Original article

Concomitant use of medicinal plants and conventional medicines among hypertensive patients in five hospitals in Ethiopia

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Abstract

Background: Even if the use of medicinal plants has a long tradition in Ethiopia, little is known about which medicinal plants are concomitantly used with which conventional medicines, since patients' disclosure to their treating physicians is low. The concomitant use of medicinal plants and conventional medicines may increase the risk of unwanted interactions, unexpected toxicities and possible under-treatment. The aim of this study was to identify plants concomitantly used with conventional medicines by hypertensive patients.

Methods: A total of 365 patients and 17 healers were surveyed to identify medicinal plants commonly used by hypertensive patients. In addition, patients' charts were reviewed to identify if they had any co-morbid conditions or history of taking medicinal plants. Descriptive statistics were used for the analysis.

Results: Of 365 hypertensive patients, 171(46.8%) reported having co-morbidities, mainly hypercholesterolemia(28, 7.7%), diabetes mellitus(38, 4.9%) and asthma (12, 3.3%). While the majority (319, 87.4%) of patients preferred modern medicines for the management of their hypertension, some preferred taking holy water (24, 6.69%) and using medicinal plants (20,5.5%). The concomitant use of medicinal plants and conventional medicines was practiced by just under half of the patients (171, 46.8%). Hydrochlorothiazide, enalapril, nifedipine, amlodipine, atenolol and aspirin were the most commonly used conventional medicines. Moringa (*Moringa stenopetala*), damakase (*Ocimumlamiifolium*Hochst.), haregresa (*Zehneriascabra*Sond.) and thyme(*Thymus serrulatus*)were the most commonly used plants. However, none of these medicinal plants were standardized in terms of the dose, frequency, duration or method of preparation.

Conclusions: Conventional medicine was the initial primary treatment choice for hypertensive patients. However, a high tendency of using medicinal plants concomitantly was observed due to the side-effects of conventional medicines, patients' curiosity to try medicinal plants and the desire to achieve better blood pressure control. [*Ethiop. J. Health Dev.* 2019; 33(4):239-249]

Key words: Hypertension, herb-drug interaction, medicinal plants, conventional medicine, Ethiopia

Introduction

The use of medicinal plants for therapeutic purposes is as old as human kind. The concomitant intake of medicinal plants with prescribed medications is increasingly common among patients with chronic diseases such as hypertension (1,2). The main reason for the co-use of medicinal plants with conventional medicine is the perception that medicinal plants are entirely safe, since they are derived from natural sources (3). Other reasons are the assumption that medicinal plants are relatively accessible, affordable and efficacious compared to conventional medicines (4-6),dissatisfaction with conventional treatment, past good experiences of taking medicinal plants, as well as family traditions (7).

The co-use of conventional anti-hypertensive medicines and medicinal plants is becoming a major safety concern due to a rise in hypertension prevalence, aging populations, intrinsic pharmacokinetic and pharmacodynamics interactions, unsupervised self-administration (8) and lack of adequate knowledge about the phytochemicals and pharmacological properties of medicinal plants (6,7). The low tendency of patients to disclose to their treating physicians and pharmacists that they are using medicinal plants, either alone or in combination with conventional medicine, makes the matter worse(2,6,9-11), since co-use may increase the risk of unwanted interactions, unexpected toxicities and possible under-treatment, either by mimicking, decreasing, or increasing the action of conventional medicines (12).

Moreover, the absence of readily available clinical and pharmacological information related to drug-herb interactions, particularly for indigenous medicinal plants commonly used by hypertensive patients, makes doctors and pharmacists oblivious to their patients' use of medicinal plants. This may result in adverse drug-herb interactions (1). Recognizing adverse effects related to medicinal plant use in health facilities is not easy and is often under-reported (13). Overtime, patients may substitute conventional therapies with medicinal plants without informing their doctors (2). In Ethiopia, despite the increase in health service coverage, a substantial number of people still rely on herbal medicines to meet their healthcare needs (14,15). A study conducted among hypertensive patients in Gondar revealed that 75.3% of patients co-used medicinal plants and conventional medicines (5).

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Moreover, some traditional healers reported providing conventional medicine along with herbal preparations for their patients (16).

In the light of these facts, the potential herb-drug interaction of commonly used medicinal plants with prescribed conventional medicines still needs to be explored. The aim of this study was to identify plants concomitantly used with conventional medicines by hypertensive patients

Methods
Study design:
A survey was conducted in four regions and one city administration from May to June2017.

Study areas:
The present study was conducted in five hospitals selected in Bahir Dar, Adama, Hawassa and Mekele in four regional states (Amhara, Oromia, SNNP and Tigray) and one city administration (Addis Ababa).

Sampling and sample size:
The five hospitals were selected purposively based on the volume of patients and the type of services they render.

Using an interviewer-administered questionnaire, the survey was conducted among all hypertensive patients aged 18 years or older who volunteered to be interviewed and visited the outpatient department during the study period.

Data collection tools:
The questionnaire had two parts: Part I: Socio-demographic characteristics; and Part II: Conventional and herbal medicine use. In the first part, respondents were asked about their age, address, religion, education status, occupation, average income, and household size. In the second part, they were asked about the duration of being diagnosed for hypertension, choice of first treatment, the use of conventional and herbal medicines, reasons for taking/not taking herbal medicines, source of information, history of discontinuing medication, and any discussions they have had with their physician or pharmacist about herbal medicines. The questionnaire was prepared in English based on previous literature and studies (17,18), and was translated into three local languages (Amharic, Oromifa, and Tigrigna) to collect the required information from respondents.

In addition, a self-administered questionnaire was used for healers to identify the different medicinal plants they use for the treatment of hypertension and to assess patients' history of plant use. The data abstraction form was also used to collect information from the patients' charts regarding any recorded herbal medicines used, in order to identify co-morbid conditions and the types of medicine taken by patients. Data were collected by 10 trained pharmacists, all of whom were based around the selected hospitals and who could speak the local language used in the area.

The questionnaire was pretested in a general hospital not included the study and was amended accordingly. Adequate training was given to all data collectors regarding the data collection tool and the approach they should follow during interviews.

The data were coded, entered, cleaned and analyzed using SPSS version 20. Descriptive statistics were used to summarize results in the form of tables and graphs.

Ethical considerations
Ethical clearance was obtained from the Institutional Review Board (IRB) of the College of Health Sciences, Addis Ababa University. In addition, permission was secured from directors of selected hospitals and administrators in the respective kebeles. Written consent was secured from each participant after explaining the aims of the study. Participants were assured that no personal identifiers would be used and the collected data would be analyzed in aggregate.

Results
Socio-demographic characteristics of participants: A total of 365 patients participated in this study. The majority were females (203, 55.6%), aged above 40 years (306, 84.8%), married (213, 58.4%) and urban dwellers (298,81.6%). In terms of education, the vast majority (164, 72.4%) had no formal education or had completed a low level of formal education. Respondents' earnings ranged from ETB 100 to ETB 20,000 per month, with a median income of ETB 1,550 (IQR=3,100) (Table 1).

Table 1: **Socio-demographic characteristics of adult patients with hypertension, May-June 2017 (n=365)**

Variables (n=365)	Frequency	Percentage
Gender		
Male	162	44.4
Female	203	55.6
Age (in years)* ††		
≤40	55	15.1
41-50	80	21.9
51-60	105	28.8
>60	121	33.2
Region		
Addis Ababa	79	21.6
Amhara	85	23.3
Oromia	98	26.8
Tigray	42	11.5
SNNP	61	16.7
Residential area		
Urban	298	81.6
Rural	67	18.4
Religion		
Orthodox Christian	254	69.6
Muslim	74	20.3
Protestant Christian	31	8.5
Others	6	1.6
Marital status††		
Married	213	58.4
Single	23	6.3
Divorced	11	3
Widowed	33	9
Educational status		
Low education†	186	51.0
Primary level	78	21.4
Secondary level	43	11.8
Post-secondary education	58	15.9
Occupational status ††		
Housewife	124	34
Salaried employment	34	9.3
Self-employed (trading, farming)	88	24.1
Unemployed or retired	62	17
Others	10	2.7

Mean±SD=55.86±13.4; range=20 to 91; median income= ETB1,550 birr (IQR=3,100),
†*Either cannot read or write or has basic reading/writing skills.*
††*missing data*

Clinical conditions and treatment of patients with hypertension: Of the 365 hypertensive patients interviewed, 171(46.8%) reported having co-morbidities, mainly hypercholesterolemia (28, 7.7%), diabetes mellitus (38, 4.9%) and asthma (12, 3.3%). On average, they had lived with hypertension for 6.0 years (SD±5.8 years, range= 1 month to40years).

Most (319, 87.4%) of the hypertension patients preferred conventional (modern) medicines for the management of their hypertension. Holy water and herbal medicines were used by 24(6.69%) and 20 (5.5%) patients, respectively.

As Figure 1 shows, 74.5% of the respondents were taking two or more medications concurrently for an average of 5.3years (SD= 5.9 years, range= 1 month to 30 years).
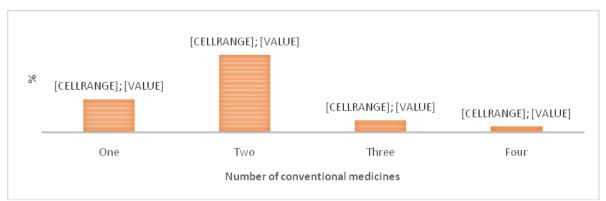
Figure1: **Number of conventional medicines taken by hypertensive patients, May-June2017 (n=365)**

Hydrochlorothiazide, enalapril, nifedipine and amlodipine were observed to be the most commonly prescribed anti-hypertensive medications (Table 2).

Table 2: **Frequently prescribed conventional medicines for hypertensive patients, May-June 2017(n=354)**

Agents	Class of medication	Drugs	n	%
Primary anti-hypertensive agents (56.4%)	Thiazide diuretics	Hydrochlorothiazide	177	20.8%
	ACE inhibitors	Enalapril	173	20.3%
	Calcium channel blockers	Nifedipine	73	8.6%
		Amlodipine	57	6.7%
Secondary anti-hypertensive agents (10.1%)	Loop diuretics	Furosemide	25	2.9%
	Beta blockers	Atenolol	52	6.1%
		Metoprolol	9	1.1%
Antiplatelets (5.5%)	NSAIDS	Aspirin	47	5.5%
Anti-diabetics (10.3%)	Biguanide	Metformin	39	4.6%
	Sulfonylureas	Glibenclamide	28	3.3%
	Insulin	Insulin	10	1.2%
		NPH insulin	10	1.2%
Cholesterol-lowering medications (8.7%)	Statins	Atorvastatin	22	2.6%
		Simvastatin	19	2.2%
		Lovastatin	15	1.8%
Anti-depressants (2.1%)	Tricyclic anti-depressants	Amitriptyline	18	2.1%
Antiulcer (1.1%)	Proton pump inhibitors	Omeprazole	9	1.1%
Others (7.9%)		Others	68	7.9%

Almost half of the hypertensive patients (171, 46.8%) reported having used medicinal plants either to treat their illness or maintain their health. They also obtained medicinal plant-related information mainly from their friends (63, 17.5%), physicians (34, 9.3%), the mass media (e.g. newspaper/internet/TV) and elders (5, 1.4%). However, one third of the patients(113, 31%) were not aware of the potential health risk of using un standardized medicinal plants (in dose, frequency and duration) and when co-used with the conventional medicine.

On the other hand, 218(59.7%) patients reported to have never used medicinal plants for the management of their hypertension. Their main reasons were satisfaction with the treatment outcome of conventional medicine (69, 31.7%) and perceived safety issues of taking medicinal plants (56, 25.7%).

One quarter of hypertensive patients (98, 26.8%) used both conventional and medicinal plants. Their reasons were to have better control of blood pressure (73, 20%), or to experiment (8, 2.1%) with medicinal plants to see if they have fewer side effects compared to using ant-hypertensive medicines. A few also used both, stating that using medicinal plants alongside conventional medicines would have no side effects.

Despite the fact that a sizable number of patients (98) reported concomitant use of medicinal plants and

conventional medicines, only 12 (3.2%) patients disclosed using both to their treating physicians or pharmacists. Of these, half of them said that they were encouraged to continue taking both. Ten percent (33) of the patients discontinued taking conventional medicines after they had started taking medicinal plants.

As shown in Table 3, 24 medicinal plants were identified by hypertensive patients. Of these, 17 were used to manage hypertension. Moringa (*Moringa stenopetala*) (76 informants) was the most commonly reported plant, followed by damakase (*Ocimumlamiifolium*) (29), haregresa (*Zehneriascabra*) (15) and thyme (*Thymus schimperi*) (15).

Table 3: **Medicinal plants used by hypertensive patients in Ethiopia, May-June 2017**

Vernacular name	Common name in English	Scientific name	Family	Part(s) used	Number of informants
Shiferaw	Moringa	*Moringastenopetala* (Baker f.) Cufod.	Moringaceae	Seed (11) and leaf (65)	76
Damakase*		*Ocimumlamiifolium*Hochst.	Lamiaceae	Leaf (29)	29
Haregresa		*Zehneriascabra*Sond.	Cucurbitaceae	Leaf (15)	15
Tossign	Thyme	*Thymus schimperi*Ronniger	Lamiaceae	Stem (1) and leaf (14)	15
Nechshinkurt	Garlic	*Allium sativum* L.	Alliaceae	Seed (7)	7
Abish	Fenugreek	*Trigonellafoenum-graecum* L.	Fabaceae	Seed (5)	5
Tikurazimud	Black cumin	*Nigella sativa* L.	Ranunculaceae	Seed (5)	5
Taliba	Flaxseed	*Linumusitatissimum*L.	Linaceae	Seed (4)	4
Tenadam*	Rue	*Rutachalapensis* L.	Rutaceae	Seed (1) and leaf (3)	4
Gibto	White lupin	*Lupinus termis*Forssk	Fabaceae	Seed (3)	3
Kerefa	Cinnamon	*Cinnamomumverum* J. Presl	Lauraceae	Root (3)	3
Bahir zaf*	Eucalyptus	*Eucalyptus globules* Labill	Myrtaceae	Leaf (2)	2
Kosso*		*Hageniaabyssinica*(Bruce) J.F.Gmel.	Rosaceae	Seed (2)	2
Tunjut		*Otostegia integrifolia Benth.*	Lamiaceae	Stem(2)	2
Zinjibil	Ginger	*Zingiberofficinale* Roscoe	Zingiberaceae	Root (2)	2
Armagusa		*Ajugaintegrifolia*Buch. Ham.	Lamiaceae	Leaf (1)	1
Buna*	Coffee	*Coffea Arabica* L.	Lamiaceae	Seed (1)	1
Dimbilal	Coriander	*Coriandrum sativum*L.	Apiaceae	Seed (1)	1
Ensilal	Fennel	*Foeniculumvulgare* Mill.	Apiaceae	Leaf (1)	1
Girawa		*Vernoniaamygdalina*Delile	Asteraceae	Leaf (1)	1
Khat	Khat	*Catha edulis* Forsk	Celastraceae	Leaf (1)	1
Lomi*	Lemon	*Citrus limon*(L.) Osbeck	Rutaceae	Seed (1)	1
Rozmerina	Rosemary	*Rosmarinusofficinalis* L.	Lamiaceae	Leaf (1)	1
Ye zeyitunakitel*	Guava	*Psidiumguajava*L.	Myrtaceae	Leaf (1)	1

* *Shows herbs used by hypertensive patients for other comorbidities they have e.g. diabetes, 'michi', cough etc.*

Leaves (70%) and seeds (26%) were the most commonly used morphological parts.

However, large inconsistencies in dose, frequency, duration and preparation techniques of medicinal plants were observed in this study. For instance, *Moringa stenopetala*, the plant most widely used by the patients for the management of hypertension, was taken in 33 different ways (Table 4). While 14.8% of the respondents used the seeds, 85.2% used the leaves. Respondents also reported taking the required amount of the seed/leaf using a spoon, a coffee cup or a glass, all of which could vary from household to household. The frequency of administration also ranged from taking the medicinal plants occasionally to three times per day. Similarly, the duration varied greatly – some were taking it when needed or available, and others were taking it once or for different periods, up to a year, or on a lifelong basis. There were also patients who did not know how much and for how long to take the medicinal plants.

Table4: **Inconsistencies in dose, frequency and duration of *Moringa stenopetala*use by hypertensive patients, May-June2017**

Plant parts used	Dose	Frequency	Duration
	1 coffee cup	Three times a day	When available
	1 glass	Once a day	As needed
Seeds	1spoonful	Once a day	For three months
	1 spoonful	Occasionally	For a month
	1 spoonful	Once a day	For a month
	1 spoonful	Three times a day	When available
	1 coffee cup	Once a day	When available
	1 coffee cup	Once a day	For a year
	1 coffee cup	Once a day	When available
	1 glass	Once a day	Lifelong
	1 glass	Once a day	When available
	1 glass	Once a day	Until improved
	1 glass	Once a day	For three months
	1 glass	Once a day	For two months
	1 glass	Once a day	For a month
	1 glass	Once a day	Only once
	1 glass	Once a day	Undefined
	1 glass	Twice a day	For a month
	1 glass	Three times a day	Lifelong
	1 glass	Three times a day	For a year
	1 glass	occasionally	When available
	1 glass	Occasionally	Undefined
	1 glass	Undefined	Undefined
Leaves	Undefined	Occasionally	Until improved
	Undefined	Once a day	Lifelong
	1spoonful	Once a day	For a year
	1 spoonful	Once a day	Until improved
	1 spoonful	Once a day	Lifelong
	1 spoonful	Occasionally	For three days
	Rub the leaf vigorously and express the liquid	Occasionally	Until improved
	Undefined	Occasionally	Undefined
	Undefined	Undefined	Undefined
	Undefined	Once a day	Only once

Respondents reported using different preparation techniques in order to take medicinal plants as a treatment (Figure2). Many of them would dry and shred the different parts of the medicinal plants and eat them as food (48.6%);some mixed the powdered herbs with coffee and drank them (9.2%);others ate the leaves and seeds as food. Boiling the leaves and inhaling the vapor was also reported (5.9%).
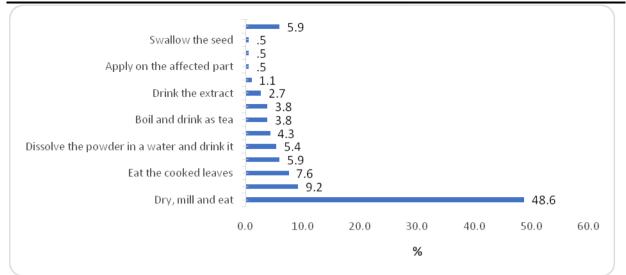
Figure 2: **Commonly used preparation and adminstration techniques of medicinal plants used by hypertensive patients in Ethiopia, May-June2017**

After using medicinal plants, 150 (41.1%) respondents said their health condition had improved, while the rest (211, 57.9%) reported no change or progress in their health condition.

Herb-drug interaction from healers' perspectives: Seventeen traditional healers agreed to participate in this study. Most of them were males (16/17), and Orthodox Christians (10/17). In terms of education, six of the 17 attended religious schools; the rest attended secondary school or university.

As Figure 3 below shows, healers reported that they obtained their knowledge from their families (15/17), religious institutions (6/17), or from other healers (4/17), friends (3), and as a gift from God (2), with most healers mentioning more than one source. At the time of the survey, almost all (15/17) healers were working full time. On average, a healer treated 23 patients (SD= 24.3; range= 3 to 70 patients per week).
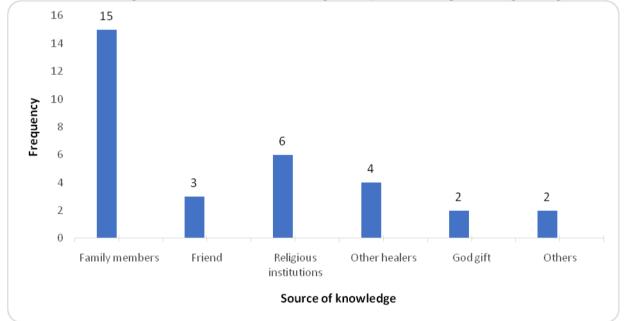

Figure 3: **Healers' source of knowledge for their traditional medicine practice (n=17), May-June 2017**

Of the 17 healers, 14 were willing to provide information regarding the different medicinal plants they used for the treatment of hypertension. On average, a healer disclosed 1.6 medicinal plants (SD=1.081) ranging from 1 to 5 (Table 5). They also reported getting the knowledge of practicing traditional medicine mainly from their families (15/17).

Table 5: **Medicinal plants and their use described by healers for the treatment of hypertension in Ethiopia, May-June 2017**

Vernacular name	Common name in English	Scientific name	Family	Frequency of citation by the healer	Parts of the herb used	Is there interaction with modern medicines?		
						Yes	No	Don't know
Amera		*Plumbagozeylanica* L.	Plumbaginaceae	1	Root		1	
Armagusa		*Ajugaintegrifolia*Buch. Ham.	Lamiaceae	2	Leaves	1		1
Damakase		*Ocimumlamiifolium*Hochst.	Lamiaceae	2	Leaves	1	1	
Dimbilal	Coriander	*Coriandrumsativum*L.	Apiaceae	1	Fruits		1	
Gibto	White lupin	*Lupinusalbus*L.	Fabaceae	2	Fruits	2		
Kerero		*Acokantheraschimperi* (A.DC.) Schweinf.	Apocynaceae	1	Leaves	1		
Koshim		*Dovyalisabyssinica*(A.Rich.) Warburg	Flacourtiaceae	1	Fruits		1	
Mekmeko		*Rumexabyssinicus* Jacq.	Polygonaceae	1	Root		1	
Shiferaw	Moringa	*Moringa stenopetala* (Baker f.) Cufod.	Moringaceae	3	Leaves		2	
					Fruits		1	
Telba	Flaxseed	*Linumusitatissimum* L.	Linaceae	1	Root		1	
Tenadam	Rue	*Ruta chalapensis* L.	Rutaceae	2	Leaves	2		
Tossign	Thyme	*Thymus schimperi*Ronniger	Lamiaceae	1	Root		1	
Tut astil		*Ajugaintegrifolia*Buch.-Ham. ex D.Don	Lamiaceae	1	Root		1	
Werkbemeda		*Cocciniagrandis* (L.) Voigt	Cucurbitaceae	1	Root		1	

Discussion

Our study revealed that patients preferred conventional medicine as their first choice for the management of hypertension, but many of them used also medicinal plants either to treat their illness or maintain their health. However, they lacked knowledge about the possible health risks of using medicinal plants alone or concomitantly with conventional medicine. Moringa, damakase, haregresa, thyme, garlic and fenugreek were found to be the most commonly used medicinal plants among hypertensive patients.

Ethnobotanic studies conducted in Ethiopia also reported anti-hypertensive effects of moringa (*Moringastenopetala*), thyme (*Thymus serrulatus* and *Thymus schimperi*), dokma (*Syzygiumguineense*), white lupin (*Lupinusalbus*), digita (*Calpurniaaurea*) and armagusa (*Ajugaremota*)(20,21).

Some herbs were reported by both patients and healers to have anti-hypertensive properties. These were: armagusa, damakase, white lupin, moringa, flaxseed, rue and thyme. *In vivo* studies conducted in rats revealed that crude extracts of moringa (21), thyme

(22) and armagusa had anti-hypertensive and diuretic activities (20).The seeds of white lupin were also used for the preparation of local alcohol in northwestern Ethiopia, which is claimed to be helpful in controlling hypertension. In white lupin, the relatively high content of arginine, a precursor of the nitrogen oxide synthesis, probably has a blood lowering effect (23).

Commonly co-used and interacting medicinal plants among patients who had a history of hypertension and other co-morbidities are: St John's wort (for depression), bee pollen granules (for general wellbeing), prickly pear cactus (for diabetes), arejin and daiokanzoto (for chronic allergic rhinitis and constipation),and fenugreek (for liver disease and to stimulate digestion) (1).

Possible interactions between commonly used conventional anti-hypertensive medicines (such as hydrochlorothiazide, enalapril, nifedipine, amlodipine, atenolol and aspirin) and medicinal plants(including moringa, damakase, haregresa and tossign) were searched for in the literature, but no interactions were found.

However, a review of patients who had a history of hypertension and other co-morbidities taking herbs and using prescribed medications showed that the interaction between St John's wort and warfarin caused upper gastrointestinal bleeding and increased the international normalized ratio (INR). While the co-use of bee pollen granules' interaction with warfarin also elevated the INR level, prickly pear cactus interaction with glipizide caused hypoglycemia. Those patients who combined arejin and daiokanzo developed mild anemia, liver dysfunction, mildly elevated creatine kinase (CK) level, and severe hypokalemia and hypochloremia (1).

Even though the present study showed a high usage of medicinal plants among hypertensive patients, most biomedical practitioners do not usually ask their patients whether they take medicinal plants. Patients' disclosure to their treating physicians regarding their concomitant use is also very low. For instance, in South Africa, among NCD patients who took conventional medicine to manage hypertension, 30% were simultaneously using medicinal plants (4). In another study conducted in rural communities in South Africa, 31 of 50 people who had been diagnosed with hypertension were supplementing their prescribed hypertension drugs with medicinal plants without notifying their doctors (2). Our study showed that documenting the use of medicinal plants in patient medical charts was also rare.

Appreciating cultural background and the personal beliefs of patients, being non-judgmental and making patients comfortable to freely tell their practice to physicians could improve the situation (10,19,24) and may help physicians and other health professionals to associate the potential effects of medicinal plants and conventional medicine use with therapeutic outcomes.

Our findings show that there is lack of standardization in the collection, handling, processing and production of medicinal plants; gaps in confirming the identity, quality and purity of the medicinal plants; and an absence of optimization in dose, frequency and duration of taking medicinal plants, which corroborate the findings of other studies (25,26). In addition, the volume held by measuring cups and spoons used should also be specified, rather than relying on this information from patients. Pre-formulated and ready-to-be-dispensed medicinal plants and plant parts should also be checked to ascertain if they are adulterated with conventional medicine, and if the compounds are being prepared in a hygienic environment, meeting the criteria of the regulatory authority. Failure to do so may endanger the public health.

Limitations of the study

Our study reported various medicinal plants used by hypertensive patients and healers. However, collecting samples of some reported plants was not possible. In addition, attempts made to check the interaction between commonly used anti-hypertensive conventional medicines and medicinal plants on the internet and Medscape drug interaction checker did not provide much information. The second phase of the study, including extraction of the herbs and testing potential interactions, may provide clinically important information. Recall bias also needs to be considered to prevent under-reporting of the extent of combined pharmaceutical/traditional medicines.

Conclusions

Hypertensive patients in Ethiopia resort to conventional medicine as a primary treatment option. They also commonly use medicinal plants such as moringa (*Moringastenopetala*), damakase (*Ocimumlamiifolium*Hochst.), haregresa (*Zehneriascabra*Sond.), thyme (*Thymus serrulatus*) nechshinkurt (*Allium sativum* L.), fenugreek (*Trigonellafoenum-graecum* L.), armagusa (*Ajugaintegrifolia*Buch. Ham.),gibto (*Lupinusalbus*) and rue (*Rutachalapensis* L.) alone or in combination with conventional medicine. However, none of the medicinal plants were standardized in dose, frequency, duration or method of preparation. More research is necessary to assess the pharmacological effect of the reported herbs and their interaction with conventional medicine to prevent therapeutic failure and toxicity among hypertensive patients and to establish guidelines for concomitant use, and to prepare a manual for physicians (and guidelines for patients) to make informed decisions. Training should be given to healers and users on how to extract and prepare different medications in a hygienic environment. The type of medicines that healers dispense should be identified and controlled by the regulatory authority so as to protect the public from health risks.

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Availability of data and materials
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Authors' contributions
MYY and TGF conceptualized the study and led the project. BMH, AIB and TGF designed the survey. DTG performed the data analysis and drafted the manuscript. All authors provided critical feedback and edits to the draft. All authors approved the final manuscript.

Ethics approval and consent to participate
This survey was approved by Institutional Review Board (IRB) of the School of Pharmacy and the College of Health Sciences, Addis Ababa University. Participants were also briefed about the purpose of the study and asked for their verbal consent to be involved in the study.

Competing interests
The authors declare that they have no competing interests.

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