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Indigenous Herbal Medicine Use and its Associated Factors among Pregnant Women attending antenatal care at Public Health Facilities in Dire Dawa Administration, Eastern Ethiopia: A cross-sectional study

ABSTRACT

Objective: The aim of this study was to investigate the prevalence of indigenous herbal medicine use and its associated factors among pregnant women attending antenatal care at public health facilities in Dire Dawa Administration, eastern Ethiopia

Design: Cross-sectional study

Main outcome measures: Outcomes of interest were the prevalence of indigenous herbal medicine use and its associated factors among pregnant women

Methods: From October 10 to November 10, 2022, a cross-sectional study was carried out in public health institutions in the Dire Dawa, Ethiopia. Participants were selected using a random selection method. A structured questionnaire was used to gather the data. Epi DATA (Version 3.1) was used to enter and clean the data, and SPSS (Version 22) was used to analyze it. To select variables for multivariate analysis, a P-value of 0.25 at bivariate and 0.05 at multivariate with 95% confidence intervals was considered statistically significant.

Results: During pregnancy, 47.8% of women took local herbal remedies. The predictors were education level: no formal education (AOR: 5.47, 95% CI: 2.40-12.46), primary level (AOR: 4.74, 95% CI: 2.15-10.44), rural residence (AOR: 2.54, 95% CI: 1.71-3.77), being housewives (AOR: 4.15, 95% CI: 1.83-9.37), number of antenatal care visits (AOR: 2.58, 95% CI: 1.27-5.25), and knowledge of IHMs (AOR: 4.58, 95% CI: 3.02-6.97).

Conclusion: Almost half of pregnant women used various indigenous herbal medicines during pregnancy and were linked to various factors. The study's findings are helpful in advancing knowledge and comprehension of the types, enforcing factors, and strategies to mitigate potential dangers associated with them. The authors recommended health facilities raise awareness about the risks of herbal medicine for pregnant women and further researches.

Keywords: herbal medicine, pregnant women

Strengths and limitation of this study

- The study focused on indigenous herbal medicine use among pregnant women, which is a common phenomenon with potentially harmful effects on pregnant women and fetuses, and this is an important topic in obstetrics.
- The data collectors were local language speakers and knew the local norms and times at which participants were comfortable (after ANC cares); this was very helpful to probe the actual information and reduce the non-response rate.
- The study included many public health facilities (both urban and rural), which increases the external validity of the study.
- Due to the cross-sectional nature of the study, it did not show causal relationships between variables.
- Because we used the interview response method, we were limited by recall bias and some social desirability biases. However, scientific procedures were used to minimize the possible effects of these limitations, such as a contextually modified and pre-tested questionnaire, using easy and simple words to understand, giving time to memorize, and explaining the aims of the study. Besides, we had provided intensive training for data collectors and supervisors before the actual data collection on how to approach and interview the participants privately to minimize social desirability bias. Therefore, using appropriate and scientific procedures at the time of interviewing participants addressed these limitations.

Introduction

Traditional medicine (TM) is characterized by the World Health Organization (WHO) as "health practices, approaches, knowledge, and beliefs incorporating plant, animal, and mineral-based medicines, spiritual therapies, manual techniques, and exercises, applied singly or in combination to treat, diagnose, and prevent illnesses and maintain well-being [1].

"Indigenous herbal medicine (IHM), a branch of traditional medicine, refers to the use of locally available herbs for the treatment of illness and enhancement of general health and wellbeing [1,2]. These herbal medicines consist of herbs, herbal materials, herbal preparations, and completed herbal products that have active components that are plant parts or other plant materials [1,3,4].

Significant physiological changes that occur during pregnancy are what cause numerous symptoms including nausea, vomiting, heartburn, constipation, and so on. These symptoms

frequently require pregnant women to use treatments like IHMs [5,6]. In addition, studies show that pregnant women utilize IHMs for conditions like exhaustion, respiratory and skin problems, and nutritional problems [7-9]. Moreover, some studies have identified three key factors that contribute to pregnant women using herbal remedies: availability, perceived effectiveness in comparison to conventional medication, and affordability [10,11].

Additionally, some studies reveal major reasons why pregnant women use herbal medicines; because of their wide availability, possibly because they perceive better effectiveness relative to modern medicine, and because of the relatively low cost of these medicines [12-14].

Globally, the use of IHMs by pregnant women has often evolved through many generations, a process that has led to many effective remedies [1,7,15]. However, many countries have not investigated the associated side effects and complications on pregnant women and the fetus [1,7,10,11,15]. Besides, the use of IHMs among pregnant women varies significantly, depending on the geographic location, cultural traditions, and socioeconomic levels [16-19].

In Africa, including Ethiopia, IHMs are widely used by the population and pregnant women too [3,13,14,20,21]. This is because, there is a lack of modern health care services and medicine in proportion to people, being available only to a limited number of pregnant women because they are either expensive or few are available for too many people [14]. Herbal medicine use could result in heartburn, increased blood flow, miscarriage, premature labour and allergic reactions[22]. Supplementing conventional treatment with HMs may also complicate the care of pregnant women who have pre-existing conditions such as epilepsy or asthma [8]. Abortion, preterm birth, intrauterine death and intrauterine growth restriction, uterine rupture, stillbirth, birth defects of the eye, ear, heart, and other risks also have been linked to the use of IHMs by pregnant women[19,21,23,24]. So, pregnant women in low-resource countries like Ethiopia routinely employ herbal medicines. However, research lacks in the study area. Therefore, the purpose of this study was to evaluate it and its associated factors in order to aid in intervention.

Methods and Materials

Study setting and Design

A facility-based cross-sectional study was conducted in Dire Dawa administration, eastern Ethiopia, from October 10 to November 10, 2022. Dire Dawa administration is located 515 kilometers from Addis Ababa, the capital city of Ethiopia. According to 2020 population projections, 506,000 people live in the Dire Dawa Administration (68% of whom are estimated

to be urban inhabitants), which has 38 rural and 9 urban kebeles (the smallest administrative units). This administration has six hospitals, including two public and four private ones, 1 defense force hospital, 17 health centers and 34 health posts. There are 35 drug shops, 35 pharmacies, 10 higher special clinics, 9 medium level clinics and 48 primary clinics. Additionally, there are 2 non-governmental clinics (Family guidance and Maristops international clinics) [25].

Study settings: one public referral hospital (Dilchora RH) and six public health centers (3 urban and 3 rural) were selected purposively based on their client flow (information taken from ANC registration book in each health facilities) and sample size was proportionately allocated (Figure 1).

Sample size and Sampling Procedure

The sample size was determined using a single population proportion formula considering the following assumptions: standard normal distribution (z = 1.96), 95% level of significance, 4% margin of error, prevalence=48.6%[26], and 10% non-response rate. The final sample size became 660. To obtain all 628 study participants, a simple random sampling technique was used. All confirmed pregnant women of any gestational age were included. However, pregnant women who were severely ill and unable to communicate were excluded.

Data Collection Methods

The data was collected via face-to-face interview using a pre-tested, interviewer-guided, structured questionnaire that was adapted from literature designed for the same study purpose, and then variables were reviewed to suit the local context [13,20,27-30]. The questionnaire contains four main parts: socio-demographic characteristics; obstetrics; commonly used herbs; knowledge; and perceptions of IHMs. A total of eight health extension workers were recruited for data collection, and four MSc midwives supervised the whole process.

Operational Definitions:

Indigenous herbal medicine (IHM): is the use of locally available plants to treat some abnormalities in pregnant women [13,30].

Income: the average family's monthly income of the pregnant women in ETB(Ethiopian Birr)[31].

Data Quality Control

The questionnaire was developed in English and translated into the local languages (Afan Oromo, Somali, and Amharic) and then back to English to maintain its consistency. Three days

of training were provided to all data collectors and supervisors. We performed a pretest on 5% of the sample size out of the selected health centers at Adisketema health center(urban) and Wahil health center(rural) 2 weeks before the actual data collection. Based on the findings of the pretest, we made minor modifications to the questionnaire. The data collection process was closely supervised, and the completeness of each questionnaire was checked by the investigators and supervisors daily. Data was entered into the EPI DATA software as part of data management. During data cleaning, a logical checking technique was used to identify the errors. Questionnaires are secured in a safe place for confidentiality and as a backup for later, in case a check is necessary. Finally, double data entry was done by two data clerks, and the consistency of the entered data was cross-checked.

Data processing and Analysis

The data were coded and entered into Epi Data (Version 3.1) and exported to SPSS (Version 22) statistical software for analysis. A univariate analysis was used to describe the frequency distribution variables. We coded the outcome variables as "1" for "IHM user" and "0" for "non-user." The association between the outcome and independent variables was analyzed using a logistic regression model. Covariates with a p-value less than 0.25 were retained and entered into the multivariable logistic regression analysis using a forward step-wise approach. A multicollinearity test was performed to determine the linear correlation among the independent variables using the variance inflation factor (>10) and standard error (>2). The goodness-of-fit test was performed using the Hosmer–Lemeshow test ($p > 0.05$). For an outcome variable, an adjusted odds ratio (AOR) with a 95% confidence interval (CI) and a p-value of less than 0.05 was considered statistically significant.

Results:

Socio-demographic characteristics: A total of 628 study participants were included, yielding a response rate of 95.15%. The respondents' ages ranged from 18 to 40 years (mean = 27 years, SD = 6.5 years). More than half (59.4%) of the study participants were rural residents and housewives (51.1%) (Table 1).

Obstetric characteristics: 50%, 34.7%, and 15.5% of study participants had 3–4, 1–2, and more than four parities, respectively. Around 18.8%, 53.2%, and 28% were in the first, second, and third trimesters, respectively. Less than half (45.1%) had three or more ANC visits, and more than half (55.9%) were pregnancies that were planned.

Using Indigenous Herbal Medicine While Pregnant

Out of the total of 628 respondents, 47.8%(300) (95% CI: 43.8%–51.6%) used indigenous herbal medicine during their current pregnancy. From this, 16.3%, 45%, 29.3%, 3.3%, 3.7%, and 2.3% used only the first trimester, only the second trimester, only the third trimester, only the first and second trimesters, only the second and third trimesters, and all trimesters, respectively.

Most commonly used IHMs by pregnant women and their reasons for use

In this study, the most commonly used IHMs were garden cress (*Lepidium sativum)* (27%), bitter leaf (*Vernonia amygdalina*) (20.3%), moringa *(Moringa oleifera) (19.7*%), flax seed (*Linum usitatissimum) (15.3%),* ginger (*Zingiber officinale) (14.7*%), and eucalyptus tree *(Eucalyptus globulus) (13.7%)* (Table 2).

The most common reasons for IHMs use were related to gastro-intestinal system problems: intestinal parasites (27%), nausea and vomiting (21.7%), constipation (20%), to increase appetite (17.3%), relief of stomach aches (9.7%), indigestion (7.7%) and abdominal cramps (7%).

The others were related to headache (17.7%), malaria (10.7%), high blood sugar (9.7%), and blood pressure (7.7%) (Table 2).

When asked where they got their IHMs, the majority of ANC-attending pregnant women said traditional healers (60%), religious places (14%), market places (13.7%), a neighbor (3%), self-preparation (2.7%), and more than once source places (6.7%). The most common sources of information listed were neighbors and friends (41.3%) and family and relatives (24.7%).

The vast majority (91.3%) of study participants took IHM via oral routes; the rest, 5.7% and 3%, were through nasal inhalation and topical form, respectively. Out of all, 16.7% had an untoward effect after IHM intake, and only 3.5% had discussions about it with health professionals, and malaises (42.6%), abdominal pain (12.5%), vomiting (17%), and headaches (14.9%) were the most common types of unfavorable effects reported. The most commonly stated influential reasons for using IHMs were the perception that "indigenous herbal medicines are more effective" (43.7%) and "safe in pregnancy" (17%) (Figure 2).

Factors associated with IHM use by pregnant women

In the multivariable logistic regression analysis, rural residence (AOR=2.54, 95% CI:1.71-3.77) level of education: no formal education(AOR=5.47, 95% CI: 2.40-12.46), primary level(AOR=4.74, 95% CI: 2.15-10.44), being housewife(AOR=4.15,95%CI:1.83-9.37), low number of

ANC visits (AOR=2.58,95% CI:1.27-5.25), and insufficient knowledge of IHM (AOR=4.58, 95% CI:3.02-6.97) were significantly associated with IHM use during the current pregnancy (Table 3).

DISCUSSION:

This study was conducted to assess indigenous herbal medicine use and its associated factors among pregnant women attending ANC at public health facilities in Dire Dawa Administration, eastern Ethiopia, from December 01 to 30/2022

We found that 47.8% (95% CI: 43.8–51.6%) of pregnant women used indigenous herbal medicine during their current pregnancy. This finding was in line with studies in Turkey (47.3%)[32], western Ethiopia (50.4%)[31] and northern Ethiopia, Gonder (48.6 %)[26], Dese (51.2%)[33]. Such consistency might be because of some socio-demographic characteristics like age—the majority of study participants in these studies were between 20 and 30 years old—educational level—the majority had secondary and primary level education—and being unemployed, housewives, or married.

This study's findings, however, were lower than those of previous studies in Bangladesh (70%) [7], Iran (71.3%) [11], Zimbabwe (69.9%) [34], Mali (79.9%) [35], Sierra Leone (82.7%) [36], Uganda (76.7%) [21] and southern Ethiopia (73.1%) [37]. The possible explanations for this discrepancy might be variations in some socio-demographic characteristics of study participants, like age and education level, residence, sample size, and study period differences. The discrepancy also might be due to differences in parity, knowledge, and attitudes of pregnant women toward IHMs.

Besides, the finding of this study was higher than studies done in Italy (27.8%) [38], South Africa (41.5 %) [39], Nigeria (36.8%) [40], Northern Uganda (20%) [18], and northern Ethiopia(36.3%)[41]. This discrepancy might be due to socio-cultural variations like residence area and education level. Access to reproductive health education and health care settings may make a greater difference in some countries, such as Iran, Bangladesh, and Nigeria, than in Ethiopia. Moreover, sample sizes and time variations associated with study periods could be the cause of such variation.

According to this study, the odds of IHM use during pregnancy were more than two times higher among rural residents as compared to urban residents. This was comparable with studies done in north Ethiopia [26]. This discrepancy might be due to differences in the accessibility of conventional medicine and health care settings, as well as health information, in rural and urban areas. northern Ethiopia

Pregnant women who had no formal or primary-level education were more than five and four times more likely to use IHM than those who had secondary or higher education. This finding was in line with the study conducted in Turkey [32], Nigeria [40], southern Ethiopia [37],and [32,33,41]. Pregnant women who were housewives and had insufficient knowledge of IHM were almost four times more likely to use IHM compared to their counterparts. This finding was in line with the study conducted in southern Ethiopia [37]. The possible explanation might be due to the fact that housewives and uneducated women might have a lack of awareness about IHMs, including its risk during pregnancy to themselves and their fetus, and a positive perception towards IHMs. Moreover, this study identified the number of ANC visits having a significant association with the use of IHM by pregnant women as a new variable. Pregnant women who attended fewer ANCs were more than two times more likely to use IHM compared to those who attended more ANCs. This might be due to adequate counseling during ANC, like risk and nutritional counseling. Furthermore, at the binary level, this study also showed the presence of traditional healers in the area has an association with the use of IHM by pregnant women, but this needs further study.

The findings of the study could have implications for society, research, and practice (health professionals and health care programs). Implications for:

Social: the study findings suggest the need for continuous awareness for pregnant women considering residence, housewives, and uneducated women since IHM use during pregnancy was higher among these women. They might lack awareness of its risks during pregnancy to themselves and their fetus. It also suggests the need for community awareness to clear up misconceptions about IHM during pregnancy, including among men.

Research: the need for future research to identify IHM use by pregnant women at the community level. Another recommendation for further research is to conduct research on the influence of traditional healers on IHM use by pregnant women because, at the binary level, this study showed the presence of traditional healers in the area has an association with the use of IHM by pregnant women, but this needs further study.

Implications for Practice (Health Professionals and Health Care Programs): According to the study's findings, health facilities require counseling of pregnant women about IHM use during pregnancy. This study identified the number of ANC visits having a significant association with the use of IHM by pregnant women as a new variable (Pregnant women who attended fewer

ANCs were more than two times more likely to use IHM compared to those who attended more ANCs).

Conclusion: Almost half of pregnant women used various indigenous herbal medicines during pregnancy and were linked to various factors. The study's findings are helpful in advancing knowledge and comprehension of the types, enforcing factors, and strategies to mitigate potential dangers associated with them.

Recommendations were forwarded for the responsible body based on study findings as follows: Planners of maternal health programs ought to develop innovative approaches that increase pregnant women's awareness of IHMs. The government, non-governmental organizations, and other stakeholders could focus on creating awareness through mass-media campaigns targeting pregnant women, especially housewives, those with lower education, and rural areas.

Health professionals can make a real difference through counseling during ANC visits, and researchers could conduct additional research using various methodologies.

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Authors' contribution:

AM and BA: participated in the conception of the idea, designing the study, data collection and analysis, writing up the draft results, reanalyzing the data, and drafting, editing, and revising the manuscript.

MH, YS, TW, YB, ZH, TD, ND, BM, TM, AN, TG, YM, AA, HL, and AS: participated in the designing the study, data collection and analysis, writing up the draft results, reanalyzing the data, and drafting, editing, and revising the manuscript. All authors agree to take responsibility and be accountable for the contents of the article, agree on the journal to which the article will be submitted, and read and approve the final manuscript.

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Competing interests

The author declares that there are no competing interests

Patient Consent for publication

Not applicable

Ethics approval and consent to participate

Ethical clearance was obtained from the institutional ethical review board of Dire Dawa University with protocol number DDU-IRB-2022-113. Informed, voluntary verbal consent was obtained from all subjects and/or their legal guardian(s). All protocols were carried out in accordance with relevant guidelines and regulations of Helsinki.

Availability statement

Data are available from the corresponding author on reasonable request

Abbreviations

IHM: **Indigenous Herbal Medicine**

ANC: Antenatal Care

AOR: Adjusted odds

CI: Confidence Interval

COR: Crude odds ratio

SPSS: Statistical Package for Social Sciences

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Supplements

Title: Indigenous Herbal Medicine Use and its Associated Factors among Pregnant Women attending antenatal care at Public Health Facilities in Dire Dawa Administration, Eastern Ethiopia: A cross-sectional study

Authors' Name

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Tables

Table 1: Distribution of study participants by their socio-demographics, Dire Dawa Administration, Ethiopia, 2022 (n=628)

Variables	Category	Frequencies	Percentage
Age (in complete years)	>30	194	30.9
	20-30	345	54.9
	<20	89	14.2
Residence	Rural	373	59.4
	Urban	255	40.6
Level of education(women)	No formal education	152	24.2
	Primary (1-8)	207	33
	High school (9-10)	132	21
	Preparatory and diploma	95	15.1
	Degree and above	42	6.7
Marital status	Married	571	90.9
	Single	36	5.7
	Divorced	13	2.1
	Widow	8	1.3
Level of education (husband, n=571)	no formal education	95	16.6
	Primary (1-8)	147	25.7
	High school (9-10)	155	27.1
	Preparatory and diploma	129	22.6
	Degree and above	45	7.9
Occupation	House wife	321	51.1
	Merchant	164	26.1
	private employee	100	15.9
	public employee	43	6.8
Monthly income	<100USD	174	27.7
	100-150USD	380	60.5
	>150 USD	74	11.8

Religion	Muslim	289	46
	Orthodox	213	33.9
	Protestant	103	16.4
	Catholic	23	3.7

Table 2: Commonly used IHMs and reasons for use by pregnant women, Dire Dawa Administration, Ethiopia, 2022 (n=300)

Local name/English name	Scientific name	Frequency	Reason of use with frequency	Part use	Another additive used with
"Abish"/fenugreek	*Trigonella foenum-graecum*	36	-Increase appetite (30) -lowering blood sugar/ diabetes (6)	Seed and leaf	fexo and moringa
"Sinafch"/mustard=21	*Brassica nigra*	21	-Increase appetite (10) -lower depression/"to be alert" (11)	powder	
"Koseret"/verbenaceae=11	*Lippia abyssinica*	11	-cough (6) -fever (3) -antimicrobial (2)	leaves	
"Girar"/Hamaresa/Acacia	*Acacia abyssinica*	15	Headache (15)	leaves	
"Girawa"/bitter leaf=61	*Vernonia amygdalina*	61	-headache (29) -intestinal worm (21) -Indigestion (6) -constipation (5)	roots or leaves	
"Tikur azmud"/black cumin	*Nigella sativa*	18	-Headache=9 -common cold=5 -cough=4	Seed	
"Dammakessie"	*Ocimum lamifolium Hochst*	15	-Common cold (9) -Inflammation of leg (3) -diabetes (3)	leaves	Ginger garlic
"Eret"/aloe	*Aloe sinana*	9	Malaria disease (9)	leaves	honey or sugar
"Kurkura"/Christ's thorn jujube	*Ziziphus spina-christi*	22	-Diarrhea (12) -Diabetes (7) -dementia (3)	leaves	

"Shifera"/moringa	*Moringa oleifera*	59	-constipation (29) -gastritis (9) -indigestion (11) -Candidiasis (4) -diabetes (6)	Leaf	coffee
"Tenaadam"/Rue	*Ruta chalepensis*	27	-Abdominal cramp/colic (16) -constipation (4) -common cold (7)	leaves	zinger garlic
"Zingibil"/Ginger	*zingiberofficinale*	44	-Nausea and vomiting (24) -Digestion problem (6) -Relieving pain/backache, leg cramps (9) -Intestinal parasite and bacterial (5)	root	with honey
"Nech bahirzaf"/eucalyptus tree	*Eucalyptus globulus*	41	-nausea and vomiting (41)	Fresh leaf /Dried leaf is put on fire and smoked	1
"Talbaa"/flax seed	*Linum Usitatissimum*	46	-increase appetite (12) -constipation (22) -to treat **stomach ulcer (12)**		
"Citashekhussien"	*Cymbopogon citratus*	9	Intestinal parasite (9)		
"Gambello"	*Gardenia ternifolia*	19	-Stomach ache (11) -fever (4) -hypotension (4)		
"Roka"	*Tamarindus indica*	11	-Abdominal pain (5) -parasite (3) -diarrhea (3)	fruit	
"Ye Kosso zaf fire"	*Hagenia abyssinica*	21	Intestinal parasites (21)		

"Fexo"/garden cress	*Lepidium sativum L*	81	-Hepatitis E (9) -GIT parasites (41) -hemorrhoids (7) - Blood pressure (11) -lowering blood sugar with moringa (20)		For BP and DM bulb of garlic, ginger with honey
"Annan Kuti"/spearmint	*Mentha spicata*	8	-Blood pressure (5) -asthma (3)		moringa
"Dunfurie"	*Leucas deflexa*	7	-Blood pressure (3) -fever (4)		moringa
"Bekerkitie"	*Lantana camara L*	5	-Fungi (2) -asthma (3)		buna
"Hadheessa"	*Teclea Nnobilis*	6	-swellings of body parts (6)	leaves	
"Birbirsa"	*Podocarpus Falcatus*	17	tooth ache (17)	bark	
"Botoroo"	*Stereospermum Kunthinium*	28	-tooth ache (28)	bark	
"Waleensuu"	*Erythrean Abyssinica*	10	tooth ache (10)	stem	
"Bisana"	*Croton macrostachyus*	4	Gonorrhea (2) -Joint pain (2)		

Note: some pregnant women used more than one IHMs, those who used only 1 IHM were =45, 2

Table 3: Bivariate and multivariable logistic regression analysis result indicating factors associated with IHM use among ANC attendant pregnant women, Dire Dawa Administration, eastern Ethiopia, 2022 (n=628)

Variables	Category	IHM use		COR (95% CI)	AOR (95% CI)	P-value
		Yes	No			
Age (in completed years)	>30	85(43.8%)	109(56.2%)	1.72(1.037-2.86) *	1.13(0.61-2.09)	.707
	20-30	164(47.5%)	181(52.5%)	1.48(0.93-2.37)	1.13(0.64-1.99)	.669
	<20	51(57.3%)	38(42.7%)	1	1	
Residence	Urban	160(62.7%)	95(37.3%)	**1**	**1**	
	Rural	140(37.5%)	233(62.5%)	2.80(2.02-3.90) ***	2.54(1.71-3.77)	0.000
Education level	No formal education	43(28.3%)	109(71.7%)	6.34(2.97-13.51) ***	5.47(2.40-12.46)	.000
	Primary (1-8th grade)	71(34.3%)	136(65.7%)	4.79(2.31-9.92) ***	4.74(2.15-10.44)	.000

	High school (9-10th grade)	99(75.0%)	33(25.0%)	0.83(0.38-1.81)	0.85(0.36-1.98)	.704
	Preparatory and diploma	57(60.0%)	38(40.0%)	1.67(0.76-3.65)	1.44(0.60-3.45)	.409
	Degree and above	30(71.4%)	12(28.6%)	1	**1**	
Occupation	Housewife	130(40.5%)	191(59.5%)	2.74(1.41-5.34) **	4.15(1.83-9.37)	.001
	Private employee	56(56.0%)	44(44.0%)	1.47(0.70-3.08)	1.66(0.68-4.07)	.266
	Merchant	86(52.4%)	78(47.6%)	1.69(0.84-3.40)	2.19(0.94-5.09)	.069
	Public employee	28(65.1%)	15(34.9%)	1	1	
Number of ANC	3 and more	156(55.1%)	127(44.9%)	1	1	
	1-2	144(41.7%)	201(58.3%)	1.71(1.25-2.35) **	2.58(1.27-5.25)	.009
Gestation	First	50(42.4%)	68(57.6%)	1.63(1.02-2.61) *	1.38(0.77-2.47)	.274
	Second	154(46.1%)	180(53.9%)	1.40(0.97-2.02)	1.37(0.88-2.14)	.166
	Third	96(54.5%)	80(45.5%)	1	1	
prior IHM use experience	No	176(51.6%)	165(48.4%)	1	1	
	Yes	124(43.2%)	163(56.8%)	1.40(1.02-1.92) *	0.84(0.42-1.71)	.638
IHM use for other health problem	No	279(49.1%)	289(50.9%)	1	1	
	Yes	21(35.0%)	39(65.0%)	1.79(1.03-3.12) *	1.74(0.88-3.46)	.113
Knowledge(IHM)	Sufficient	240(60.2%)	159(39.8%)	1	**1**	
	Insufficient	60(26.2%)	169(73.8%)	4.25(2.98-6.07) ***	4.58(3.02-6.97)	.000
Perception	Unfavorable	207(50.7%)	201(49.3%)	**1**	1	
	Favorable	93(42.3%)	127(57.7%)	1.41(1.01-1.96) *	1.46(0.97-2.18)	.068
Presence of traditional healer in near	>5 kilometer	277(49.7%)	280(50.3%)	**1**	1	
	≤5 kilometer	23(32.4%)	48(67.6%)	2.06(1.22-3.49) **	1.44(0.75-2.76)	.268

Significant at: *p=<0.05, **p=<0.01, ***p=0.000, 1=reference

Figures

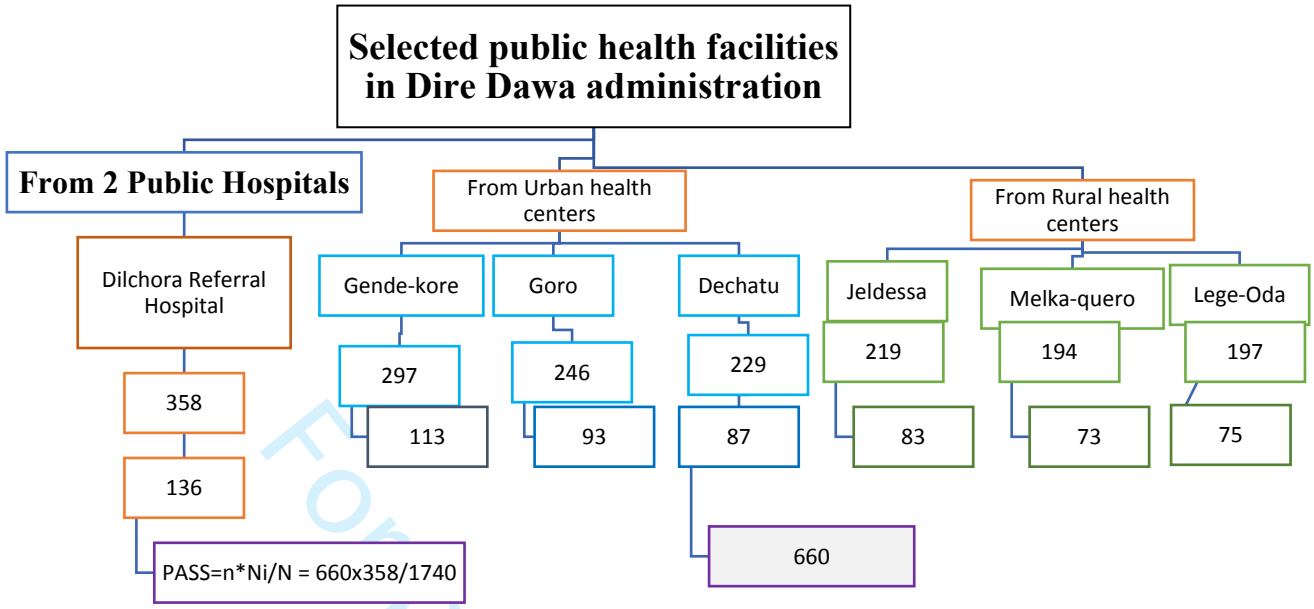

Figure 1: Diagram presentation of sampling procedure for the study on indigenous herbal medicine use and its associated factors among pregnant women attending ANC at public HFs in Dire Dawa Administration, Ethiopia, 2022; where PASS=proportionally allocated sample size %)

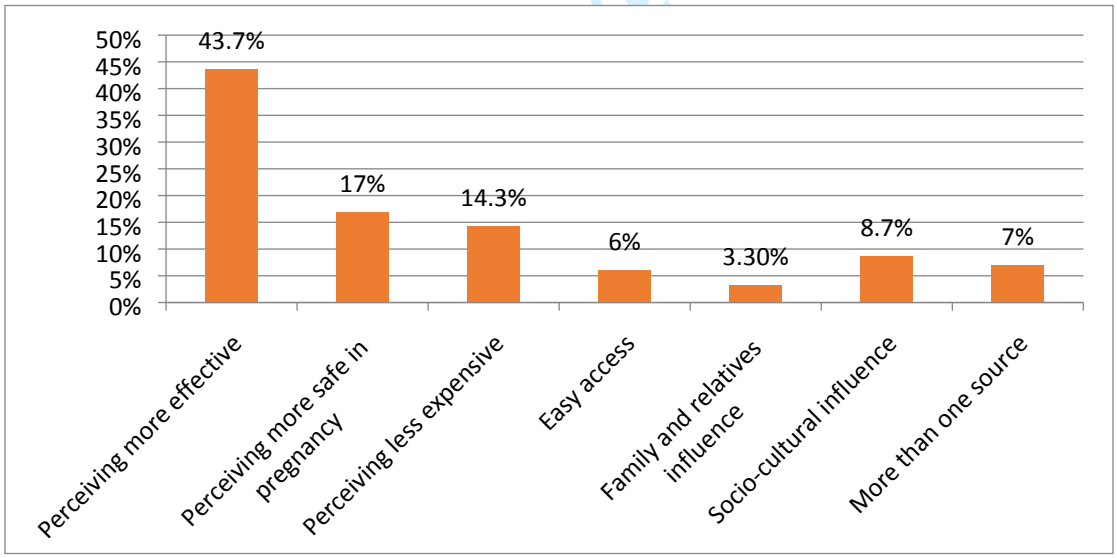

Figure 2: Influential reasons for the use of IHMs among ANC attending pregnant women, Dire Dawa Administration, Ethiopia, 2022 (n=300)

(1) Ethics approval

Ethical clearance was obtained from the institutional ethical review board of Dire Dawa University with protocol number DDU-IRB-2022-113.

(2) Informed consent

Informed, voluntary verbal consent was obtained from all interviewed students in the study. All protocols were carried out in accordance with the relevant guidelines and regulations of Helsinki

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Indigenous Herbal Medicine Use and its Associated Factors among Pregnant Women attending antenatal care at Public Health Facilities in Dire Dawa, Ethiopia: A cross-sectional study

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ABSTRACT

Objective: The aim of this study was to investigate the prevalence of indigenous herbal medicine use and its associated factors among pregnant women attending antenatal care at public health facilities in Dire Dawa, Ethiopia.

Design: a facility-based cross-sectional study design

Setting: The study was conducted in seven public health facilities (one referral hospital, three urban and three rural health centers) in Dire Dawa, Ethiopia, from October to November 2022.

Participants: 628 pregnant women of any gestational age who had been on ANC follow-up at selected public health facilities were included.

Main outcome measures: prevalence of indigenous herbal medicine (users vs. non-users) and associated factors

Results: The study revealed that 47.8% (95% CI: 43.8%–51.6%) of pregnant women used herbal medicines. Lack of formal education (AOR: 5.47, 95% CI: 2.40–12.46), primary level (AOR: 4.74, 95% CI: 2.15–10.44), housewives (AOR: 4.15, 95% CI: 1.83–9.37), number of ANC visits (AOR = 2.58, 95% CI: 1.27–5.25), insufficient knowledge (AOR = 4.58, 95% CI: 3.02–6.77), and favorable perception (AOR = 2.54, 95% CI: 1.71-3.77) were factors significantly associated with herbal medicine use. The most commonly used IHMs were garden cress (*Lepidium sativum)* (32%), bitter leaf (*Vernonia amygdalina*) (25.2%), moringa *(Moringa oleifera) (*24.5%). *Common* indications were related to gastro-intestinal problems, blood pressure, and sugar.
Conclusion: The prevalence of herbal medicine use is high (one in two pregnant women) and significantly associated with education level, occupation, antenatal care visits, knowledge, and perceptions. The study's findings are helpful in advancing comprehension of herbal medicines using status, types, and enforcing factors. It is essential that health facilities provide herbal counseling during antenatal care visits, and health regulatory bodies ought to raise awareness and implement interventions to lower the risks from over-the-counter (OTC) herbal medicine use by pregnant women.

Strengths and limitation of this study

- The study assured representativeness and generalizability using a multicenter study, six public health centers (3 urban and 3 rural), and one public referral hospital in the study region.
- The study used a diverse sample (which included participants from rural and urban areas), which increases the external validity of the study.
- The accuracy of the data was improved by the use of primary data as well as experienced data collectors.
- A valid data collection tool that has high internal consistency (α = 0.801) was used.
- Due to the cross-sectional nature of the study, it did not show causal relationships between variables. Because we used the interview response method, we were limited by some recall bias.

INTRODUCTION

Traditional medicine (TM) is characterized by the World Health Organization (WHO) as "health practices, approaches, knowledge, and beliefs incorporating plant, animal, and mineral-based medicines, spiritual therapies, manual techniques, and exercises, applied singly or in combination to treat, diagnose, and prevent illnesses and maintain well-being (1). Indigenous herbal medicine (IHM), a branch of traditional medicine, refers to the use of locally available herbs for the treatment of illness and enhancement of general health and wellbeing (1, 2)**.** These herbal medicines consist of herbs, herbal materials, herbal preparations, and completed herbal products that have active components that are plant parts like seeds, leaves, stems, flowers, and roots (1, 3, 4).

From a historical perspective, the WHO estimated that 80% of the global population used traditional and complementary medicine as primary healthcare (1).Regarding the current global prevalence, available systematic review data reveals 32.4% medicinal herb use during pregnancy worldwide (5). However, the prevalence of IHM use by pregnant women varies across countries owing to differences in access, regulations, cultural aspects, historical influence, socioeconomic levels, and conventional healthcare system progress (6-10). Generally, prevalence of use is higher in low-income countries where access to conventional healthcare is inadequate, traditional medicine is protuberant due to its cultural and historical reputation, and traditional medicine is one of the key sources, or sometimes the only available basis of healthcare(10). In Africa,

including Ethiopia, the prevalence of IHMs is high and widely used by pregnant women and the population too (3, 11-14). For instance, a systematic review of studies in Africa shows the prevalence rate varying from 12% to 60% (15). Likewise, a meta-analysis study revealed that the prevalence of herbal medicine use in Ethiopia is 46% (95% CI, 37–54%) (16).This is because there is a lack of modern health care services and medicine in proportion to people, being available only to a limited number of pregnant women because they are either expensive or few are available for too many people (12).

Herbs could be used for a variety of reasons, like infection prevention by increasing immunity through the use of medicinal plants(17). Studies also have identified some reasons that force pregnant women to use IHM, like physiological symptoms during pregnancy, including nausea, vomiting, heartburn, constipation, and so on(18, 19). Similarly, studies show that pregnant women utilize IHMs for conditions like exhaustion, respiratory and skin problems, and nutritional problems (20-22). Moreover, some studies have identified three key factors that contribute to pregnant women using herbal remedies: availability, perceived better therapeutic value in comparison to conventional medicines, and affordability (23, 24).

IHMs benefited from the development of many effective remedies that evolved through many generations (1, 20, 25). Besides, the majority of contemporary pharmaceuticals and dietary supplements are developed after processing medicinal plants(26). However, IHMs have associated complications that affect pregnant women and their fetus (1, 20, 23-25).For instance, IHM use could result in heartburn, increased blood flow, miscarriage, premature labor, and allergic reactions (27). They also have herb-drug interactions (28), are associated with induced liver injury *(29),* and complicate the care of pregnant women who have pre-existing conditions such as epilepsy or asthma (21). Moreover, intrauterine death and intrauterine growth restriction, uterine rupture, stillbirth, birth defects of the eye, ear, and heart, and other risks have also been linked to the use of IHMs by pregnant women (9, 14, 30, 31). Due to various reasons, pregnant women in low-resource countries, including Ethiopia, commonly use herbal medicines. Although there are many different types of herbal medicines that come from different cultures, studies are lacking, and the few available are highly variable and inconsistent. Therefore, the purpose of this study was to investigate the prevalence of indigenous herbal medicine use and its associated factors among pregnant women attending antenatal care at public health facilities in Dire Dawa Administration, eastern Ethiopia, which helps in generating evidence and interventions to lower the risks from over-the-counter (OTC) herbal medicine use by pregnant women.

Materials and Methods

Study area and period

The study was conducted in the Dire Dawa administration, which is located 515 kilometers east of Addis Ababa, the capital city of Ethiopia. According to 2020 population projections, 506,000 people live in the Dire Dawa Administration (68% of whom are estimated to be urban inhabitants), which has 38 rural and 9 urban kebeles (the smallest administrative units). This administration has two public hospitals (1 referral and 1 general), 15 health centers (32). One public referral hospital (Dilchora RH) and six public health centers (3 urban and 3 rural) were selected purposefully based on their client flow (information taken from the ANC registration book in each health facility), and the sample size was proportionately allocated (Figure 1). The study was conducted from October to November 2022**.**

Study design and population

A facility-based cross-sectional study design was employed among 628 randomly selected pregnant women attending ANC at public health facilities in the Dire Dawa Administration. All pregnant women in Dire Dawa administration during the study period were the source population, whereas all randomly selected pregnant women on ANC follow-up at selected public health facilities in Dire Dawa administration during the study period were the study population.

Inclusion and exclusion criteria

Included were all confirmed pregnant women of any gestational age who had been on ANC follow-up at selected public health facilities in the Dire Dawa administration. However, pregnant women who were severely ill and unable to communicate were excluded.

Sample size determination and sampling technique

The sample size was determined using the single population proportion formula and considering a proportion of IHM use of 48.6% (33), a standard normal distribution (z = 1.96), a 95% CI, and a 4% margin of error. After adding a 10% non-response rate, the final sample size was 660. To obtain all 628 study participants, a simple random sampling technique was used. The sample was proportionally allocated to each public health facility to select a representative sample (Figure 1).

Data collection method

The data was collected via face-to-face interview using a structured questionnaire that was adapted from literature designed for the same study purpose, and then variables were reviewed to suit the local context (11, 13, 34-37). The questionnaire was initially prepared in English, then translated by language experts into the local languages of Afaanoromo and Amharic, and finally back into English to maintain consistency. The questionnaire contains four main parts: socio-demographic characteristics; obstetrics; indigenous herbal medicine (IHM) awareness and uses during pregnancy; and environmental, past experience, and medical factors**.** A total of eight health extension workers were recruited for data collection, and four MSc midwives supervised the whole process.

Operational and definition of terms

Indigenous herbal medicine (IHM) use is the use of locally available plants (any parts like seeds, roots, leaves, bark, or flowers for medicinal purposes) by any route (oral, inhalation, topical application) either self-prescribed or recommended by family members, friends, or herbalists to treat some abnormalities during the current pregnancy period (11, 37).

Knowledge was measured using seven items prepared to assess it. Study participants were asked the knowledge-related questions, and value one was given for correct answers and value zero was given for incorrect (or I do not know) answers. Then the respondent's score was dichotomized as sufficient knowledge or insufficient knowledge after the total score was computed by summing up all the items together (38, 39).

Sufficient in knowledge: study participants who answered equal to or greater than the mean values of knowledge-related questions (38, 39).

Insufficient knowledge: study participants who answered less than the mean values of knowledge-related questions (38, 39).

Perception: The pregnant woman's perception towards the effects of IHM usage during pregnancy. Eight questions were prepared to assess it. Each question has a five-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = not sure, 4 = agree, and 5 = strongly agree). Then the respondent's score was dichotomized as favorable perception or unfavorable perception (strongly disagree, disagree, and not sure to "unfavorable" and agree and strongly agree to "favorable") (38, 39).

Income: the average family's monthly income of the pregnant women in ETB (Ethiopian Birr) (40).

Data quality control

The questionnaire was developed in English and translated into the local languages by language experts (Afan Oromo, Somali, and Amharic) and then back to English to maintain its consistency. The research's objectives, the sampling procedure, interviewing techniques, and general approaches to the study participants were all thoroughly covered over a 2-day training session for data collectors and supervisors. We performed a pretest on 5% of the sample size out of the selected health centers at Adisketema Health Center (urban) and Wahil Health Center (rural) two weeks before the actual data collection. Based on the findings of the pretest, we made minor modifications to the questionnaire. The data collection process was closely supervised, and the completeness and accuracy of each questionnaire were checked by the investigators and supervisors daily. Data was entered into the EPI DATA software as part of data management. During data cleaning, a logical checking technique was used to identify the errors. Questionnaires are secured in a safe place for confidentiality and as a backup for later, in case a check is necessary. Finally, double data entry was done by two data clerks, and the consistency of the entered data was cross-checked. To determine the internal reliability of the data, Cronbach's α was calculated (α = 0.801).

Data management and analysis

The data were coded, entered into Epi Data (Version 3.1), and exported to SPSS (Version 22) statistical software for analysis. A univariate analysis was used to describe the frequency distribution variables. We coded the outcome variables as "1" for "IHM user" and "0" for "non-user." The association between the outcome and independent variables was analyzed using a binary logistic regression model. Variables with a p-value less than 0.25 at the bivariable binary logistic regression analysis were retained and entered into the multivariable binary logistic regression analysis using a forward step-wise approach. A multicollinearity test was performed to determine the linear correlation among the independent variables using the variance inflation factor (>10) and standard error (>2). The goodness-of-fit test was performed using the Hosmer-Lemeshow test (p > 0.05). For an outcome variable, an adjusted odds ratio (AOR) with a 95% confidence interval (CI) and a p-value of less than 0.05 was considered statistically significant.

Results

Socio-demographic characteristics: A total of 628 study participants were included, yielding a response rate of 95.15%. The respondents' ages ranged from 18 to 40 years (mean = 27 years, SD = 6.5 years). More than half (65%) of the study participants were rural residents and housewives (51.1%) (Table 1).

Table 1: Socio-demographic characteristics of the respondents, Dire Dawa, Ethiopia, 2022 (n = 628).

Variables	Category	Frequencies	Percentage
Age (in complete years)	>30	194	30.9
	20-30	345	54.9
	<20	89	14.2
Residence	Urban	408	65
	Rural	220	35
Level of education(women)	No formal education	152	24.2

	Primary (1-8)	207	33
	High school (9-10)	132	21
	Preparatory and diploma	95	15.1
	Degree and above	42	6.7
Marital status	Married	571	90.9
	Single	36	5.7
	Divorced	13	2.1
	Widow	8	1.3
Level of education (husband, n=571)	No formal education	95	16.6
	Primary (1-8)	147	25.7
	High school (9-10)	155	27.1
	Preparatory and Diploma	129	22.6
	Degree and above	45	7.9
Occupation	House wife	321	51.1
	Merchant	164	26.1
	Private employee	100	15.9
	Public employee	43	6.8
Monthly income	<100USD	174	27.7
	100-150USD	380	60.5
	>150 USD	74	11.8
Religion	Muslim	289	46
	Orthodox	213	33.9
	Protestant	103	16.4
	Catholic	23	3.7

Obstetric characteristics: 50%, 34.7%, and 15.5% of study participants had 3–4, 1–2, and more than four parities, respectively. Around 18.8%, 53.2%, and 28% were in the first, second, and third trimesters, respectively. Less than half (45.1%) had three or more ANC visits, and more than half (55.9%) were pregnancies that were planned.

Awareness about herbal medicine

Most respondents had awareness about IHM (89.6%), and their most common sources of information were neighbors and friends (41.3%), family and relatives (34%), traditional healers (14%), and religious fathers (10.7%).

Prevalence of IHM use during the current pregnancy

Out of the total of 628 respondents, 47.8% (300) (95% CI: 43.8%–51.6%) used indigenous herbal medicine during their current pregnancy. From this, 16.3%, 45%, 29.3%, 3.3%, 3.7%, and 2.3% used only the first trimester, only the second trimester, only the third trimester, only the first and second trimesters, only the second and third trimesters, and all trimesters, respectively.

Herbals used, indications, parts and additives

The most commonly used IHMs were garden cress (*Lepidium sativum)* (32%), bitter leaf (*Vernonia amygdalina*) (25.2%), moringa *(Moringa oleifera) (*24.5%), flax seed (*Linum usitatissimum) (15.3%)*, and eucalyptus tree *(Eucalyptus globulus) (13.7%)* (Table 2).

The most common stated reasons were related to gastro-intestinal system problems: intestinal parasites (27%), nausea and vomiting (21.7%), constipation (20%), to increase appetite (17.3%), relief of stomach aches (9.7%), indigestion (7.7%), and abdominal cramps (7%). The others were

related to headache (17.7%), malaria (10.7%), high blood sugar (9.7%), and blood pressure (7.7%). The most commonly used parts of the herbs were seeds and leaves, with different additives (Table 2). More than half of the respondents used the leaves of herbs, followed by the seeds. Moringa, rue, and honey were the most commonly used additives (Table 2).

Table 2: Most commonly used herbal medicines, indications, parts, and additives during pregnancy, Dire Dawa, Ethiopia, 2022 (n = 300)

Local name/English name	Scientific name	Frequency	Reason of use with frequency	Part use	Another additive used with IHM
"Fexo"/garden cress	*Lepidium sativum L*	96	-Hepatitis E (9) -intestinal parasites (46) -hemorrhoids (7) - lowering blood pressure (11) -lowering blood sugar with moringa (20) -Relieving pain/backache, leg cramps (4) -Digestion problem (6)	Seed	For BP and DM bulb of garlic, ginger with honey -moringa
"Girawa"/bitter leaf	*Vernonia amygdalina*	77	Indigestion (6) -constipation (5) -Nausea and vomiting (16) -headache (29) -intestinal worm (21)	roots or leaves	With Rue Or moringa water
"Shifera"/moringa	*Moringa oleifera*	74	-constipation (34) -gastritis (11) -indigestion (14) -Candidiasis (4) -diabetes (11)	Leaf	coffee
"Talbaa"/flax seed	*Linum Usitatissimum*	46	-to increase appetite (12) -constipation (22) -to treat stomach ulcer (12)		Slaughter
"Nech bahirzaf"/eucalyptus tree	*Eucalyptus globulus*	41	-nausea and vomiting (41)	Fresh leaf /Dried leaf is put on	No

				fire and smoked	
"Abish"/fenugreek	*Trigonella foenum-graecum*	36	-to increase appetite (30) -lowering blood sugar/ diabetes (6)	Seed and leaf	fexo and moringa
"Botoroo"	*Stereospermum Kunthinium*	28	-tooth ache (28)	bark	Ginger
"Tenaadam"/Rue	*Ruta chalepensis*	27	-Abdominal cramp/colic (16) -constipation (4) -common cold (7)	leaves	zinger garlic

Routes, number, and frequency per day

The majority (91.3%) of pregnant women took IHM via oral routes; the rest, 5.7% and 3%, were through nasal inhalation and topical form, respectively. Out of three hundred respondents, the majority (142) took two types of IHM, followed by three types (76) and one type (45). 59.7% of pregnant women took IHM two times, 24.6% took it once (early morning in the bare stomach), and 15.7% took it three times per day. There were herbal medicines occasionally used by pregnant women (Table 3).

Table 3: Occasionally used herbal medicines, indications, parts, and additives during pregnancy, Dire Dawa, Ethiopia, 2022 (n = 300)

Local name/English name	Scientific name	Frequency	Reason of use with frequency	Part use	Another additive used with IHM
"Kurkura"/Christ's thorn jujube	*Ziziphus spina-christi*	22	-Diarrhea (12) -Diabetes (7) -dementia (3)	leaves	Moringa water
"Sinafch"/mustard	*Brassica nigra*	21	-to increase appetite (10) -lower depression/"to be alert" (11)	powder	No
"Ye Kosso zaf fire"	*Hagenia abyssinica*	21	Intestinal parasites (21)	Seed	No
"Gambello"	*Gardenia ternifolia*	20	-Stomach ache (11) -fever (4) -hypotension (4)		Rue
"Tikur azmud"/black cumin	*Nigella sativa*	16	-Headache=9 -common cold=5 -cough=4	Seed	No
"Annan Kuti"/spearmint	*Mentha spicata*	12	-lowering blood pressure (5)		moringa

			-asthma (3)		
"Dammakessie"	*Ocimum lamifolium Hochst*	11	-Common cold (9) -Inflammation of leg (3) -diabetes (3)	leaves	Ginger garlic
"Eret"/aloe	*Aloe sinana*	9	Malaria (9)	leaves	honey or sugar

Side effects, discussions with health professionals, and satisfaction

Among IHM users**,**16.7% stated side effects after IHM intake. The most common stated types of these side effects were malaises (42.6%), abdominal pain (12.5%), vomiting (17%), and headaches (14.9%), and only 3.5% had discussions about them with health professionals. The majority (73%) were satisfied, 23% were on average, and 4% were dissatisfied with the use of IHM during pregnancy.

Source place and influential factors for IHM usage

When asked where they got their IHMs, respondents reported traditional healers (60%), religious places (14%), market places (13.7%), a neighbor (3%), self-preparation (2.7%), and more than one source (6.6%). The most commonly stated influential reasons for using IHMs were the perception that "indigenous herbal medicines are more therapeutic than modern medicines" (43.7%) and "safe in pregnancy" (17%) (Figure 2).

knowledge and perception of respondents towards IHM

More than half (63.5 and 59.4% of respondents had sufficient knowledge on the effects of IHM use during pregnancy and a favorable perception of IHM, respectively.

Environmental, past experience, and medical factors (n = 628)

Access to health facilities: 18.3%, 53.2%, and 28.5% had access to health facilities within < 5 kilometers, between 5 and 10 kilometers, and > 10 kilometers, respectively.

The presence of traditional healers in close proximity: 88.7% and 11.3% of respondents reported the presence of traditional healers > 5 kilometers and ≤5 kilometers, respectively.

Regarding prior IHM use experience (during a past pregnancy), 45.7% reported using it, and only 9.5% had used IHM for other health problems.

Reasons for not using IHM among non-users (n = 328): Perceiving unsafe during pregnancy (60.4%), forbidden by husbands (20.4%), preference of modern medicines (14.6%), lack of availability (6.7%).

Factors associated with IHM use by pregnant women

In the multivariable binary logistic regression analysis, level of education: no formal education (AOR = 5.47, 95% CI: 2.40–12.46), primary level (AOR = 4.74, 95% CI: 2.15–10.44), being a housewife (AOR = 4.15, 95% CI: 1.83–9.37), low number of ANC visits (AOR = 2.58, 95% CI: 1.27–5.25), insufficient knowledge on the effect of IHM during (AOR = 4.58, 95% CI: 3.02–6.77), and favorable perception (AOR = 2.54, 95% CI: 1.71–1.77) were significantly associated with IHM use during the current pregnancy (Table 4).

Table 4: Bivariable and multivariable binary logistic regression analysis results indicating factors associated with IHM use during pregnancy, Dire Dawa, Ethiopia, 2022 (n = 628).

Variables	Category	IHM use		COR (95% CI)	AOR (95% CI)	P-value
		Yes	No			
Age (in completed years)	>30	85(43.8%)	109(56.2%)	1.72(1.037-2.86) *	1.13(0.61-2.09)	.707
	20-30	164(47.5%)	181(52.5%)	1.48(0.93-2.37)	1.13(0.64-1.99)	.668
	<20	51(57.3%)	38(42.7%)	1	1	

Residence	Urban	207(50.7%)	201(49.3%)	1	1	
	Rural	93(42.3%)	127(57.7%)	1.41(1.01-1.96) *	1.46(0.97-2.18)	.068
Education level	No formal education	43(28.3%)	109(71.7%)	6.34(2.97-13.51) ***	5.47(2.40-12.46)	.000
	Primary (1-8th grade)	71(34.3%)	136(65.7%)	4.79(2.31-9.92) ***	4.74(2.15-10.44)	.000
	High school (9-10th grade)	99(75.0%)	33(25.0%)	0.83(0.38-1.81)	0.85(0.36-1.98)	.704
	Preparatory and diploma	57(60.0%)	38(40.0%)	1.67(0.76-3.65)	1.44(0.60-3.45)	.409
	Degree and above	30(71.4%)	12(28.6%)	1	1	
Occupation	Housewife	130(40.5%)	191(59.5%)	2.74(1.41-5.34) **	4.15(1.83-9.37)	.001
	Private employee	56(56.0%)	44(44.0%)	1.47(0.70-3.08)	1.66(0.68-4.07)	.268
	Merchant	86(52.4%)	78(47.6%)	1.69(0.84-3.40)	2.19(0.94-5.09)	.069
	Public employee	28(65.1%)	15(34.9%)	1	1	
Number of ANC	3 and more	156(55.1%)	127(44.9%)	1	1	
	1-2	144(41.7%)	201(58.3%)	1.71(1.25-2.35) **	2.58(1.27-5.25)	.009
Gestation	First	50(42.4%)	68(57.6%)	1.63(1.02-2.61) *	1.38(0.77-2.47)	.274
	Second	154(46.1%)	180(53.9%)	1.40(0.97-2.02)	1.37(0.88-2.14)	.166
	Third	96(54.5%)	80(45.5%)	1	1	
Prior IHM use experience	No	176(51.6%)	165(48.4%)	1	1	
	Yes	124(43.2%)	163(56.8%)	1.40(1.02-1.92) *	0.84(0.42-1.71)	.638
IHM use for other health problem	No	279(49.1%)	289(50.9%)	1	1	
	Yes	21(35.0%)	39(65.0%)	1.79(1.03-3.12) *	1.74(0.88-3.46)	.113
Knowledge (IHM)	Sufficient	240(60.2%)	159(39.8%)	1	1	
	Insufficient	60(26.2%)	169(73.8%)	4.25(2.98-6.07) ***	4.58(3.02-6.97)	.000
Perception	Unfavorable	160(62.7%)	95(37.3%)	1	1	
	Favorable	140(37.5%)	233(62.5%)	2.80(2.02-3.90) ***	2.54(1.71-3.77)	0.000
Presence of traditional healer in near	>5 kilometer	277(49.7%)	280(50.3%)	1	1	
	≤5 kilometer	23(32.4%)	48(67.6%)	2.06(1.22-3.49) **	1.44(0.75-2.76)	.268

Significant at: *p=<0.05, **p=<0.01, ***p=0.000, 1=reference

DISCUSSION:

For a country with a national policy aimed at strengthening the quality of healthcare, like Ethiopia, it is fundamental to investigate the status of conventional and traditional medicines with their potential influencing factors, like in pregnant women. This study gives important findings regarding the prevalence and factors significantly associated with the use of IHM during pregnancy. The present study revealed that the prevalence of IHM use during a current pregnancy is high (one in two pregnant women, 47.8%). This finding was in line with a study in

Turkey (47.3%)(41). Such consistency might be because of the aggregated similarity of some socio-demographic characteristics of study participants. In the present study, the majority of study participants were in the age range of 20–30 (54.9%), were housewives (51%), and were married (90.9%). Likewise, in the study in Turkey, the study participants' ages ranged from 21-25%; the majority were housewives (87.4%), and 34.2% had completed only primary school or below (41).The present finding was also in line with three studies in Ethiopia: Nekemte (50.4%)(40), Gonder (48.5%)(33), and Dessie (51.2%)(42). Similarly, the possible reason for consistency might be related to the major compacted variables among study participants. In all three studies, most participants' ages were below 30 years, their education level was secondary and below, and they were urban residents, unemployed, or housewives (33, 40, 42). Similarly, in the present study, more than half (54.9%) of participants were in the age range of 20–30 years, unemployed or housewives (51.1%), and the majority were urban dwellers (65%), and their education level was secondary or below (78.2%).

The present study's prevalence is higher than studies conducted in Italy (27.8%) (43), two studies in Africa, Nigeria (36.8%) (44), Uganda (20%) (8), and one study in northern Ethiopia, Debre Tabor (36.3%) (43). This discrepancy might be due to study methods. For instance, the study in Italy used only two hospitals and 392 samples with a 10-month study period (43). The study in Nigeria used only a tertiary hospital and 500 samples selected by systematic techniques (44). Likewise, the study in Uganda used four study sites, a mixed study design with 383 samples for the quantitative part, and participants were interviewed while attending postnatal care about the use of herbal medicines during their pregnancy period; this could have a recall bias that varied the study result (8). In addition, the study in Northern Ethiopia, Debre Tabor, used a mixed community-based study design with 267, 12, and 6 sample sizes for quantitative, focus group discussion, and in-depth interviews, respectively (45). While the present study used multiple health settings, both urban and rural, with a facility-based study design and 628 samples, pregnant women attended ANC visits. This may be due to the accessibility and affordability of the regulatory systems of IHM and traditional medicine usage in different countries. These may make a difference in countries such as Italy and Nigeria, versus in Ethiopia, where traditional healers and traditional medicine usage are relatively common. For instance, in the present study, 88.7% and 11.3% of respondents reported the availability of traditional healers at a distance > 5 kilometers and ≤ 5 kilometers, respectively.

The present study's prevalence, however, is lower than studies conducted in Bangladesh (70%) (20), Iran (71.3%) (24), Zimbabwe (69.9%) (46), Mali (79.9%) (47), Sierra Leone (82.7%) (48), and Uganda (76.7%) (14).The discrepancy may be caused by variations in the study setting, sample size, sampling technique, study design, study populations, study duration, and participants' ages. For instance, in a study in Bangladesh (20), two public hospitals, a study in Iran (24), 12 health centers, a study in Mali(47), 3 health centers, and a study in Zimbabwe (46), only 2 rural districts were included as study settings. In the present study, 3 health centers from urban areas, 3 urban public health centers, 3 rural public health centers, and one public referral hospital were included.

Regarding the sample size, 243, 150, 398, 209, 134, and 46 sample sizes were used in studies in Bangladesh, Iran, Zimbabwe, Mali, Serra Leon, and Uganda, respectively(14, 20, 24, 46-48). But in the present study, a sample size of 628 was used. In the present study, a facility-based cross-sectional study design was used, while a study in Uganda used a community-based survey, which could also result in result variations (14). In the present study, the study populations were pregnant women on ANC visits, while in a study in Bangladesh, postpartum women were

interviewed about patterns of herbal medicines used in the previous pregnancy; this can have recall bias and could result in result variations(20). In addition, the studies in Zimbabwe and Uganda used convenient and snowball sampling techniques, respectively (14, 46). While the present study used random sampling techniques. The participants age may also be a possible reason for variation, as their experience with IHM knowledge and perception might be related to age (39). All these methodological variations could create discrepancies between the studies. Besides, the discrepancy may be related to socio-cultural variables like residence area, education level, and awareness status in different countries and their districts. Moreover, the discrepancy may be related to access to community and/or health facility-based population health education programs that involve traditional medicines. The present study's prevalence was also lower than one study conducted in southern Ethiopia, Hosana (73.1%) (38). This discrepancy may be caused by variations in the study setting, sample size, and sampling technique. The study in southern Ethiopia, Hosana, used public health facilities available only in the town, a sample size of 363, and a systematic sampling technique (38). While the present study used public health facilities available both in urban and rural sites, a larger sample size (628) and a random selection technique. Besides, the discrepancy may be related to socio-cultural variations and the awareness or attitude of populations in different districts of Ethiopia.

According to this study, low levels of education, being housewives, lower antenatal care visits, insufficient knowledge, and favorable perceptions were all associated with a higher likelihood of IHM use during a current pregnancy. Pregnant women who had no formal or primary-level education were more than five and four times more likely to use IHM than those who had secondary or higher education. This was supported by research conducted in Turkey(41), Nigeria (44), and different parts of Ethiopia (33, 38, 42, 45, 49). The study conducted at Debre Birhan, Dessie, Gonder, Hosana, and Debre Tabor revealed the odds of IHM use during pregnancy were 2, 3, 4, 4, and 9 times higher among pregnant women with low-level education, respectively (33, 38, 42, 45, 49).

Pregnant women who had insufficient knowledge regarding the effects of herbal medicine usage during pregnancy were almost four times more likely to use IHM compared to those who had sufficient knowledge. Previous studies conducted in the west and northern parts of Ethiopia did not assess participants knowledge on the effects of herbal medicine usage during pregnancy (33, 40, 42, 45). But two studies, one in north Ethiopia, Debre Birhan, and one in southern Ethiopia, Hosana, assessed participants knowledge on the effects of herbal medicine usage during pregnancy (38, 49). And the former study (at Debre Birhan) did not show an association between knowledge and herbal medicine usage during pregnancy (49). While the later one revealed that knowledge on the effect of herbal medicine use during pregnancy had a significant association with its use (38), which is in line with the present study. The possible explanation may be the fact that insufficient knowledge regarding the effects of herbal medicine usage during pregnancy may reduce thoughtfulness to the risks that can occur during pregnancy, either to pregnant women or their fetus or to both.

In previous studies done in different parts of Ethiopia, only one study assessed perception but did not show a significant association with the use of IHM by pregnant women (38). In contrast, the present study showed the odds of IHM use during pregnancy were more than two times higher among favorable preceptors. One possible explanation might be that those who had a favorable perception of IHM might perceive herbal medicines as lacking risks that can occur during pregnancy, either to pregnant women or their fetus or to both.

Moreover, the present study revealed two variables having a significant association with the use of IHM by pregnant women: being housewives and the number of ANC visits. Pregnant women who were housewives were almost four times more likely to use IHM compared to their counterparts. The possible explanation might be due to the fact that housewives might have a lack of awareness about IHMs compared to their counterparts and a positive perception towards their use. Pregnant women who attended fewer ANC visits were more than two times more likely to use IHM compared to those who attended more ANC visits. The possible reason might be due to the effects of counseling during ANC, like risk and nutritional counseling, and this needs further research.

Furthermore, at the binary level, this study also showed the presence of traditional healers in a nearby area has an association with the use of IHM by pregnant women, but this also needs further study.

The present study showed commonly used herbal medicines during pregnancy as garden cress (*Lepidium sativum)* (32%), bitter leaf (*Vernonia amygdalina*) (25.2%), moringa *(Moringa oleifera) (24.5%*), flax seed (*Linum usitatissimum) (15.3%)*, and eucalyptus tree *(Eucalyptus globulus) (13.7%).* A little bit related finding was indicated by a study conducted in Nigeria, in which the bitter leaf/iron weed plant (Vernonia amygdalina) (54.3%) was the most common herbal medicine used by pregnant women (44). Studies conducted in Turkey (41) and Ethiopia showed ginger (Zingiber officinale) as the most common herbal medicine used by pregnant women(33, 38, 40, 42, 45, 49). *Unlike previous studies* in Ethiopia (33, 38, 40, 42, 45, 49)*, ginger was not the commonest herb but rather used as an additive in the present study.*

A study in Italy showed chamomile, licorice, fennel, aloe, valerian, echinacea, almond oil, propolis, and cranberry as the common herbal medicines used by pregnant women (43). A study in Mali revealed *chevalieri* (55.5%), *Combretum micranthum* (39.7%), *Parkia biglobosa* (12.0%), and *Vepris heterophylla* (8.1%) as the common herbal medicines used by pregnant women (47).

In addition, a study in Serra Leon identified *Luffa acutangula* (L.*Roxb*as the most cited herbal medicine used during pregnancy(48). The study at Gonder and Dessie, north Ethiopia, showed ginger (Zingiber ofcinale Roscoe) (43.8%) and garlic (Allium sativum L.) as the commonest herbal medicines used by pregnant women (42). The study at Debre Birhan showed ginger (Zingiber officinale Roscoe), damakesse (Ocimum lamiifolium), and tenadam (Fringed rue) as the commonest herbal medicines used by pregnant women (49). In the study at Nekemte, west Ethiopia, ginger (44.36%) and tenaadam (9.15%) were found to be the most common herbal medicines used by pregnant women(40). This indicates that the types and frequency of herbal medicines vary according to different research findings. This might be due to the fact that there are many different types of herbal medicine from different cultures and the variety of sample sizes in different research studies. Such variation could also be due to differences in user-friendliness, openness (lacking a regulatory body), and environmental spreading of the herbs across diverse countries and provinces in the same country.

As per the present study, common indications of herbal remedies were related to gastro-intestinal system problems: intestinal parasites (27%), nausea and vomiting (21.7%), constipation (20%), to increase appetite (17.3%), and relief of stomach aches (9.7%). The others were related to headache (17.7%), malaria (10.7%), high blood sugar (9.7%), and blood pressure (7.7%). The indications of herbal remedies also vary; for instance, a study in Mali showed: for well-being (36.7%), symptoms of malaria (37.1%), and to reduce edema (19.2%)) (47). A study at Serra Leon indicated urinary tract infection and pedal oedema (48).A study at Dessie, north Ethiopia,

showed indications for herbal drug use were nausea/vomiting (43.8%), headache (30.8%), and common cold (25.4%)(42). In a study at Gonder, north Ethiopia, common cold (66%), and inflammation (31.6%) were the most common reasons (33). This suggests that there are a number of therapeutic tasks that herbal remedies are demanded to play during the gestational period, duties that may require scientific explanation. The present study showed that only few pregnant women are aware of the side effects after taking herbal medicines and only few have disclosure for discussion with health professionals about the side effects. This suggests that to prevent the possible harm imposed by the use of herbal medicines, health care providers should emphasize safety issues to pregnant women and make functional counselling during ANC cares and provide updated evidence-based information regarding herbal medicines. Unlike the previous studies available in Ethiopia so far (33, 38, 40, 42, 45, 49), the present study identified traditional healers (60%) followed by religious places, as the major source place to obtain herbal medicines by pregnant women. This indicates the need for training for traditional healers and religious leaders about the possible risks for pregnant women and their fetuses, dose proportion of herbs and gestational time of pregnant women.

The present study also revealed the most commonly stated influential reasons for using IHM as perception that "indigenous herbal medicines are more therapeutic than modern medicines" and "safe in pregnancy". Moreover, the present study showed reason for not using IHM among non-users as perceiving unsafe during pregnancy (60.4%), forbidden by husbands (20.4%), and preference of modern medicines (14.6%). These indicates the need for community awareness about herbal medicines including husbands, traditional healers and religious leaders at community level.

Furthermore, unlike the previous studies available in Ethiopia (33, 38, 40, 42, 45, 49), the present study showed the additives, number, and frequency per day of IHM used. Consequently, moringa, rue, honey, and ginger were commonly used as additives. In the present study, the majority of pregnant women took two types of IHM, followed by three types; the majority took IHM two times per day, and a quarter (24.6%) of them took it once (early morning in the bare stomach). This highlights the issue of herbal medicine frequency as well as dose during pregnancy.

The findings of the study could have implications for society, research, and practice (health professionals and health care programs). Implications for:

Social: the study findings suggest the need for continuous awareness for pregnant women considering education level, housewives, and the number of ANC visits since IHM use during pregnancy was higher among these women. They might lack awareness of the risks of pregnancy to themselves and their fetus. It also suggests the need for community awareness to clear up misconceptions about IHM during pregnancy and among general women.

Research: the need for future research to identify IHM use by pregnant women at the community level. Another recommendation for further research is to conduct research on the effects of the number of ANC visits and the influence of traditional healers and religious leaders on IHM use by pregnant women. Further research on the bioavailability, dose, efficacy, and safety of the herbal medicines used by pregnant women should also be done.

Implications for Practice (Health Professionals and Health Care Programs)**:** According to the study's findings, health facilities require counseling of pregnant women about IHM use during ANC visits and counseling pregnant women to disclose IHM usage and any untoward or side effects if they use it. Since there is a high prevalence and low disclosure rate of herbal medicine

use, it should be ensured that obstetricians, midwives, and other health professionals establish a good level of communication with pregnant women during ANC visits.

Conclusion: The prevalence of herbal medicine use is high (one in two pregnant women) and significantly associated with education level, occupation, antenatal care visits, knowledge, and perceptions. The study's findings are helpful in advancing comprehension of herbal medicines using status, types, and enforcing factors. It is essential that health facilities provide herbal counseling during antenatal care visits, and health regulatory bodies ought to raise awareness and implement interventions to lower the risks from over-the-counter (OTC) herbal medicine use by pregnant women.

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Authors' contribution

AM and BA: participated in the conception of the idea, designing the study, data collection and analysis, writing up the draft results, reanalyzing the data, and drafting, editing, and revising the manuscript.

MH, YS, TW, YB, ZH, TD, ND, BM, TM, AN, TG, YM, AA, HL, and AS participated in the designing the study, data collection and analysis, writing up the draft results, reanalyzing the data, and drafting, editing, and revising the manuscript. All authors agree to take responsibility and be accountable for the contents of the article, agree on the journal to which the article will be submitted, and read and approve the final manuscript.

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Competing interests

The author declares that there are no competing interests

Patient Consent for publication

Not applicable

Ethics approval and consent to participate

Ethical clearance was obtained from the institutional ethical review board of Dire Dawa University with protocol number DDU-IRB-2022-113. Informed, voluntary verbal consent was obtained from all subjects and/or their legal guardian(s). All protocols were carried out in accordance with relevant guidelines and regulations of Helsinki.

Availability statement

Data are available from the corresponding author on reasonable request

Abbreviations

IHM: Indigenous Herbal Medicine
ANC: Antenatal Care
AOR: Adjusted odds
CI: Confidence Interval
COR: Crude odds ratio
SPSS: Statistical Package for Social Sciences

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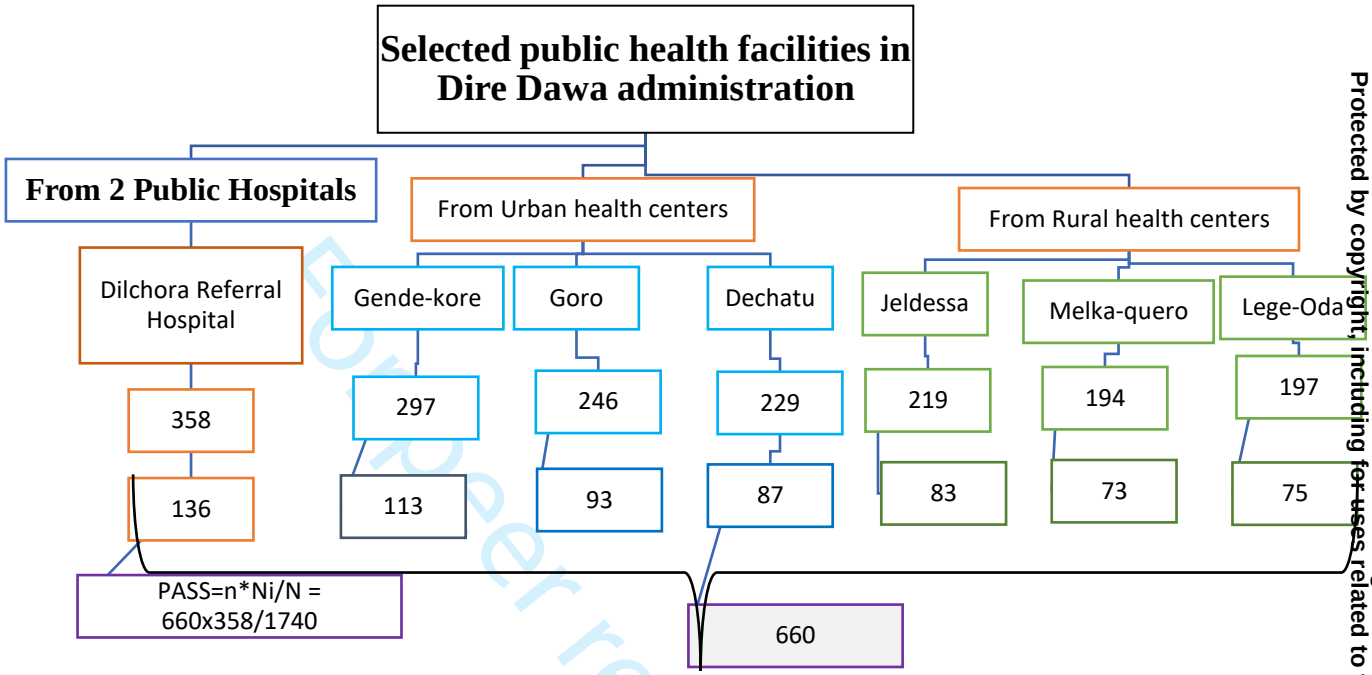
Figure legends

Figure 1: Diagram presentation of sample size allocation for the study on indigenous herbal medicine use among ANC-attending pregnant women, Dire Dawa, Ethiopia, 2022. PASS indicates a proportionally allocated sample sizes, Ni=sample size, N=total estimated number of pregnant women, and 660 is the sum of all proportionally allocated sample sizes.

Figure 2: Most common influential reasons for using IHMs by ANC attending pregnant women, Dire Dawa, Ethiopia, 2022 (n = 300). The black indicates "perceived as more therapeutic." The red indicates "perceiving more safety in pregnancy." The pink indicates "family and relatives' influence.". The yellow indicates "socio-cultural influence," the blue indicates "easy access, and the green indicates "less expensive."

Figure on indigenous herbal medicine use



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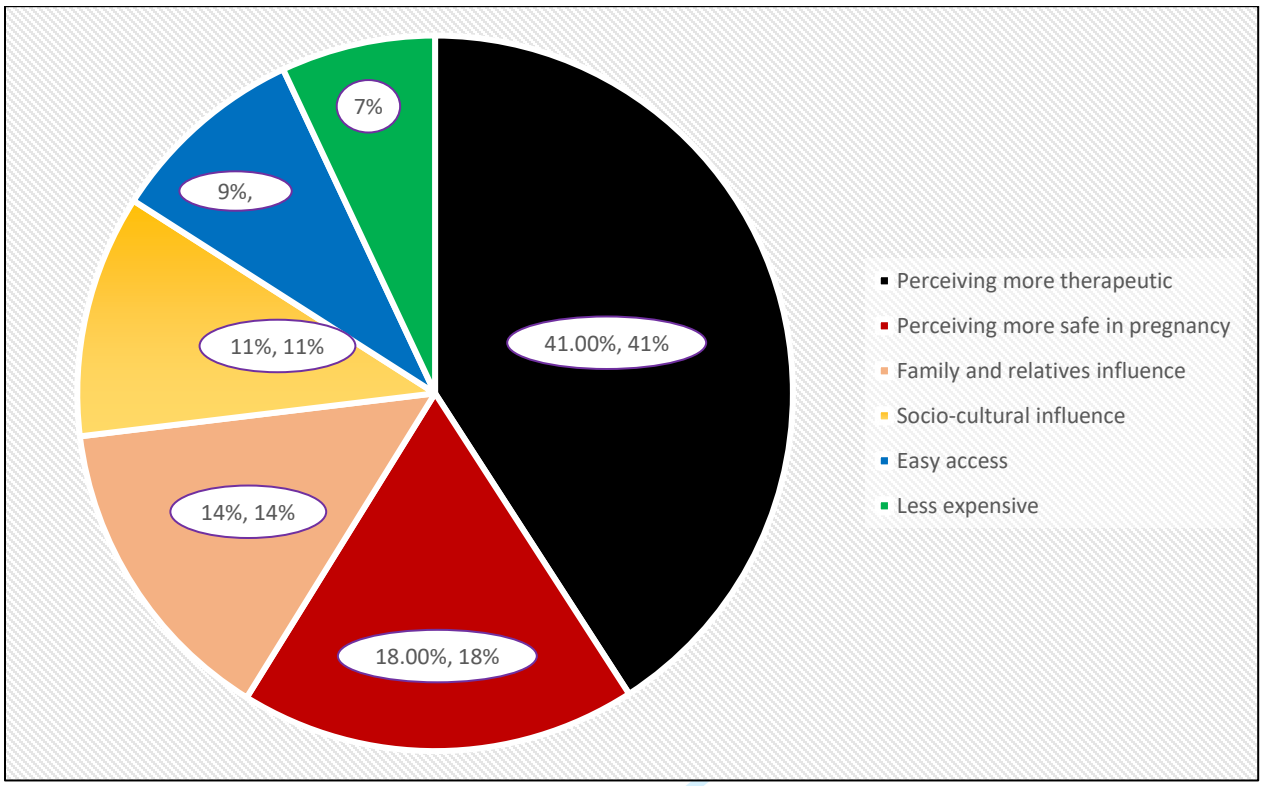

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Table S1. STROBE Statement—checklist of items that should be included in reports of observational studies.

	Item No	Recommendation	Check
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	*The type of study is indicated in the title*
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	*The abstract gives a summary of the study*
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	*Background and rationale are reported*
Objectives	3	State specific objectives, including any prespecified hypotheses	*Aims are detailed in the Introduction*
Methods			
Study design	4	Present key elements of study design early in the paper	*Key elements are reported*
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	*Setting is described*
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	*Cross-sectional study; eligibility criteria and methods of selection are detailed.* *The comparison of HCWs with COVID-19 (cases) with a 2N sample of workers who had unprotected exposure and a 6N sample of HCWs without unprotected exposure and tested negative at RT-PCR test was done according to principles of case study, unconfounding and accuracy*
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	*Predictors and outcome variables are described; possible confounders and modifiers are studied*
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*Psychometric characteristics of questionnaires are reported.* *Criteria for comparability of groups are reported.*
Bias	9	Describe any efforts to address potential	*Reporting bias deriving from*

		sources of bias	*incomplete answer was addressed removing these answers*
Study size	10	Explain how the study size was arrived at	*Sample size was evaluated with the formula suggested by Pocock: N= f (α/2, β) * [p1 * (100- p1) + p2 * (100- p2)] / (p2 – p1)2 If we calculate the probability of finding a symptom in the CASE group and in the CONTROL group, we can calculate the size of the population, placing a significance level (alpha) at 5% and a power (1-beta) at 90%. For a symptom such as anosmia, which has a prevalence of 42% in cases and 0.8% in controls, the minimum sample size involves 16 cases and as many controls, total = 32 observations. For a symptom such as anxiety, which has a prevalence of 35% in CASES and 11% in CHECKS, the required dimensions are 60 per group, total 120 observations. All calculations were carried out with the help of the automatic calculator: Sealed Envelope Ltd. 2012. Power calculator for binary outcome superiority trial. Available online at: https://www.sealedenvelope.com/power/binary-superiority/ [Access May 26, 2020].*
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	*Method of handling variables was reported. The criteria for selecting groups were detailed.*
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	*Statistical methods were described*
		(*b*) Describe any methods used to examine subgroups and interactions	*Statistical methods were described*
		(*c*) Explain how missing data were addressed	*Cases with missing data were eliminated*
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe	*Statistical methods were described*

	analytical methods taking account of sampling strategy
	(*e*) Describe any sensitivity analyses

[e]

Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	*Number of participants is reported*
		(b) Give reasons for non-participation at each stage	*Participation was voluntary. Some workers stopped testing before the end and were eliminated for incomplete responses*
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	*Characteristics are reported and analysed*
		(b) Indicate number of participants with missing data for each variable of interest	*Answers with missing data were eliminated*
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	*Numbers are reported*
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	*Unadjusted and adjusted estimates and their precision are reported*
		(*b*) Report category boundaries when continuous variables were categorized	*Age was categorized*
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	*All analyses done were reported*
Discussion			
Key results	18	Summarise key results with reference to study objectives	*Key results are summarized*
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	*Limitations of the study are discussed*

Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	*The interpretation of the results was very cautious, given the cross-sectional nature of the study which does not allow to infer causality*
Generalisability	21	Discuss the generalisability (external validity) of the study results	*The generalisability was discussed*
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	*The study was not funded*

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Indigenous Herbal Medicine Use and its Associated Factors among Pregnant Women attending antenatal care at Public Health Facilities in Dire Dawa, Ethiopia: A cross-sectional study

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Indigenous Herbal Medicine Use and its Associated Factors among Pregnant Women attending antenatal care at Public Health Facilities in Dire Dawa, Ethiopia: A cross-sectional study

Authors' Name

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ABSTRACT

Objective: The aim of this study was to investigate the prevalence of indigenous herbal medicine use and its associated factors among pregnant women attending antenatal care at public health facilities in Dire Dawa, Ethiopia.

Design: a facility-based cross-sectional study design

Setting: The study was conducted in seven public health facilities (one referral hospital, three urban and three rural health centers) in Dire Dawa, Ethiopia, from October to November 2022.

Participants: 628 pregnant women of any gestational age who had been on ANC follow-up at selected public health facilities were included.

Main outcome measures: prevalence of indigenous herbal medicine (users vs. non-users) and associated factors

Results: The study revealed that 47.8% (95% CI: 43.8%–51.6%) of pregnant women used herbal medicines. Lack of formal education (AOR: 5.47, 95% CI: 2.40–12.46), primary level (AOR: 4.74, 95% CI: 2.15–10.44), housewives (AOR: 4.15, 95% CI: 1.83–9.37), number of ANC visits (AOR = 2.58, 95% CI: 1.27–5.25), insufficient knowledge (AOR = 4.58, 95% CI: 3.02–6.77), and favorable perception (AOR = 2.54, 95% CI: 1.71-3.77) were factors significantly associated with herbal medicine use. The most commonly used herbs were garden cress (*Lepidium sativum)* (32%), bitter leaf (*Vernonia amygdalina*) (25.2%), moringa *(Moringa oleifera) (*24.5%). *Common* indications were related to gastro-intestinal problems, blood pressure, and sugar.
Conclusion: The prevalence of herbal medicine use is high (one in two pregnant women) and significantly associated with education level, occupation, antenatal care visits, knowledge, and perceptions. The study's findings are helpful in advancing comprehension of herbal medicines using status, types, and enforcing factors. It is essential that health facilities provide herbal counseling during antenatal care visits, and health regulatory bodies ought to raise awareness and implement interventions to lower the risks from over-the-counter (OTC) herbal medicine use by pregnant women.

Strengths and limitation of this study

- The study assured representativeness and generalizability using a multicenter study, six public health centers (3 urban and 3 rural), and one public referral hospital in the study region.
- The study used a diverse sample (which included participants from rural and urban areas), which increases the external validity of the study.
- The accuracy of the data was improved by the use of primary data as well as experienced data collectors.
- A valid data collection tool that has high internal consistency (α = 0.801) was used.
- Due to the cross-sectional nature of the study, it did not show causal relationships between variables.

INTRODUCTION

Traditional medicine (TM) is characterized by the World Health Organization (WHO) as "health practices, approaches, knowledge, and beliefs incorporating plant, animal, and mineral-based medicines, spiritual therapies, manual techniques, and exercises, applied singly or in combination to treat, diagnose, and prevent illnesses and maintain well-being" (1). Indigenous herbal medicine (IHM), a branch of traditional medicine, refers to the use of locally available herbs for the treatment of illness and enhancement of general health and wellbeing (1, 2)**.** These herbal medicines consist of herbs, herbal materials, herbal preparations, and completed herbal products that have active components that are plant parts like seeds, leaves, stems, flowers, and roots (1, 3, 4).

From a historical perspective, the WHO estimated that 80% of the global population used traditional and complementary medicine as primary healthcare (1).Regarding the current global prevalence, available systematic review data reveals 32.4% medicinal herb use during pregnancy worldwide (5). However, the prevalence of IHM use by pregnant women varies across countries owing to differences in access, regulations, cultural aspects, historical influence, socioeconomic levels, and conventional healthcare system progress (6-10). Generally, prevalence of use is higher in low-income countries where access to conventional healthcare is inadequate, traditional medicine is protuberant due to its cultural and historical reputation, and traditional medicine is one of the key sources, or sometimes the only available basis of healthcare(10). In Africa, including Ethiopia, the prevalence of IHMs is high and widely used by pregnant women and the

population too (3, 11-14). For instance, a systematic review of studies in Africa shows the prevalence rate varying from 12% to 60% (15). Likewise, a meta-analysis study revealed that the prevalence of herbal medicine use in Ethiopia is 46% (95% CI, 37–54%) (16).This is because there is a lack of modern health care services and medicine in proportion to people, being available only to a limited number of pregnant women because they are either expensive or few are available for too many people (12).

Herbs could be used for a variety of reasons, like infection prevention by increasing immunity through the use of medicinal plants(17). Studies also have identified some reasons that force pregnant women to use IHM, like physiological symptoms during pregnancy, including nausea, vomiting, heartburn, constipation, and so on(18, 19). Similarly, studies show that pregnant women utilize IHMs for conditions like exhaustion, respiratory and skin problems, and nutritional problems (20-22). Moreover, some studies have identified three key factors that contribute to pregnant women using herbal remedies: availability, perceived better therapeutic value in comparison to conventional medicines, and affordability (23, 24).

IHMs benefited from the development of many effective remedies that evolved through many generations (1, 20, 25). Besides, the majority of contemporary pharmaceuticals and dietary supplements are developed after processing medicinal plants(26). However, IHMs have associated complications that affect pregnant women and their fetus (1, 20, 23-25).For instance, IHM use could result in heartburn, increased blood flow, miscarriage, premature labor, and allergic reactions (27). They also have herb-drug interactions (28), are associated with induced liver injury *(29),* and complicate the care of pregnant women who have pre-existing conditions such as epilepsy or asthma (21). Moreover, intrauterine death and intrauterine growth restriction, uterine rupture, stillbirth, birth defects of the eye, ear, and heart, and other risks have also been linked to the use of IHMs by pregnant women (9, 14, 30, 31). Due to various reasons, pregnant women in low-resource countries, including Ethiopia, commonly use herbal medicines. Although there are many different types of herbal medicines that come from different cultures, studies are lacking, and the few available are highly variable and inconsistent. Therefore, the purpose of this study was to investigate the prevalence of indigenous herbal medicine use and its associated factors among pregnant women attending antenatal care at public health facilities in Dire Dawa Administration, eastern Ethiopia, which helps in generating evidence and interventions to lower the risks from over-the-counter (OTC) herbal medicine use by pregnant women.

Materials and Methods

Study area and period

The study was conducted in the Dire Dawa administration, which is located 515 kilometers east of Addis Ababa, the capital city of Ethiopia. According to 2020 population projections, 506,000 people live in the Dire Dawa Administration (68% of whom are estimated to be urban inhabitants), which has 38 rural and 9 urban kebeles (the smallest administrative units). This administration has two public hospitals (1 referral and 1 general), 15 health centers (32). One public referral hospital (Dilchora RH) and six public health centers (3 urban and 3 rural) were selected purposefully based on their client flow (information taken from the ANC registration book in each health facility), and the sample size was proportionately allocated (Figure 1). The study was conducted from October to November 2022**.**

Patient and public involvement

None

Study design and population

A facility-based cross-sectional study design was employed among 628 randomly selected pregnant women attending ANC at public health facilities in the Dire Dawa Administration. All pregnant women in Dire Dawa administration during the study period were the source population, whereas all randomly selected pregnant women on ANC follow-up at selected public health facilities in Dire Dawa administration during the study period were the study population.

Inclusion and exclusion criteria

Included were all confirmed pregnant women of any gestational age who had been on ANC follow-up at selected public health facilities in the Dire Dawa administration. However, pregnant women who were severely ill and unable to communicate were excluded.

Sample size determination and sampling technique

The sample size was determined using the single population proportion formula and considering a proportion of IHM use of 48.6% (33), a standard normal distribution (z = 1.96), a 95% CI, and a 4% margin of error. After adding a 10% non-response rate, the final sample size was 660. To obtain all 628 study participants, a simple random sampling technique was used. The sample was proportionally allocated to each public health facility to select a representative sample (Figure 1).

Data collection method

The data was collected via face-to-face interview using a structured questionnaire that was adapted from literature designed for the same study purpose, and then variables were reviewed to suit the local context (11, 13, 34-37). The questionnaire was initially prepared in English, then translated by language experts into the local languages of Afaanoromo and Amharic, and finally back into English to maintain consistency. The questionnaire contains four main parts: socio-demographic characteristics; obstetrics; indigenous herbal medicine (IHM) awareness and uses during pregnancy; and environmental, past experience, and medical factors**.** A total of eight health extension workers were recruited for data collection, and four MSc midwives supervised the whole process.

Operational definition

Indigenous herbal medicine (IHM) use is the use of locally available plants (any parts like seeds, roots, leaves, bark, or flowers for medicinal purposes) by any route (oral, inhalation, topical application) either self-prescribed or recommended by family members, friends, or herbalists to treat some abnormalities during the current pregnancy period (11, 37).

Knowledge was measured using seven items prepared to assess it. Study participants were asked the knowledge-related questions, and value one was given for correct answers and value zero was given for incorrect (or I do not know) answers. Then the respondent's score was dichotomized as sufficient knowledge or insufficient knowledge after the total score was computed by summing up all the items together (38, 39).

Sufficient in knowledge: study participants who answered equal to or greater than the mean values of knowledge-related questions (38, 39).

Insufficient knowledge: study participants who answered less than the mean values of knowledge-related questions (38, 39).

Perception: The pregnant woman's perception towards the effects of IHM usage during pregnancy. Eight questions were prepared to assess it. Each question has a five-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = not sure, 4 = agree, and 5 = strongly agree). Then the respondent's score was dichotomized as favorable perception or unfavorable perception (strongly

disagree, disagree, and not sure to "unfavorable" and agree and strongly agree to “favorable”) (38, 39).

Income: the average family’s monthly income of the pregnant women in ETB (Ethiopian Birr) (40).

Data quality control

The questionnaire was developed in English and translated into the local languages by language experts (Afan Oromo, Somali, and Amharic) and then back to English to maintain its consistency. The research’s objectives, the sampling procedure, interviewing techniques, and general approaches to the study participants were all thoroughly covered over a 2-day training session for data collectors and supervisors. We performed a pretest on 5% of the sample size out of the selected health centers at Adisketema Health Center (urban) and Wahil Health Center (rural) two weeks before the actual data collection. Based on the findings of the pretest, we made minor modifications to the questionnaire. The data collection process was closely supervised, and the completeness and accuracy of each questionnaire were checked by the investigators and supervisors daily. Data was entered into the EPI DATA software as part of data management. During data cleaning, a logical checking technique was used to identify the errors. Questionnaires are secured in a safe place for confidentiality and as a backup for later, in case a check is necessary. Finally, double data entry was done by two data clerks, and the consistency of the entered data was cross-checked. To determine the internal reliability of the data, Cronbach’s α was calculated (α = 0.801).

Data management and analysis

The data were coded, entered into Epi Data (Version 3.1), and exported to SPSS (Version 22) statistical software for analysis. A univariate analysis was used to describe the frequency distribution variables. We coded the outcome variables as "1" for "IHM user" and "0" for "non-user." The association between the outcome and independent variables was analyzed using a binary logistic regression model. Variables with a p-value less than 0.25 at the bivariable binary logistic regression analysis were retained and entered into the multivariable binary logistic regression analysis using a forward step-wise approach. A multicollinearity test was performed to determine the linear correlation among the independent variables using the variance inflation factor (>10) and standard error (>2). The goodness-of-fit test was performed using the Hosmer-Lemeshow test (p > 0.05). For an outcome variable, an adjusted odds ratio (AOR) with a 95% confidence interval (CI) and a p-value of less than 0.05 was considered statistically significant.

Results

Socio-demographic characteristics: A total of 628 study participants were included, yielding a response rate of 95.15%. The respondents' ages ranged from 18 to 40 years (mean = 27 years, SD = 6.5 years). More than half (65%) of the study participants were rural residents and housewives (51.1%) (Table 1).

Table 1: Socio-demographic characteristics of the respondents, Dire Dawa, Ethiopia, 2022 (n = 628).

Variables	Category	Frequencies	Percentage
Age (in complete years)	>30	194	30.9
	20-30	345	54.9
	<20	89	14.2
Residence	Urban	408	65

	Rural	220	35
Level of education(women)	No formal education	152	24.2
	Primary (1-8)	207	33
	High school (9-10)	132	21
	Preparatory and diploma	95	15.1
	Degree and above	42	6.7
Marital status	Married	571	90.9
	Single	36	5.7
	Divorced	13	2.1
	Widow	8	1.3
Level of education (husband, n=571)	No formal education	95	16.6
	Primary (1-8)	147	25.7
	High school (9-10)	155	27.1
	Preparatory and Diploma	129	22.6
	Degree and above	45	7.9
Occupation	House wife	321	51.1
	Merchant	164	26.1
	Private employee	100	15.9
	Public employee	43	6.8
Monthly income	<100USD	174	27.7
	100-150USD	380	60.5
	>150 USD	74	11.8
Religion	Muslim	289	46
	Orthodox	213	33.9
	Protestant	103	16.4
	Catholic	23	3.7

Obstetric characteristics: 50%, 34.7%, and 15.5% of study participants had 3–4, 1–2, and more than four parities, respectively. Around 18.8%, 53.2%, and 28% were in the first, second, and third trimesters, respectively. Less than half (45.1%) had three or more ANC visits, and more than half (55.9%) were pregnancies that were planned.

Awareness about herbal medicine

Most respondents had awareness about IHM (89.6%), and their most common sources of information were neighbors and friends (41.3%), family and relatives (34%), traditional healers (14%), and religious fathers (10.7%).

Prevalence of IHM use during the current pregnancy

Out of the total of 628 respondents, 47.8% (300) (95% CI: 43.8%–51.6%) used indigenous herbal medicine during their current pregnancy. From this, 16.3%, 45%, 29.3%, 3.3%, 3.7%, and 2.3% used only the first trimester, only the second trimester, only the third trimester, only the first and second trimesters, only the second and third trimesters, and all trimesters, respectively.

Herbals used, indications, parts and additives

The most commonly used IHMs were garden cress (*Lepidium sativum)* (32%), bitter leaf (*Vernonia amygdalina*) (25.2%), moringa *(Moringa oleifera) (*24.5%), flax seed (*Linum usitatissimum) (15.3%)*, and eucalyptus tree *(Eucalyptus globulus) (13.7%)* (Table 2).

The most common stated reasons were related to gastro-intestinal system problems: intestinal parasites (27%), nausea and vomiting (21.7%), constipation (20%), to increase appetite (17.3%), relief of stomach aches (9.7%), indigestion (7.7%), and abdominal cramps (7%). The others were related to headache (17.7%), malaria (10.7%), high blood sugar (9.7%), and blood pressure (7.7%). The most commonly used parts of the herbs were seeds and leaves, with different additives (Table 2). More than half of the respondents used the leaves of herbs, followed by the seeds. Moringa, rue, and honey were the most commonly used additives (Table 2).

Table 2: Most commonly used herbal medicines, indications, parts, and additives during pregnancy, Dire Dawa, Ethiopia, 2022 (n = 300)

Local name/English name	Scientific name	Frequency	Reason of use with frequency	Part use	Another additive used with IHM
"Fexo"/garden cress	*Lepidium sativum L*	96	-Hepatitis E (9) -intestinal parasites (46) -hemorrhoids (7) - lowering blood pressure (11) -lowering blood sugar with moringa (20) -Relieving pain/backache, leg cramps (4) -Digestion problem (6)	Seed	For BP and DM bulb of garlic, ginger with honey -moringa
"Girawa"/bitter leaf	*Vernonia amygdalina*	77	Indigestion (6) -constipation (5) -Nausea and vomiting (16) -headache (29) -intestinal worm (21)	roots or leaves	With Rue Or moringa water
"Shifera"/moringa	*Moringa oleifera*	74	-constipation (34) -gastritis (11) -indigestion (14) -Candidiasis (4) -diabetes (11)	Leaf	coffee
"Talbaa"/flax seed	*Linum Usitatissimum*	46	-to increase appetite (12) -constipation (22) -to treat stomach ulcer (12)		Slaughter

"Nech bahirzaf"/eucalyptus tree	*Eucalyptus globulus*	41	-nausea and vomiting (41)	Fresh leaf /Dried leaf is put on fire and smoked	No
"Abish"/fenugreek	*Trigonella foenum-graecum*	36	-to increase appetite (30) -lowering blood sugar/ diabetes (6)	Seed and leaf	fexo and moringa
"Botoroo"	*Stereospermum Kunthinium*	28	-tooth ache (28)	bark	Ginger
"Tenaadam"/Rue	*Ruta chalepensis*	27	-Abdominal cramp/colic (16) -constipation (4) -common cold (7)	leaves	zinger garlic

Routes, number, and frequency per day

The majority (91.3%) of pregnant women took IHM via oral routes; the rest, 5.7% and 3%, were through nasal inhalation and topical form, respectively. Out of three hundred respondents, the majority (142) took two types of IHM, followed by three types (76) and one type (45). 59.7% of pregnant women took IHM two times, 24.6% took it once (early morning in the bare stomach), and 15.7% took it three times per day. There were herbal medicines occasionally used by pregnant women (Table 3).

Table 3: Occasionally used herbal medicines, indications, parts, and additives during pregnancy, Dire Dawa, Ethiopia, 2022 (n = 300)

Local name/English name	Scientific name	Frequency	Reason of use with frequency	Part use	Another additive used with IHM
"Kurkura"/Christ's thorn jujube	*Ziziphus spina-christi*	22	-Diarrhea (12) -Diabetes (7) -dementia (3)	leaves	Moringa water
"Sinafch"/mustard	*Brassica nigra*	21	-to increase appetite (10) -lower depression/"to be alert" (11)	powder	No
"Ye Kosso zaf fire"	*Hagenia abyssinica*	21	Intestinal parasites (21)	Seed	No
"Gambello"	*Gardenia ternifolia*	20	-Stomach ache (11) -fever (4) -hypotension (4)		Rue

"Tikur azmud"/black cumin	*Nigella sativa*	16	-Headache=9 -common cold=5 -cough=4	Seed	No
"Annan Kuti"/spearmint	*Mentha spicata*	12	-lowering blood pressure (5) -asthma (3)		moringa
"Dammakessie"	*Ocimum lamifolium Hochst*	11	-Common cold (9) -Inflammation of leg (3) -diabetes (3)	leaves	Ginger garlic
"Eret"/aloe	*Aloe sinana*	9	Malaria (9)	leaves	honey or sugar

Side effects, discussions with health professionals, and satisfaction

Among IHM users,16.7% stated side effects after IHM intake. The most common stated types of these side effects were malaises (42.6%), abdominal pain (12.5%), vomiting (17%), and headaches (14.9%), and only 3.5% had discussions about them with health professionals. The majority (73%) were satisfied, 23% were on average, and 4% were dissatisfied with the use of IHM during pregnancy.

Source place and influential factors for IHM usage

When asked where they got their IHMs, respondents reported traditional healers (60%), religious places (14%), market places (13.7%), a neighbor (3%), self-preparation (2.7%), and more than one source (6.6%). The most commonly stated influential reasons for using IHMs were the perception that "indigenous herbal medicines are more therapeutic than modern medicines" (43.7%) and "safe in pregnancy" (17%) (Figure 2).

knowledge and perception of respondents towards IHM

More than half (63.5 and 59.4% of respondents had sufficient knowledge on the effects of IHM use during pregnancy and a favorable perception of IHM, respectively.

Environmental, past experience, and medical factors (n = 628)

Access to health facilities: 18.3%, 53.2%, and 28.5% had access to health facilities within < 5 kilometers, between 5 and 10 kilometers, and > 10 kilometers, respectively.

The presence of traditional healers in close proximity: 88.7% and 11.3% of respondents reported the presence of traditional healers > 5 kilometers and ≤5 kilometers, respectively.

Regarding prior IHM use experience (during a past pregnancy), 45.7% reported using it, and only 9.5% had used IHM for other health problems.

Reasons for not using IHM among non-users (n = 328): Perceiving unsafe during pregnancy (60.4%), forbidden by husbands (20.4%), preference of modern medicines (14.6%), lack of availability (6.7%).

Factors associated with IHM use by pregnant women

In the multivariable binary logistic regression analysis, level of education: no formal education (AOR = 5.47, 95% CI: 2.40–12.46), primary level (AOR = 4.74, 95% CI: 2.15–10.44), being a housewife (AOR = 4.15, 95% CI: 1.83–9.37), low number of ANC visits (AOR = 2.58, 95% CI: 1.27–5.25), insufficient knowledge on the effect of IHM during (AOR = 4.58, 95% CI: 3.02–6.77), and favorable perception (AOR = 2.54, 95% CI: 1.71–1.77) were significantly associated with IHM use during the current pregnancy (Table 4).

Table 4: Bivariable and multivariable binary logistic regression analysis results indicating factors associated with IHM use during pregnancy, Dire Dawa, Ethiopia, 2022 (n = 628).

Variables	Category	IHM use		COR (95% CI)	AOR (95% CI)	P-value
		Yes	No			
Age (in completed years)	>30	85(43.8%)	109(56.2%)	1.72(1.037-2.86) *	1.13(0.61-2.09)	.707
	20-30	164(47.5%)	181(52.5%)	1.48(0.93-2.37)	1.13(0.64-1.99)	.668
	<20	51(57.3%)	38(42.7%)	1	1	
Residence	Urban	207(50.7%)	201(49.3%)	1	1	
	Rural	93(42.3%)	127(57.7%)	1.41(1.01-1.96) *	1.46(0.97-2.18)	.068
Education level	No formal education	43(28.3%)	109(71.7%)	6.34(2.97-13.51) ***	5.47(2.40-12.46)	.000
	Primary (1-8th grade)	71(34.3%)	136(65.7%)	4.79(2.31-9.92) ***	4.74(2.15-10.44)	.000
	High school (9-10th grade)	99(75.0%)	33(25.0%)	0.83(0.38-1.81)	0.85(0.36-1.98)	.704
	Preparatory and diploma	57(60.0%)	38(40.0%)	1.67(0.76-3.65)	1.44(0.60-3.45)	.409
	Degree and above	30(71.4%)	12(28.6%)	1	1	
Occupation	Housewife	130(40.5%)	191(59.5%)	2.74(1.41-5.34) **	4.15(1.83-9.37)	.001
	Private employee	56(56.0%)	44(44.0%)	1.47(0.70-3.08)	1.66(0.68-4.07)	.268
	Merchant	86(52.4%)	78(47.6%)	1.69(0.84-3.40)	2.19(0.94-5.09)	.069
	Public employee	28(65.1%)	15(34.9%)	1	1	
Number of ANC	3 and more	156(55.1%)	127(44.9%)	1	1	
	1-2	144(41.7%)	201(58.3%)	1.71(1.25-2.35) **	2.58(1.27-5.25)	.009
Gestation	First	50(42.4%)	68(57.6%)	1.63(1.02-2.61) *	1.38(0.77-2.47)	.274
	Second	154(46.1%)	180(53.9%)	1.40(0.97-2.02)	1.37(0.88-2.14)	.166
	Third	96(54.5%)	80(45.5%)	1	1	
Prior IHM use experience	No	176(51.6%)	165(48.4%)	1	1	
	Yes	124(43.2%)	163(56.8%)	1.40(1.02-1.92) *	0.84(0.42-1.71)	.638
IHM use for other health problem	No	279(49.1%)	289(50.9%)	1	1	
	Yes	21(35.0%)	39(65.0%)	1.79(1.03-3.12) *	1.74(0.88-3.46)	.111
Knowledge (IHM)	Sufficient	240(60.2%)	159(39.8%)	1	1	
	Insufficient	60(26.2%)	169(73.8%)	4.25(2.98-6.07) ***	4.58(3.02-6.97)	.000
Perception	Unfavorable	160(62.7%)	95(37.3%)	1	1	
	Favorable	140(37.5%)	233(62.5%)	2.80(2.02-3.90) ***	2.54(1.71-3.77)	0.000
Presence of traditional healer in near	>5 kilometer	277(49.7%)	280(50.3%)	1	1	
	≤5 kilometer	23(32.4%)	48(67.6%)	2.06(1.22-3.49) **	1.44(0.75-2.76)	.269

Significant at: *p=<0.05, **p=<0.01, ***p=0.000, 1=reference

DISCUSSION:

For a country with a national policy aimed at strengthening the quality of healthcare, like Ethiopia, it is fundamental to investigate the status of conventional and traditional medicines with their potential influencing factors, like in pregnant women. This study gives important findings regarding the prevalence and factors significantly associated with the use of IHM during pregnancy. The present study revealed that the prevalence of IHM use during a current pregnancy is high (one in two pregnant women, 47.8%). This finding was in line with a study in Turkey (47.3%)(41). Such consistency might be because of the aggregated similarity of some socio-demographic characteristics of study participants. In the present study, the majority of study participants were in the age range of 20–30 (54.9%), were housewives (51%), and were married (90.9%). Likewise, in the study in Turkey, the study participants' ages ranged from 21-25%; the majority were housewives (87.4%), and 34.2% had completed only primary school or below (41).The present finding was also in line with three studies in Ethiopia: Nekemte (50.4%)(40), Gonder (48.5%)(33), and Dessie (51.2%)(42). Similarly, the possible reason for consistency might be related to the major compacted variables among study participants. In all three studies, most participants' ages were below 30 years, their education level was secondary and below, and they were urban residents, unemployed, or housewives (33, 40, 42). Similarly, in the present study, more than half (54.9%) of participants were in the age range of 20–30 years, unemployed or housewives (51.1%), and the majority were urban dwellers (65%), and their education level was secondary or below (78.2%).

The present study's prevalence is higher than studies conducted in Italy (27.8%) (43), two studies in Africa, Nigeria (36.8%) (44), Uganda (20%) (8), and one study in Ethiopia (36.3%) (45). This discrepancy might be due to study methods. For instance, the study in Italy used only two hospitals and 392 samples with a 10-month study period (43). The study in Nigeria used only a tertiary hospital and 500 samples selected by systematic techniques (44). Likewise, the study in Uganda used four study sites, a mixed study design with 383 samples for the quantitative part, and participants were interviewed while attending postnatal care about the use of herbal medicines during their pregnancy period; this could have a recall bias that varied the study result (8). In addition, the study in Northern Ethiopia, Debre Tabor, used a mixed community-based study design with 267, 12, and 6 sample sizes for quantitative, focus group discussion, and in-depth interviews, respectively (45). While the present study used multiple health settings, both urban and rural, with a facility-based study design and 628 samples, pregnant women attended ANC visits. This may be due to the accessibility and affordability of the regulatory systems of IHM and traditional medicine usage in different countries. These may make a difference in countries such as Italy and Nigeria, versus in Ethiopia, where traditional healers and traditional medicine usage are relatively common. For instance, in the present study, 88.7% and 11.3% of respondents reported the availability of traditional healers at a distance > 5 kilometers and ≤ 5 kilometers, respectively.

The present study's prevalence, however, is lower than studies conducted in Bangladesh (70%) (20), Iran (71.3%) (24), Zimbabwe (69.9%) (46), Mali (79.9%) (47), Sierra Leone (82.7%) (48), and Uganda (76.7%) (14).The discrepancy may be caused by variations in the study setting, sample size, sampling technique, study design, study populations, study duration, and participants' ages. For instance, in a study in Bangladesh (20), two public hospitals, a study in Iran (24), 12 health centers, a study in Mali(47), 3 health centers, and a study in Zimbabwe (46), only 2 rural districts were included as study settings. In the present study, 3 health centers from urban areas, 3 urban public health centers, 3 rural public health centers, and one public referral hospital were included.

Regarding the sample size, 243, 150, 398, 209, 134, and 46 sample sizes were used in studies in Bangladesh, Iran, Zimbabwe, Mali, Serra Leon, and Uganda, respectively(14, 20, 24, 46-48). But in the present study, a sample size of 628 was used. In the present study, a facility-based cross-sectional study design was used, while a study in Uganda used a community-based survey, which could also result in result variations (14). In the present study, the study populations were pregnant women on ANC visits, while in a study in Bangladesh, postpartum women were interviewed about patterns of herbal medicines used in the previous pregnancy; this can have recall bias and could result in result variations(20). In addition, the studies in Zimbabwe and Uganda used convenient and snowball sampling techniques, respectively (14, 46). While the present study used random sampling techniques. The participants age may also be a possible reason for variation, as their experience with IHM knowledge and perception might be related to age (39). All these methodological variations could create discrepancies between the studies. Besides, the discrepancy may be related to socio-cultural variables like residence area, education level, and awareness status in different countries and their districts. Moreover, the discrepancy may be related to access to community and/or health facility-based population health education programs that involve traditional medicines. The present study's prevalence was also lower than one study conducted in southern Ethiopia, Hosana (73.1%) (38). This discrepancy may be caused by variations in the study setting, sample size, and sampling technique. The study in southern Ethiopia, Hosana, used public health facilities available only in the town, a sample size of 363, and a systematic sampling technique (38). While the present study used public health facilities available both in urban and rural sites, a larger sample size (628) and a random selection technique. Besides, the discrepancy may be related to socio-cultural variations and the awareness or attitude of populations in different districts of Ethiopia.

According to this study, low levels of education, being housewives, lower antenatal care visits, insufficient knowledge, and favorable perceptions were all associated with a higher likelihood of IHM use during a current pregnancy. Pregnant women who had no formal or primary-level education were more than five and four times more likely to use IHM than those who had secondary or higher education. This was supported by research conducted in Turkey(41), Nigeria (44), and different parts of Ethiopia (33, 38, 42, 45, 49). The study conducted at Debre Birhan, Dessie, Gonder, Hosana, and Debre Tabor revealed the odds of IHM use during pregnancy were 2, 3, 4, 4, and 9 times higher among pregnant women with low-level education, respectively (33, 38, 42, 45, 49).

Pregnant women who had insufficient knowledge regarding the effects of herbal medicine usage during pregnancy were almost four times more likely to use IHM compared to those who had sufficient knowledge. Previous studies conducted in the west and northern parts of Ethiopia did not assess participants knowledge on the effects of herbal medicine usage during pregnancy (33, 40, 42, 45). But two studies, one in north Ethiopia, Debre Birhan, and one in southern Ethiopia, Hosana, assessed participants knowledge on the effects of herbal medicine usage during pregnancy (38, 49). And the former study (at Debre Birhan) did not show an association between knowledge and herbal medicine usage during pregnancy (49). While the later one revealed that knowledge on the effect of herbal medicine use during pregnancy had a significant association with its use (38), which is in line with the present study. The possible explanation may be the fact that insufficient knowledge regarding the effects of herbal medicine usage during pregnancy may reduce thoughtfulness to the risks that can occur during pregnancy, either to pregnant women or their fetus or to both.

In previous studies done in different parts of Ethiopia, only one study assessed perception but did not show a significant association with the use of IHM by pregnant women (38). In contrast, the present study showed the odds of IHM use during pregnancy were more than two times higher among favorable preceptors. One possible explanation might be that those who had a favorable perception of IHM might perceive herbal medicines as lacking risks that can occur during pregnancy, either to pregnant women or their fetus or to both.

Moreover, the present study revealed two variables having a significant association with the use of IHM by pregnant women: being housewives and the number of ANC visits. Pregnant women who were housewives were almost four times more likely to use IHM compared to their counterparts. The possible explanation might be due to the fact that housewives might have a lack of awareness about IHMs compared to their counterparts and a positive perception towards their use. Pregnant women who attended fewer ANC visits were more than two times more likely to use IHM compared to those who attended more ANC visits. The possible reason might be due to the effects of counseling during ANC, like risk and nutritional counseling, and this needs further research.

Furthermore, at the binary level, this study also showed the presence of traditional healers in a nearby area has an association with the use of IHM by pregnant women, but this also needs further study.

The present study showed commonly used herbal medicines during pregnancy as garden cress (*Lepidium sativum)* (32%), bitter leaf (*Vernonia amygdalina*) (25.2%), moringa *(Moringa oleifera) (24.5*%), flax seed (*Linum usitatissimum) (15.3%)*, and eucalyptus tree *(Eucalyptus globulus) (13.7%).* A little bit related finding was indicated by a study conducted in Nigeria, in which the bitter leaf/iron weed plant (Vernonia amygdalina) (54.3%) was the most common herbal medicine used by pregnant women (44). Studies conducted in Turkey (41) and Ethiopia showed ginger (Zingiber officinale) as the most common herbal medicine used by pregnant women(33, 38, 40, 42, 45, 49). *Unlike previous studies* in Ethiopia (33, 38, 40, 42, 45, 49)*, ginger was not the commonest herb but rather used as an additive in the present study.*

A study in Italy showed chamomile, licorice, fennel, aloe, valerian, echinacea, almond oil, propolis, and cranberry as the common herbal medicines used by pregnant women (43). A study in Mali revealed *chevalieri* (55.5%), *Combretum micranthum* (39.7%), *Parkia biglobosa* (12.0%), and *Vepris heterophylla* (8.1%) as the common herbal medicines used by pregnant women (47).

In addition, a study in Serra Leon identified *Luffa acutangula* (L.*Roxb*as the most cited herbal medicine used during pregnancy(48). The study at Gonder and Dessie, north Ethiopia, showed ginger (Zingiber ofcinale Roscoe) (43.8%) and garlic (Allium sativum L.) as the commonest herbal medicines used by pregnant women (42). The study at Debre Birhan showed ginger (Zingiber officinale Roscoe), damakesse (Ocimum lamiifolium), and tenadam (Fringed rue) as the commonest herbal medicines used by pregnant women (49). In the study at Nekemte, west Ethiopia, ginger (44.36%) and tenaadam (9.15%) were found to be the most common herbal medicines used by pregnant women(40). This indicates that the types and frequency of herbal medicines vary according to different research findings. This might be due to the fact that there are many different types of herbal medicine from different cultures and the variety of sample sizes in different research studies. Such variation could also be due to differences in user-friendliness, openness (lacking a regulatory body), and environmental spreading of the herbs across diverse countries and provinces in the same country.

As per the present study, common indications of herbal remedies were related to gastro-intestinal system problems: intestinal parasites (27%), nausea and vomiting (21.7%), constipation (20%), to increase appetite (17.3%), and relief of stomach aches (9.7%). The others were related to headache (17.7%), malaria (10.7%), high blood sugar (9.7%), and blood pressure (7.7%). The indications of herbal remedies also vary; for instance, a study in Mali showed: for well-being (36.7%), symptoms of malaria (37.1%), and to reduce edema (19.2%)) (47). A study at Serra Leon indicated urinary tract infection and pedal oedema (48).A study at Dessie, north Ethiopia, showed indications for herbal drug use were nausea/vomiting (43.8%), headache (30.8%), and common cold (25.4%)(42). In a study at Gonder, north Ethiopia, common cold (66%), and inflammation (31.6%) were the most common reasons (33). This suggests that there are a number of therapeutic tasks that herbal remedies are demanded to play during the gestational period, duties that may require scientific explanation. The present study showed that only few pregnant women are aware of the side effects after taking herbal medicines and only few have disclosure for discussion with health professionals about the side effects. This suggests that to prevent the possible harm imposed by the use of herbal medicines, health care providers should emphasize safety issues to pregnant women and make functional counselling during ANC cares and provide updated evidence-based information regarding herbal medicines. Unlike the previous studies available in Ethiopia so far (33, 38, 40, 42, 45, 49), the present study identified traditional healers (60%) followed by religious places, as the major source place to obtain herbal medicines by pregnant women. This indicates the need for training for traditional healers and religious leaders about the possible risks for pregnant women and their fetuses, dose proportion of herbs and gestational time of pregnant women.

The present study also revealed the most commonly stated influential reasons for using IHM as perception that "indigenous herbal medicines are more therapeutic than modern medicines" and "safe in pregnancy". Moreover, the present study showed reason for not using IHM among non-users as perceiving unsafe during pregnancy (60.4%), forbidden by husbands (20.4%), and preference of modern medicines (14.6%). These indicates the need for community awareness about herbal medicines including husbands, traditional healers and religious leaders at community level.

Furthermore, unlike the previous studies available in Ethiopia (33, 38, 40, 42, 45, 49), the present study showed the additives, number, and frequency per day of IHM used. Consequently, moringa, rue, honey, and ginger were commonly used as additives. In the present study, the majority of pregnant women took two types of IHM, followed by three types; the majority took IHM two times per day, and a quarter (24.6%) of them took it once (early morning in the bare stomach). This highlights the issue of herbal medicine frequency as well as dose during pregnancy.

The findings of the study could have implications for society, research, and practice (health professionals and health care programs). Implications for:

Social: the study findings suggest the need for continuous awareness for pregnant women considering education level, housewives, and the number of ANC visits since IHM use during pregnancy was higher among these women. They might lack awareness of the risks of pregnancy to themselves and their fetus. It also suggests the need for community awareness to clear up misconceptions about IHM during pregnancy and among general women.

Research: the need for future research to identify IHM use by pregnant women at the community level. Another recommendation for further research is to conduct research on the effects of the number of ANC visits and the influence of traditional healers and religious leaders

on IHM use by pregnant women. Further research on the bioavailability, dose, efficacy, and safety of the herbal medicines used by pregnant women should also be done.

Implications for Practice (Health Professionals and Health Care Programs)**:** According to the study's findings, health facilities require counseling of pregnant women about IHM use during ANC visits and counseling pregnant women to disclose IHM usage and any untoward or side effects if they use it. Since there is a high prevalence and low disclosure rate of herbal medicine use, it should be ensured that obstetricians, midwives, and other health professionals establish a good level of communication with pregnant women during ANC visits.

Conclusion: The prevalence of herbal medicine use is high (one in two pregnant women) and significantly associated with education level, occupation, antenatal care visits, knowledge, and perceptions. The study's findings are helpful in advancing comprehension of herbal medicines using status, types, and enforcing factors. It is essential that health facilities provide herbal counseling during antenatal care visits, and health regulatory bodies ought to raise awareness and implement interventions to lower the risks from over-the-counter (OTC) herbal medicine use by pregnant women.

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Authors' contribution

AM and BA: participated in the conception of the idea, designing the study, data collection and analysis, writing up the draft results, reanalyzing the data, and drafting, editing, and revising the manuscript.

MH, YS, TW, YB, ZH, TD, ND, BM, TM, AN, TG, YM, AA, HL, and AS participated in the designing the study, data collection and analysis, writing up the draft results, reanalyzing the data, and drafting, editing, and revising the manuscript. All authors agree to take responsibility and be accountable for the contents of the article, agree on the journal to which the article will be submitted, and read and approve the final manuscript.

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Competing interests

The author declares that there are no competing interests

Patient Consent for publication

Not applicable

Ethics approval and consent to participate

Ethical clearance was obtained from the institutional ethical review board of Dire Dawa University with protocol number DDU-IRB-2022-113. Informed, voluntary verbal consent was obtained from all subjects and/or their legal guardian(s). All protocols were carried out in accordance with relevant guidelines and regulations of Helsinki.

Availability statement

Data are available from the corresponding author on reasonable request

Abbreviations

IHM: Indigenous Herbal Medicine
ANC: Antenatal Care
AOR: Adjusted odds
CI: Confidence Interval
COR: Crude odds ratio
SPSS: Statistical Package for Social Sciences

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Figure legends

Figure 1: Diagram presentation of sample size allocation for the study on indigenous herbal medicine use among ANC-attending pregnant women, Dire Dawa, Ethiopia, 2022. PASS indicates a proportionally allocated sample sizes, Ni=sample size, N=total estimated number of pregnant women, and 660 is the sum of all proportionally allocated sample sizes.

Figure 2: Most common influential reasons for using IHMs by ANC attending pregnant women, Dire Dawa, Ethiopia, 2022 (n = 300). The black indicates "perceived as more therapeutic." The red indicates "perceiving more safety in pregnancy." The pink indicates "family and relatives'

influence.”. The yellow indicates "socio-cultural influence," the blue indicates "easy access, and the green indicates "less expensive."

Figure on indigenous herbal medicine use

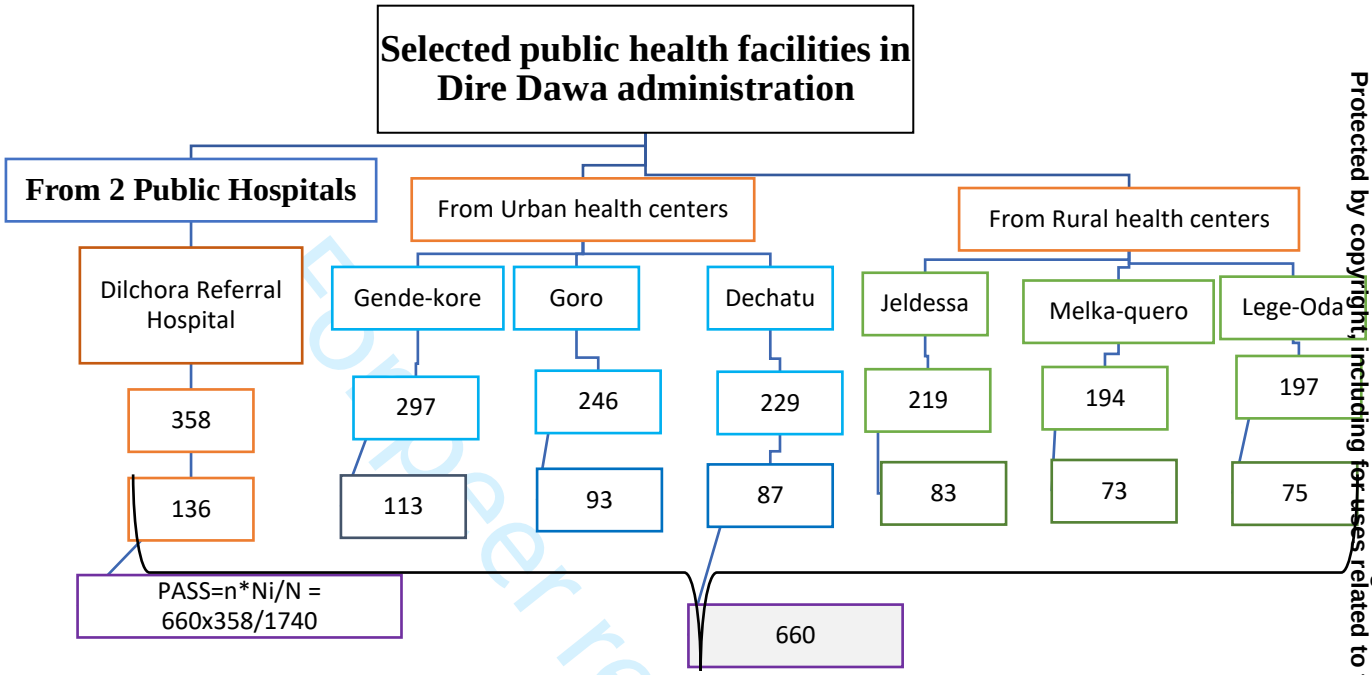

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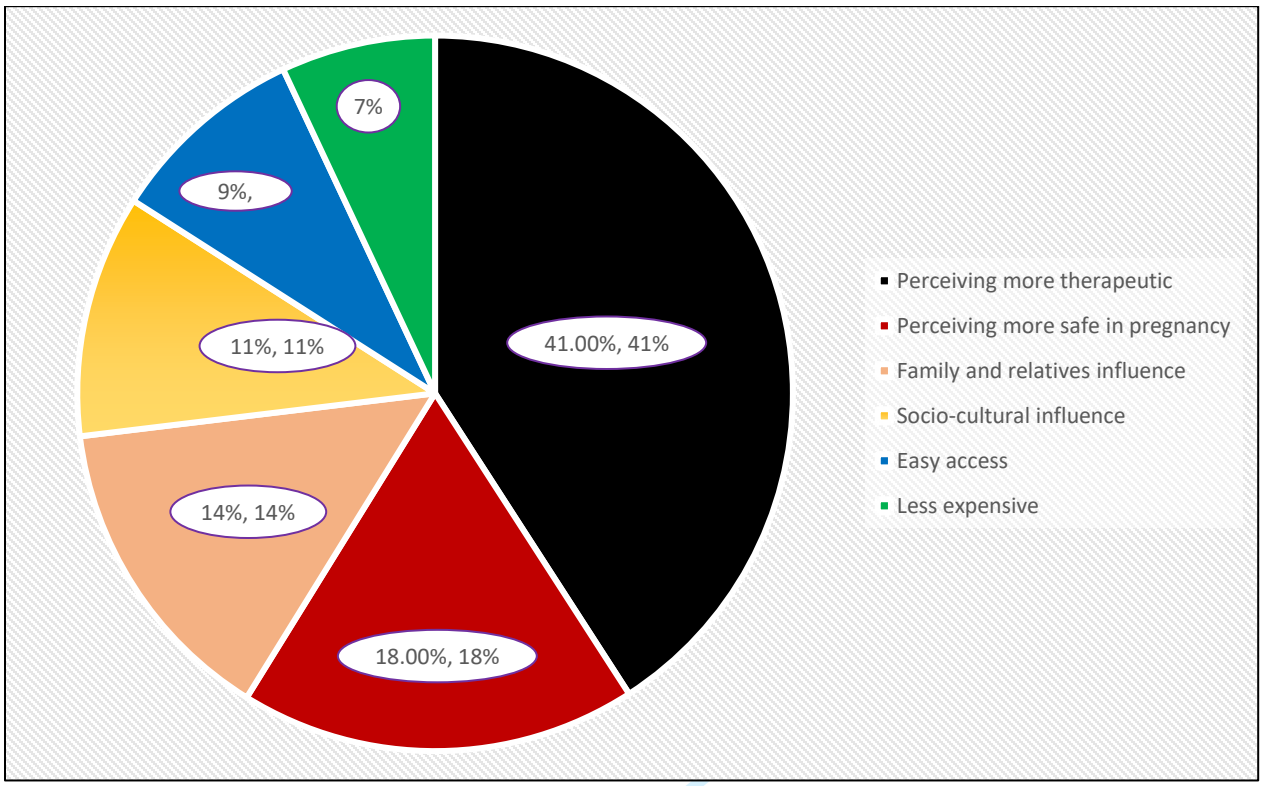
Figure on indigenous herbal medicine use



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STROBE check list used for this study

	Content	Checked or not
Title	-Does the title cover the main aspect of the work? - should be: • Informative (by describing the subject of the research, not results of the research) • do not use abbreviations, formulas and jargon, omit the verb in the title. • contain key words for the benefit of information retrieval system • Specific (by differentiating your research from others on the subject) • concise (brief and suitable for indexing- by limiting it to main or avoiding unnecessary words- Eliminate '**waste words**', words that say nothing like: • "Observations of …", • "Studies of …", • "Investigations of …" or • "Examination of…" • Assessment of…...etc.	Checked
Abstract/summary	-Does the abstract cover the main aspect of the work? - No citation (no use of reference), no abbreviation (unless well-known e.g. DNA, RNA), no table, no figure **-size=** a one paragraph summary of the work 100-300 words (varies in each journal criteria, most journals recommend 250 words) -its **components:** **#background** (summary of introduction + GAP (from statement of the problem) + SMART objective/Purpose of the study # **Methods:** study design, area, period, sampling technique, data collection (tools and methods, data management and analysis…) # **Results:** summary of findings **#Conclusion and/recommendation**	Checked

	#Keywords=are words that help indexers and search engines find the research paper. These words should be words or phrases that suggest what the topic is about/key concept/should be descriptive i.e. should reflect a collective understanding of the topic. Also include words and phrases that are closely related to your topic. E.g. if the paper is about heart diseases, use words like stroke, circulatory system, blood, etc. -3-5 words (varies in each journal criteria)	
Introduction (summary of background +statement of the problem)	▪ a brief section (summary) designed to inform the relevance of your research ▪ it provides *sufficient context and background for the reader to understand and evaluate* your research. ▪ It provides background and information relevant to the study ▪ size=varies but no more than 1 page usually ▪ a **short history or relevant background (**provides background and information relevant to the study) that leads to a statement of the problem that is being addressed. ▪ focuses on the overall issue, problem, or question that your research addresses ▪ usually follow a *funnel style (starting broadly and then narrowing).* ▪ *funnel from* something known, to something unknown, to the question the paper is asking (known→ unknown→ question of paper (gap/rationale or reason of the research). A) Background | B) Problem statement	Checked

	-Definition and description of the **outcome variable** -a **short history or background** and information relevant to the study -Directions (e.g. from WHO, UNICEF, FMOH etc. about your study	-Brief about magnitude of the research problem -Major problems/factors related to the outcome variable /DV (What is known) - What others did to solve the problem, what is unknown (research gap/reason to do this research/ this answers to the question-why the work was done?) - Your intention on how to narrow the gap with justification/relevance of your research	
Methods # each method parts like study design, area, period, sampling technique…...	Are the methods clear and replicable? Do all the results presented match the methods described? -Do each method parts like study design, area, period, sampling technique (study settings and participants), data collection (tools and methods, quality assurance, data management and analysis…) are appropriate to the work? #Setting= Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection # Participants= **Cross-sectional study**—Give the eligibility criteria, and the sources and methods of selection of participants		Checked
Variables	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable		Checked
Data sources/ measurement	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group		Checked
Bias	Describe any efforts to address potential sources of bias		Checked
Study size	- **Explain how the study size was arrived at** **Quantitative variables** = Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why		Checked

	Statistical methods=(a) Describe all statistical methods, including those used to control for confounding **Cross-sectional study**—If applicable, describe analytical methods taking account of sampling strategy	
Results	Correctly analyzed? Reliable?	Checked
Participants	a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analyzed	
Descriptive data	a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Checked
Outcome data	**Cross-sectional study**—Report numbers of outcome events or summary measures	Checked
Main results	**a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included**	Checked
Other analyses	**Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses**	**Not-applicable**
Discussion	Do the findings described by the author correlate with the results? Are interpretations correlate with the results?	Checked
Key results	Summarize key results with reference to study objectives	Checked
Limitations	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Checked
Interpretation	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Checked
Generalizability/conclusion And recommendation	Discuss the generalizability (external validity) of the study results - Do the conclusions correlate to the results found? -do the recommendation/s are appropriate and specific?	Checked

Strength and limitations	Are study strength and limitation scientifically sound?	Checked
key points	#**what new thing/s** from your study? Are the findings relevant? #relevance to literature/clinical/practice/ future research (Does the paper raise any concerns?)	Checked
References	Are the references used are appropriate.?	Checked