology or metabolic change as a result of differences in the human race. These are some cues for further investigation.

The other real advantage identified in this study is the economic benefit of the herb. Its economic benefits are multi-faceted. Firstly, the health care cost of individuals is less. Secondly, the country benefits from a reduction of foreign currency requirement. On the other hand, the need for *Artemisia Annua* in the world market is ever growing (28). Therefore

large scale production of the plant for the world market can be the other economic benefit for the farmers, investors, and the country at large.

In general, from the findings of this study, one can conclude that the effectiveness of the herb in treating malaria, the simplicity, low cost, plus the absence of major adverse effects, as well as other benefits related to the treatment have created a high level of awareness and utilization of the herb. Therefore, policy, regulatory mechanisms, and guidelines should be formulated for the use of the herb. Safety, efficacy and quality assessment should be carried out on the herb using the intervention approach. Mechanisms of integrating the herb with the modern health care system should also be studied.

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