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Ethnobotanical survey of antimalarial plants in Awash-Fentale District of Afar Region of Ethiopia and *in vivo* evaluation of selected ones against *Plasmodium berghei*

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ABSTRACT

Objective: To document plants used in traditional treatment of malaria in the Awash-Fentale District, the Afar Region of Ethiopia, and to evaluate antimalarial activity of selected ones against *Plasmodium berghei* in mice. **Methods:** Semi-structured interviews were carried out with purposively selected informants in the District to gather information on plants used in the traditional treatment of malaria. Standard procedures were used to investigate acute toxicity and a four-day suppressive effect of crude aqueous and ethanol extracts of the leaves of the two most frequently cited plants [*Aloe trichosantha* (*A. trichosantha*) and *Cadaba rotundifolia* (*C. rotundifolia*)] against *Plasmodium berghei* in Swiss albino mice. **Results:** The informants cited a total of 17 plants used in the traditional treatment of malaria in Awash-Fentale District. Plant parts were prepared as infusions or decoctions. Leaf was the most commonly cited (44%) plant part, followed by stem (22%). Shrubs were the most frequently cited (63%) medicine source followed by trees (21%). Of the 17 plants, *C. rotundifolia* and *A. trichosantha* were the most frequently mentioned plants in the district. Ethanol extracts of the leaves of *C. rotundifolia* and *A. trichosantha* suppressed *P. berghei* parasitaemia significantly accounting for 53.73% and 49.07%, respectively at 900 mg/kg. The plants were found to be non-toxic up to a dose of 1 500 mg/kg. **Conclusions:** Seventeen plant species were reported to be used for treatment of malaria in the Awash Fentale Distinct, among which *A. trichosantha* and *C. rotundifolia* were the most preferred ones. *P. berghei* suppressive activity of these plants may partly explain their common use in the community.

1. Introduction

About 3.3 billion people are at risk of malaria globally. In 2013, there were 198 million cases and 584 000 deaths. Africa contributed to 90% of all malaria deaths, where children under five years old accounted for 78% of the deaths. However, there was a trend of significant reduction in malaria cases and deaths between 2001 and 2013. This reduction is attributed to expanded malaria funding, progress in vector control (insecticide net use and indoor residual spraying), scaled up diagnostic testing and antimalarial treatments[1]. Ethiopia is also one of the sub-Saharan African countries where morbidity and mortality due to the disease is declining significantly. However, the emergence of resistant *Plasmodium* parasites to most available drugs of choice posed a threat in the control of the disease. *Plasmodium falciparum* resistance to artimisinin has been detected in Cambodia, Lao People's Democratic Republic, Myanmar, Thailand and Viet Nam. In many areas along the Cambodia-Thailand border,

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P. falciparum has become resistant to most available antimalarial medicines. This is a threat to Ethiopia and other malarious areas of the world. Thus, it is important to search for new and effective antimalarial drugs.

Plants have been used in the treatment of malaria and several other illnesses since time immemorial[2]. The great majority of modern antimalarial drugs have been derived from medicinal plants or plant based lead compounds[2]. Among these, quinine and artemisinin are most notable antimalarial drugs. This entails a focus on plants in attempts of antimalarial research. In Ethiopia, medicinal plants have been widely used for the treatment of various ailments including malaria[3-6]. The country is rich for its plant species, culture, language and tradition which contribute to the diverse practices. However, the practices remain poorly documented and less accessible for modern research. Hence, the search for alternative antimalarial drugs of plant origin in the country requires a basic ethnobotanical survey in different localities and districts to document diverse knowledge owned by different ethnic groups and communities. So far no study has been carried out in the Afar Region in general and Awash-Fentale District in particular to solely document traditionally used antimalarial plants. This study was thus conducted to document medicinal plants used in traditional treatment of malaria by the Afar people in Awash Fentale District, Afar Region of Ethiopia, and evaluated *in vivo* selected two plants [*Aloe trichosantha* (*A. trichosantha*) and *Cadaba rotundifolia* (*C. rotundifolia*)] for their antimalarial activities.

2. Materials and methods

2.1. Study area

Ethnobotanical survey was undertaken in the Awash-Fentale District, Zone 3 of the Afar Regional State of Ethiopia, between January 2008 and May 2010. Awash Fentale District is located at about 200 km east of Addis Ababa and is bordered in the south by the Oromia Region, in the west by the Amhara Region, in the north and in the east by Dulcha and Amibara districts of the Afar Region, respectively.

2.2. Informants selection and ethnobotanical data collection

Twenty-four Afar informants (23 males and 1 female) that were considered knowledgeable were selected from the the study district using purposive sampling method with the help of local administrators and elders. The ages of the informants ranged from 30 to 78 years. Interviews were conducted in the Afar language with the help of local translator and ethnobotanical data were recorded in English. Additional data were also collected through field observation and local market surveys. Data collected, among others, included local name of the antimalarial plant, part used and procedures followed in remedy preparation. Voucher specimens were collected for all specimens and stored at the National Herbarium, Addis Ababa University, after identification by botanists.

2.3. Toxicity and antimalarial activity tests

2.3.1. Selection of plants

With the assumption that plants cited most frequently are more likely to be biologically active against the parasites[7], *A. trichosantha* and *C. rotundifolia* were selected from among the 17 plant species that were claimed by informants in the study District to have antimalarial activity.

2.3.2. Plant samples collection and extraction

The leaves of *A. trichosantha* and *C. rotundifolia* were collected and dried under shade at room temperature and grounded to powder using mortar and pestle. The powders were extracted using distilled water and ethanol. Powder produced from each plant was mixed with each solvent in the proportion of 1: 10 (w/v) in separate Erlenmeyer flasks and placed on orbital shaker (GFL, Model 3020, Germany) at room temperature for 24 h. The extracts were then filtered through cotton and subsequently with Whatman filter paper (15.0 cm size). Ethanol was removed from the filtrate by rotary evaporator (Buchi RE 121, Switzerland) and the water extracts were freeze-dried by a centrifugal freeze drier. Each extract was placed in a labeled small screw cupped bottle and kept in refrigerator at -70 ℃ until use[8].

2.3.3. Toxic effect test of extracts

Acute toxic effects of the extracts were evaluated against white Swiss albino mice arranged into three groups (each group had 4 mice). Group one was treated orally with 500 mg/kg, group two with 1 000 mg/kg and group three with 1 500 mg/kg for four consecutive days. Signs of acute toxicity such as death, changes in physical appearance and behavioral changes were observed for ten days[9].

2.3.4. Antimalarial activity test

Plasmodium berghei (*P. berghei*) infected Swiss albino mice (5-7 weeks of age) obtained from Aklilu Lemma Institute of Pathobiology, Addis Ababa University were treated for four days by the extracts[10]. Blood was taken from *P. berghei* infected donor mouse (with growing parasitaemia of 20%), diluted with 3% citrate and brought to a volume of 0.2 mL containing 1×10^6-1×10^7 infected erythrocytes was injected intraperitonially on day 0.

The mice were put randomly into five groups each containing four mice. Group 1 was treated with 300 mg/kg, group 2 with 600 mg/kg, group 3 with 900 mg/kg of water and ethanol extracts of the leaves of *A. trichosantha* and *C. rotundifolia*. The negative control group (group 4) was given the vehicle (0.4 mL distilled water) and the positive control group (group 5) chloroquine (10 mg/kg). Treatment continued daily for four consecutive days starting 3 h after infection from day 0 to day 3. On day 4, thin smears of blood films were prepared for each mouse from the peripheral blood on the tail and percentage parasitaemia was recorded[11]. Packed cell volume was measured to predict the effectiveness of the extracts. The mice were fed with standard mice pellet ad libitum and given water. *P. berghei* used in the test was subsequently maintained in the laboratory by serial blood passage from mouse to mouse.

Table 1
Antimalarial plant species collected from Awash Fentale District of the Afar Region of Ethiopia.

Botanical name	Family name	Local name	Habit	Part used	Administration	Treatment preparation	Frequency of citation	Voucher no.
Acacia mellifera Benth.	Fabaceae	Merkeato	shrub	whole	oral	Decoction	1	NA-13-2007
Acalypha fruticosa Forssk.	Euphorbiaceae	Migameli	shrub	leaf	oral	Cold water infusion	1	NA-17-2007
A. trichosantha Berger	Aloaceae	Urae	shrub	leaf	oral	Cold water infusion	12	NA-09-2007
Azadirachta indica A.Juss	Meliaceae	Neem	tree	leaf	oral	Decoction in water	4	NA-16-2007
Barleria sp.	Acanthaceae	Yamerktu	shrub	whole	oral	Cold water infusion	1	NA-05-2007
Boswellia papyrifera (Del.) Hochst.	Bursseraceae	Melmele	tree	bark	oral	Hot water decoction	3	NA-15-2007
Cadaba rotundifolia Forssk.	Capparidaceae	Adangele	shrub	leaf	oral	Cold water infusion	8	NA-19-2007
C. papaya L.	Caricaceae	Papaya	tree	leaf	oral	Cold water infusion with honey/sugar	5	NA-10-2007
Casuarina equissetifolia (Fosberg) Sachet.	Casuarinaceae	Sagento	shrub	stem	oral	Decoction in water	1	NA-06-2007
Celosia polystachia (Forssk.) C.C. Townsend	Amaranthaceae	Kontoma	shrub	stem	oral	Cold water infusion in soup	1	NA-01-2007
Cucumis sp.	Cucurbitaceae	Hashrel-ajer*	shrub	root	oral	Decoction	2	NA-18-2007
Grewia schweinfurthii Burret.	Tiliaceae	Hidaytu	herb	leaf/stem	oral	Cold water infusion	2	
Indigofera coerulea Roxb.	Fabaceae	Kimbiro-hada, hawda*	shrub	leaf/root	Oral	Decoction	4	NA-02-2007
M. reflexum Chiov.	Euphorbiaceae	Labnema	shrub	stem	oral	Cold water infusion	7	NA-12-2007
Salvadora persica Brenan	Salvadoraceae	Adaytu	shrub	leaf/stem	oral	Decoction in water	1	NA-03-2007
Senna italica Mill.	Fabaceae	Selmeky	shrub	leaf/root	oral	Cold water infusion	5	NA-14-2007
Terminalia brownii Fresen.	Combertaceae	Woybu	tree	leaf/bark	oral	Cold water infusion	3	NA-20-2007

*Sudanese name (Arabic).

2.4. Data analysis

Data was entered in to Microsoft Excel work sheet and frequencies were worked out. Day 4 parasitaemia was presented as mean plus or minus standard error (mean±SEM). Statistical significance was determined by one way analysis of variance using SPSS computer software. Students paired *t*-test was used to compare parameters with in groups. For all the data values with $P<0.05$ were considered statistically significant. Percentage parasitaemia and percentage suppression were also determined[12]. Weight in grams and survival time in days were recorded for each mouse and the mean for each group calculated.

2.5. Ethical considerations

Approval letter was obtained from the Institutional Review Board of the Department of Biology, Faculty of Science, Addis Ababa University, before the actual conduct of the study. Oral informed consent was obtained from every informant participating in the ethnobotanical study. Study permission was also obtained from the Administration of the Awash-Fentale District.

3. Results

3.1. Ethnobotanical survey

3.1.1. Comparison of knowledge of informants on antimalarial plants

Analysis of knowledge between two age groups indicated that informants above the age of 40 years reported an average of 3 antimalarial plants, whereas, informants up to the age of 39 years, on average, cited 2.5 antimalarial plants. However, there was no significant difference between the two age groups ($P>0.05$) in the mean number of cited antimalarial plants.

3.1.2. Plants reported as antimalarials

A total of 17 species of antimalarial plants belonging to 14 families were documented as being used by the Afar people residing in Awash Fentale District, Afar Region of Ethiopia (Table 1). The families Fabaceae and Euphorbiaceae were represented by three and two antimalarial plants, respectively, and the rest by one antimalarial plan each. Most of the reported antimalarial plants were shrubs (63%), followed by trees (21%) and herbs (16%).

The most frequently cited antimalarial plant species were *A. trichosantha*, *C. rotundifolia*, *Monadenium reflexum* (*M. reflexum*) and *Carica papaya* (*C. papaya*). *A. trichosantha* was reported by 12 informants and *C. rotundifolia* and *M. reflexum* by eight and seven informants, respectively (Table 1).

3.1.3. Plant parts used, mode of remedy preparation and route of administration

Leaf was the most frequently cited part used in the preparation of remedies accounting for 44% of the reported antimalarial plants, followed by stem (22%), root (17%), whole plant (13%) and bark (4%). The remedies were prepared in the form of decoctions and cold infusions using water as a solvent. In some cases, honey, sugar or crushed Allium sativum is added to preparations to make them more palatable and/or improve their effectiveness. All antimalarial

preparations were administered orally.

3.1.4. Abundance of antimalarial plants

According to reports of informants and field observation, two of the antimalarial plants, *M. reflexum* and *A. trichosantha* (Aloaceae) are becoming rare in the nearby areas and as a result collectors needed to travel longer distances to harvest them.

3.2. In vivo acute toxicity and antimalarial activity tests

3.2.1. Acute toxicity of the extracts in mice

Water extracts of the leaves of *C. rotundifolia* and *A. trichosantha* showed no lethal effect on mice up to a dose of 1 500 mg/kg. The mice did not show sign of toxicity for a week. No urination and muscle weakness. There was no significant change (P>0.05) in body weight of mice between day 0 and day 4 (Table 2).

Table 2

Body weight of mice after administration of aqueous extracts of leaves of *A. trichosantha* and *C. rotundifolia* on non-infected mice.

Treatment type	Dose (mg/kg)	Body weight		
		Day 0	Day 4	% change
A. trichosantha	500	25.63±0.70	26.30±0.34	2.54
	1 000	24.97±0.22	25.57±0.34	2.35
	1 500	25.72±0.61	26.20±0.63	1.80
Distilled H_2O	-	30.60±0.55	28.33±0.38	-8.01
C. rotundifolia	500	28.20±0.29	28.60±0.40	1.40
	1 000	27.34±0.62	27.64±0.71	1.08
	1 500	29.23±0.83	29.97±0.81	2.47
Distilled H_2O	-	26.33±0.96	26.10±0.88	-0.88

Values are presented as mean±SEM; n=4.

Similarly, ethanol extracts of the leaves of the two plants showed no lethal effect up to the dose of 1 500 mg/kg. Mice treated with ethanol extracts of the leaves of *A. trichosantha* did not show sign of toxicity. Gross behavioral and physical observations revealed no urination, no muscle weakness and no significant (P>0.05) change in body weight was recorded. Oral administration of ethanol extracts of *C. rotundifolia* leaves revealed no toxicity signs. The mice were physically active, no body convolution, and active to feed. However, some body weight loss was observed, although not significant (P>0.05) on the fifth day in mice given a dose of 500 mg/kg. Mice given 1 000 mg/kg and 1 500 mg/kg of the ethanol extract of *C. rotundifolia* showed significant (P>0.05) body weight change and were physically active (Table 3).

Table 3

Body weight of mice after administration of ethanol extracts of leaves of *A. trichosantha* and *C. rotundifolia* on non-infected mice.

Treatment type	Dose (mg/kg)	Body weight		
		Day 0	Day 4	% change
A. trichosantha	500	24.34±0.53	24.83±0.71	1.9
	1 000	25.25±0.38	25.98±0.88	2.8
	1 500	27.42±0.62	27.83±0.72	1.4
Distilled H_2O	-	24.57±0.85	24.35±0.75	-0.9
C. rotundifolia	500	28.21±0.64	27.39±0.71	-2.9
	1 000	26.24±0.34	26.63±0.83	1.4
	1 500	28.43±0.54	28.92±0.63	1.7
Distilled H_2O	-	27.64±0.91	26.86±0.87	-2.9

Values are presented as mean±SEM; n=4.

3.2.2. Efficacy of the extracts against P. berghei in mice

Treatment with crude aqueous and ethanol extracts of *A. trichosantha* and *C. rotundifolia* resulted in lower *P. berghei* parasitaemia in mice compared to their respective negative controls (Table 4). However, parasitaemia was not cleared in the experimental groups. The highest *P. berghei* suppressive value (53.73%) was recorded for ethanol extract of the leaves of *C. rotundifolia* at a dose of 900 mg/kg and the lowest (3.85%) for the aqueous extract of the same plant at a dose of 300 mg/kg. Mice treated with 600 mg/kg and 900 mg/kg of ethanol extracts of the two plants (*A. trichosantha* and *C. rotundifolia*) significantly (P<0.05) lowered parasitaemia. But treatment at the dose of 300 mg/kg of ethanol extracts of both plants did not show significant effect against parasitaemia compared to the negative control. Mice treated with 900 mg/kg of aqueous extracts of both plants significantly (P<0.05) lowered parasitaemia. But treatment at the doses of 300 mg/kg and 600 mg/kg of aqueous extracts of both plants did not show significant effect against the parasitaemia compared to the negative control.

Table 4

Antiplasomodial activity of crude extracts of leaves of *A. trichosantha* and *C. rotundifolia* against *P. berghei* in mice.

Treatment type		Dose (mg/kg)	% parasitaemia	% suppression	MST (days)
Aqueous extract of *A. trichosantha*	Negative control (H_2O)	-	13.62±0.57	0.00	7.50±0.39
	Positive control (CQ)	10	0.00	100.00	13.65±0.78
		300	11.67±1.88	18.00	10.67±1.48
		600	10.97±0.21	23.00	8.60±0.93
		900	9.76±0.89*	31.50	9.40±0.77
Ethanol extract of *A. trichosantha*	Negative control (H_2O)	-	13.92±0.91	0.00	5.50±0.65
	Positive control (CQ)	10	0.00	100.00	12.97±0.75
		300	10.01±1.71	28.09	10.00±1.82
		600	8.88±1.21*	36.27	10.50±1.19
		900	7.09±1.28*	49.07	13.00±1.06*
Aqueous extract of *C. rotundifolia*	Negative control (H_2O)	-	14.24±0.76	0.00	6.24±0.57
	Positive control (CQ)	10	0.00	100.00	14.36±0.71
		300	13.74±1.94	3.85	8.50±0.50
		600	12.01±1.16	15.96	9.20±0.58
		900	8.46±0.20	40.80	11.50±1.50
Ethanol extract of *C. rotundifolia*	Negative control (H_2O)	-	13.92	0.00	7.15±0.82
	Positive control (CQ)	10	0.00	100.00	13.70±0.83
		300	9.48±2.21	30.46	11.00±0.91
		600	9.07±1.67*	34.84	11.75±1.10
		900	6.44±0.34*	53.73	13.50±0.96*

Values are presented as mean±SEM; *P<0.05 compared with negative control; n=4; MST: mean survival time.

The mean survival times of the mice treated with 600 mg/kg and 900 mg/kg ethanol extract of *A. trichosantha* leaves were (10.50±1.19) and (13.00±1.06) days, respectively (Table 4), whereas, mice in the negative control group lived for (5.50±0.65) days. On the other hand, mean survival times of mice treated with water extract of the leaves of *A. trichosantha* at a dose of 600 mg/kg and 900 mg/kg

were (8.6±0.93) and (9.4±0.77) days, respectively.

Mean survival times of the mice treated with 600 mg/kg and 900 mg/kg ethanol extract of leaves of *C. rotundifolia* were (11.75±1.10) and (13.5±0.96) days, respectively (Table 4), whereas that of mice in the negative control group was (7.50±0.15) days. On the other hand, mean survival times of water extract of the leaves of *C. rotundifolia* at a dose of 600 mg/kg and 900 mg/kg were (9.20±0.58) and (11.5±1.5) days, respectively, which is better even though not significant as compared to the negative control group of (6.24±0.57) days.

Extracts of the leaves of *A. trichosantha* did not cause reduction of body weight in the infected mice even with increasing parasitaemia (Table 5). Analysis of packed cell volume on day 4 indicated that water and ethanol extracts of leaves of the two plants (*A. trichosantha* and *C. rotundifolia*) showed insignificant effect on packed cell volume values (Table 5).

Table 5

Effect of crude extracts of leaves of *A. trichosantha* and *C. rotundifolia* on body weight and packed cell volume of *P. berghei* infected mice.

Treatment type		Dose (mg/kg)	Body weight		Packed cell volume
			Day 0	Day 4	
Aqueous extract of *A. trichosantha*	Negative control (H_2O)	-	23.60±0.75	21.71±0.93	53.76±0.74
	Positive control (CQ)	10	26.68±0.96	27.83±0.58	54.76±0.84
		300	25.86±1.26	25.59±0.70	47.69±0.23
		600	24.89±1.59	25.13±2.20	54.61±0.87
		900	25.48±2.81	27.86±0.53	51.88±1.30
Ethanol extract of *A. trichosantha*	Negative control (H_2O)	-	25.63±0.87	24.20±0.58	48.02±0.64
	Positive control (CQ)	10	24.35±0.77	24.62±0.83	52.34±0.47
		300	29.40±1.14	30.30±2.07	51.00±0.01
		600	30.16±2.60	31.33±4.16	47.17±0.41
		900	30.84±1.84	32.50±1.01	51.01±1.41
Aqueous extract of *C. rotundifolia*	Negative control (H_2O)	-	25.34±0.76	24.25±0.92	52.14±0.87
	Positive control (CQ)	10	24.38±0.69	26.35±0.78	58.45±0.56
		300	28.64±1.34	24.54±1.39	59.04±1.87
		600	24.66±2.12	27.53±1.30△	58.48±0.82
		900	22.15±0.99	19.18±1.16	57.32±1.00*
Ethanol extract of *C. rotundifolia*	Negative control (H_2O)	-	34.30±1.12	27.23±1.94	53.34±0.71
	Positive control (CQ)	10	25.58±0.88	25.86±0.71	57.38±0.44
		300	22.05±0.50	24.22±1.33	53.93±1.16
		600	27.90±1.07	29.21±1.09	52.32±0.49
		900	25.92±0.39	24.70±0.61	56.38±1.22

Values are presented as mean±SEM; *P<0.05 compared with negative control; △Significant difference between Day 0 and Day 4; n=4; MST: mean survival time.

4. Discussion

Some of the antimalarial plants reported during the current study were found to be also used in Ethiopia and elsewhere in Africa for the same purpose. These included *C. papaya*, *Azadirachta indica*, *Aloe* spp., *Senna italica*, *M. reflexum* and *Acalypha fruticosa*[2,5,6,13-16]. The fact that the plants *A. trichosantha*, *C. rotundifolia*, *M. reflexum* and *C. papaya* were the most frequently cited antimalarial plants in the study area may also indicate their effectiveness.

The most widely used antimalarial plants in the study area were trees and shrubs, and this may be related to their accessibility throughout the year tolerating harsh environmental conditions. Leaf was the most commonly used plant part in the area, the harvest of which does not normally causes significant harm to survival of individuals as compared to other parts such as the root, stem and bark. Different communities in Ethiopia commonly use leaves in the preparation of remedies[17-21].

Antimalarial remedies in the study area were prepared in the forms of decoctions and cold water infusions, which in agreement with results of a study conducted elsewhere[2]. The reason behind the choice of these two preparation forms might be related to their relatively better efficiency of extracting active compounds. All antimalarial preparations were administered orally. A study conducted in Shinile District of the Somali Region of Ethiopia also reported that the majority of antimalarial preparations were taken orally.

Knowledge of medicinal plants in the study area is largely transferred orally and thus there is a great danger of losing it. Medicinal plants in the study area are harvested from an area which is facing great pressure due to habitat destruction and over utilization of plant resources. As a result, some antimalarial plants may disappear from the area before appropriate conservation measures are taken.

There was no observed sign of acute toxicity in mice provided with water and ethanol extracts of the leaves of two plants (*A. trichosantha* and *C. rotundifolia*). Administration of the extracts of both plants did not bring significant change in body weight of the mice. The result could justify the local use of the two plants in the study area to treat malaria. The traditional healers or practitioners in the study area primarily used water as a solvent. But the *in vivo* study showed that ethanol extracts were of better antimalarial activity. This may be due to the better solubility of the active components in organic solvents.

The observed antimalarial activity of extracts of the two plants is consistent with their traditional use to treat malaria in Awash Fentale District as well as elsewhere in Ethiopia[6,22]. The suppression effect caused by extracts of the two plants might be associated with the presence of chemical ingredients that have antimalarial properties. Different *Cadaba* species were reported to contain alkaloids and sesquiterpene lactones. Cadabicine and cadabicine acetate spermidine alkaloids were isolated from the stem bark of *Cadaba farinosa*[23-25]. A new flavonol triglycoside, rhamnocitrin-3-*O*-neohesperoside-4-*O*-glucoside was also isolated from the ethanol extract of *Cadaba* glandulosa together with two known diglycosides rhamnocitrin-3-*O*-neohesperoside and rhamnetin-3-neohesperoside[8].

The ethnobotanical study conducted in Awash Fentale District of the Afar National Regional State of Ethiopia documented 17 plant species that were traditionally used by the Afar community for the management of malaria. Two plants (*A. trichosantha* and *C. rotundifolia*) that had the highest number of informant citations were screened for their *in vivo* antiplasmodial activity and found to

demonstrate appreciable suppressive effects. Despite the presence of rich knowledge and use of antimalarial medicinal plants in the study area, the ongoing habitat destruction and overexploitation of plant resources is posing a great danger to the continuation of traditional medical practice. Thus, appropriate conservation measures are required to save the medicinal plants from further destruction. The antimalarial activity of *A. trichosantha* and *C. rotundifolia* may partly explain and support the traditional use of the plants for malaria treatment. However, further activity tests and phytochemical investigations need to be carried out to isolate and identify active principles that may serve as potential source of antimalarial drugs.

Conflict of interest statement

Authors declare that they have no conflict of interests.

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