



Herbal medicine use among pregnant women at antenatal clinic in Ethiopia

Fentaw Girmaw^{*}, Getachew Ashagrie, Tenaw Baye, Abebe Tarekegn Kassaw

Department of Pharmacy, College of Health Science, Woldia University, Woldia, Ethiopia

ARTICLE INFO

Keywords:

Herbal
Medicine
Pregnancy
Woldia
Ethiopia

ABSTRACT

Background: Herbal medicines are raw or processed plant-derived ingredients. Their use during pregnancy may contribute to several adverse effects that could be lethal to the mother and their unborn children.

Aims: This study aims to assess the prevalence of herbal medicine use and associated factors among pregnant women at Woldia General Comprehensive Specialized Hospital (WGCSH) in Ethiopia.

Samples: The sample size in this study was 272.

Methods: A facility-based cross-sectional study was conducted among 270 pregnant mothers from March 2 to April 2, 2021, at WGCSH in the antenatal care clinic. A standardized, structured questionnaire-based interviewer was used to collect the socio-demographic variables; obstetrics variables; and other related variables for this study. The prevalence of herbal medicine use and associated factors were determined using descriptive and logistic regression analysis, with $p < 0.05$ considered statistically significant.

Results: The prevalence of herbal medicine use in this study was 22.6%. Most of the pregnant women used *Ocimum lamiifolium* and *Rutachalepensis*. The use of herbal medicines during pregnancy in rural areas was higher than in urban areas (OR 2.51; 95% CI 1.35–3.54). The place of residence (AOR 3.66; 95% CI 1.83–4.74), perception of needing to use herbal medicine (AOR 2.20; 95% CI 4.99–9.86), stage of pregnancy (AOR 2.56; 95% CI 1.16–9.36), distance from the health facility (AOR 2.90; 95% CI 1.52–12.65), and previous use of herbal medicine (AOR 3.23; 95% CI 2.74–7.56) were significantly associated with herbal medicine use.

Conclusions: Nearly one-fourth of pregnant mothers at WGCSH used herbal products and preparations.

1. Introduction

Pregnancy is a dynamic change from fertilization to parturition with a lot of maternal physical, physiological, pharmacokinetic, and pharmacodynamic alterations [1]. The term “herbal medicines” is defined as raw or processed plant-derived ingredients that are prepared for the treatment and prophylaxis of different ailments. It includes different herbal parts that contain the active ingredients that are responsible for the therapeutic effects of the plant materials [2]. Herbal medicines are frequently used by pregnant mothers to maintain their healthcare needs because of the perception that they are safe and a natural substitute for conventional drugs. It is

^{*} Corresponding author. Department of Pharmacy, College of Health Science, Woldia University, P.O. Box 400, Woldia, Ethiopia.
E-mail address: fentawgirmaw2@gmail.com (F. Girmaw).

<https://doi.org/10.1016/j.heliyon.2023.e18408>

Received 5 June 2023; Received in revised form 14 July 2023; Accepted 17 July 2023

Available online 18 July 2023

2405-8440/© 2023 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

commonly used in many regions of the world, especially in developing countries, even though the scientific findings on the safety profile of herbal therapy are minimal [3,4]. Moreover, in developing countries, the use of herbal medicines during pregnancy is more common due to their easy availability, low price, poor access to modern medicines, and the view that herbs are not more harmful to the fetus than modern medicine [5].

Globally, about 80% of the population uses herbal medicines for the treatment, prevention, and diagnosis of illnesses. As their primary form of health care, it also improves their general well-being. Moreover, herbal medicines serve the health care needs of millions of people in the vast rural areas of developing countries to treat their illnesses [2,6,7]. Herbal medicines do not often replace conventional medicines, but they can be used as adjuncts [8]. Worldwide, nearly 67% of pregnant mothers used herbal medicines [9, 10]. Depending on the living environment, identity, sociocultural context, traditional values, and economic status, there is a significant variation in the prevalence of herbal medicine use during pregnancy [3].

Different studies reveal that the rates of herbal medicine use during pregnancy in Western nations and Africa are varied. The rates of herbal medicine use during pregnancy in Western nations are between 1 and 60%, as shown in different studies [11–13]. However, the use of herbal medicine ranges from 2% to 100% in Africa during pregnancy [8]. Some herbal products could cause harmful effects on pregnant women and the fetus since herbal product dose, duration, frequency, and other interaction issues were not scientifically addressed. Maternal and fetal morbidity and mortality were high in the experimental study conducted on ginger in rats [14]. Herbs, supplements, and medications should be used with great care during pregnancy as they can harm the mother and the fetus. Since most healthcare providers are not aware of the use of herbal medicines regarding potential benefits or harm of herbal medicines when used by pregnant mothers, it will be challenging to counsel pregnant women who come for ANC follow-up [15,16]. As a result, safety associated with the use of herbal medicines was a great concern since herbal medicines contributed to several adverse effects and unnecessary interactions that could be lethal to the mother and their unborn children [14,17]. Although the use of herbal medicine during pregnancy is increasing, clinical evidence on its frequency, risks, and benefits is scarce [18].

In the Middle East, a literature review on herbal medicine use showed that 82.2% of pregnant mothers used herbs during pregnancy at some point. In China, traditional medicine covered 40% of all healthcare needs [19]. Similarly, in Australia, 36% of women used a minimum of one herbal product during pregnancy [20]. The most common herbal products used by pregnant mothers worldwide are ginger (*Zingiber officinale*), garlic (*Allium sativum*), green tea (*Camellia sinensis*), peppermint (*Mentha piperita*), and fenugreek (*Trigonella foenum graecum*) [21]. A multinational study revealed that 28.9% of pregnant mothers used herbal medicine during pregnancy in different countries [22].

In 2018, maternal and neonatal mortality rates in Ethiopia were among the highest in the world, with 353 deaths per 100,000 live births and 28 deaths per 1000 live births, respectively [23]. This is associated with a lack of modern health facilities and medical inaccessibility or unaffordability. As a result, to fulfill their healthcare needs, pregnant women do rely on herbal medicines, which are accessible and a lower-cost alternative [10,23,24]. In Ethiopia, a study conducted in Hossana town revealed that 73.1% of pregnant mothers use herbal medicines. The study also revealed that ginger (*Zingiber officinale*), garlic (*Allium sativum*), and fringed rue (*Rutachalepensis*) were the most commonly used herbs [13]. A similar study conducted in Gondar showed that the common cold and inflammation were the top two indications for the use of herbal medicine, and ginger and garlic were the two most commonly used herbs during pregnancy [12].

The tradition, culture, and easy access to traditional healers in Ethiopia promote the use of herbal medicines by pregnant mothers. The rules and regulations regarding complementary and alternative medicine are not the same as those regarding modern medicine. Moreover, there is no full evidence of the purity, safety, or teratogenicity of herbal product use. Therefore, it is difficult for pregnant mothers and their unborn children to maintain their well-being [24]. Controlling the use of herbal medicine among pregnant mothers has a very important role in reducing the mortality and morbidity of both the mother and her unborn children. The majority of the women in Ethiopia live with poor access to conventional medicine and have a low level of education. As a result, the need to use herbal medicine could be high. Furthermore, there has been no study done so far on the use of herbal medicine among pregnant women in Woldia town. Therefore, this study aims to evaluate the herbal medicine use and associated factors among pregnant women at Woldia General Comprehensive Specialized Hospital.

2. Methods

2.1. Study design

A facility-based cross-sectional study was conducted using a structured questionnaire-based interview of pregnant women who attended ANC at Woldia General Comprehensive Specialized Hospital.

2.2. Study setting and period

The study was conducted at Woldia General Comprehensive Specialized Hospital, Woldia town, Northern Ethiopia, which is 521 km from Addis Ababa [25]. The hospital was established in 1960 by American missionaries. Based on the national census conducted by the Central Statistical Agency of Ethiopia (CSA) in 2007, Woldia has a total population of 46,139, of whom 23,000 are men and 23,139 are women. According to the data obtained from the North Wollo Zone Health Office report in 2019, North Wollo has a population of 1, 675,732 (841,217 men and 834,515 women). The study was conducted in the ANC clinic of Woldia General Comprehensive Specialized Hospital from March 2 to April 2, 2021.

2.3. Study population

All pregnant women who came to the antenatal care clinic in Woldia General Comprehensive Specialized Hospital were the study population. Pregnant mothers of any gestational age who came for ANC follow-up at Woldia General Comprehensive Specialized Hospital during the study period were included. Those mentally ill pregnant mothers who came for ANC services were excluded from the study.

2.4. Sample size determination and sampling technique

The sample size was calculated using a single population proportion formula and the prevalence of herbal medicines; 48.6% [12] with the assumptions of a 95% confidence level and a 5% margin of error.

$$n = \frac{(Z\alpha/2)^2 * P(1 - P)}{d^2} = \frac{(1.96)^2 * 0.486(1 - 0.486)}{(0.05)^2} = 383$$

Where n = required sample size, z = standard normal distribution for 95% confidence level = 1.96, α = level of significance, p = proportion of herbal medicine use during pregnancy from a previous study, and d = tolerable margin of error. The final sample size was determined to be 272 by using a reduction formula and adding a 10% non-respondent rate since the total number of pregnant mothers attending ANC was 694 which was <10,000. The study participants were selected by a simple random sampling technique using the lottery method. As a result, the selection of the study participants depends on chance.

2.5. Study variables

Herbal medicine use was the dependent variable. Socio-demographic variables (age, educational level, monthly income, marital status, place of residence, distance from the HF) and obstetrics variables (parity, gravidity, stage of pregnancy) were the independent variables.

2.6. Data collection instrument and procedure

Data were collected using a structured interviewer-administered questionnaire. The questionnaires were adapted from previous studies and relevant literature in the English language [12,13,26,27]. Then it was translated into the local Amharic language. To check the consistency, validity, and reliability of the meanings, a back-translation to English was made. The adapted questionnaires were modified accordingly to suit our research objectives and situations. The questionnaire was comprised of different sections to address the objective of this study. The first section contained questions about the women's socio-demographic characteristics, including age, place of residence, marital status, educational level, average monthly income, place of residence, and distance from the hospital. The second section contained questions about obstetrics information, including parity, gravidity, and stage of pregnancy. Pregnant women were also asked about the number of ANC visits, illness during pregnancy, herbal medicine use, alleviation from illness, payment for herbal medicine, adverse effects, and effectiveness issues of herbs. Furthermore, questions were asked about the most common reasons for using herbal medicine, the herbs they used, the parts of plants used, the method of preparation, and the indications for using them during pregnancy. The study tool was assessed by a group of researchers to evaluate and enhance the items in the question.

2.7. Data quality assurance

A pre-test was done before the actual data collection period on 5% of the sample size of the nearby health facilities (Kobo Hospital) to ensure the clarity, wording, logical sequences, and skip patterns of the questions. Accordingly, necessary corrections were made to the data collection instruments. The data collectors were trained for one day in data collection tools and procedures. The principal investigator was also checked for incompleteness, edited in the field and office, coded, and cleaned to assure the quality of the findings. Any personal name and identity were not recorded for confidentiality purposes, and collected data were kept in a secure place.

2.8. Data processing and analysis

Data were checked for inconsistencies and incompleteness before being edited, coded, and entered into the epi data. The data was then exported to SPSS Windows version 23 statistical software. Descriptive statistics were computed to determine the frequency and percentage of dependent and independent variables. Indeed, binary logistic regression analysis was also conducted to obtain the odds ratio and the confidence interval of statistical associations. Then, multivariable logistic regression analysis was carried out based on the result of binary logistic regression analysis that had a statistically significant association. The strength of statistical associations was measured by adjusted odds ratios and 95% confidence intervals at $P < 0.05$.

3. Results

3.1. Socio-demographic variables of pregnant mothers

About 88.5% (239/270) of the respondents were below the age of 35, and the mean age was 31.62 ± 4.58 years. Among the study participants, 91.5% (247/270) were married. Nearly half of the respondents, 46.3% (125/270) were living in urban settings. Of the total respondents, 28.5% (58/270) were illiterate, followed by the study participants that had a primary education. 3/4th of the study participants had a low average monthly income and 44.4% of the respondents were more than 5 km far from the health facility (Table 1).

3.2. Obstetrics variables of the pregnant mothers

About 61.5% (166/270) of study participants were multigravida and 38.5% of the respondents were primiparous. Similarly, 34.8% (94/270) of the study participants were in the 1st trimester of pregnancy (Table 2).

3.3. Prevalence of herbal medicines

In this study, more than half of pregnant mothers (54.8%, or 148/270) had two or more ANC visits, and 58.5%, or 158/270, of pregnant mothers encountered illness during pregnancy. The prevalence of herbal medicine use in the current study was 22.6% (61/270), while the use of herbal medicines that alleviated maternal illness in the study setting was 90.2% (55/61). Of all the participants, only 24.6% (15/61) of pregnant mothers were paid for herbal medicines. Considering perceptions about herbal medicine use, nearly 2/3 of pregnant mothers perceived it to be effective and had a previous history of herbal medicine use. In addition, 80% of participants said herbal medicine had an adverse effect, and 29.2% of them assumed that herbal medicine use resulted in neonatal death (Table 3).

Of the respondents, 36.1% (22/61) of them used herbal medicines for the treatment of their nausea and vomiting. Similarly, consumption of herbal medicines for common colds was comparable to that for nausea and vomiting, which accounted for 34.4%. Only three pregnant mothers used herbal medicines for the treatment of pneumonia, and two of them for pain. The other indications for using herbal medicines during pregnancy are shown in Table 4.

A majority (62.3%) of the pregnant women used *Ocimum lamiifolium* (damakase) and *Ruta chalepensis* (tenaadam) during pregnancy. Less than half of the respondents used other herbal products like *Zingiber officinale* (ginger), *Linum usitatissimum* (flaxseed), and *Eucalyptus globulus* (eucalyptus). Only one pregnant mother took neem during pregnancy in this study. Moreover, the most commonly used part of the plants was the leaves, and the most frequently used route of administration was oral (Table 5).

When it came to where they learned about using herbal remedies while pregnant, the majority of participants (60.2%) said they got their information from family or friends (Fig. 1).

Table 1
Socio-demographic variables of Pregnant Mothers Attending ANC in Woldia General Comprehensive Specialized Hospital, Ethiopia, March2-April 2, 2021 (n = 270).

Variables	Frequency	Percentage (%)
Age group (years)		Mean age = 31.62 ± 4.58
<35	239	88.5
≥35	31	11.5
Marital status		
Married	247	91.5
Not married ^a	23	8.5
Education level		
Illiterate	77	28.5
Primary education	76	28.2
Secondary education	57	21.1
Higher education	60	22.2
Average monthly income (ETB) ^b		
<1380 (poor)	53	19.6
1381-6900 (low)	209	77.4
6901-13900 (middle)	8	3.0
Residence		
Rural	145	53.7
Urban	125	46.3
Distance from the health facility		
≥5 km	120	44.4
<5 km	150	55.6

^a Divorced, separated, widowed.

^b Classification is in accordance with the WHO income level scale for developing countries. ETB, Ethiopian birr.

Table 2

Obstetrics variables of pregnant mothers attending ANC in woldia general comprehensive specialized hospital, Ethiopia, March 2-April 2, 2021 (n = 270).

Variables	Frequency	Percentage (%)
Parity		
Para = 1	90	33.3
Primiparous	73	27.0
Para \geq 2	107	39.7
Gravidity		
Primigravida	104	38.5
Multi-gravida	166	61.5
Stage of pregnancy		
1st trimester	94	34.8
2nd trimester	81	30.0
3rd trimester	95	35.2

Table 3

Prevalence of herbal medicine among pregnant mothers attending antenatal care in woldia general comprehensive specialized hospital, Ethiopia, March 2-April 2, 2021.

Variables	Frequency	Percentage (%)
What is the number of your ANC visit?		
First ANC visit	122	45.2
ANC visit \geq 2	148	54.8
Do you have an illness during pregnancy? (N = 270)		
Yes	158	58.5
No	112	41.5
Did you use herbal medicines during pregnancies? (N = 270)		
Yes	61	22.6
No	209	77.4
Can herbal medicine alleviate your illness? (N = 61)		
Yes	55	90.2
No	6	9.8
Are herbal medicines effective? (N = 61)		
Effective	38	62.3
Not effective	23	37.7
Did you use herbal medicine in the previous pregnancy? (N = 61)		
Yes	40	65.6
No	21	34.4
Do you pay for herbal medicine? (N = 61)		
Yes	15	24.6
No	56	75.4
Do herbal medicines have adverse effects? (n = 270)		
Yes	216	80.0
No	54	20.0
What are the possible adverse effects? (N = 270)		
Abortion	33	15.3
Maternal death	68	31.5
Preterm birth	52	24.0
Neonatal death	63	29.2

Table 4

Indication for Herbal Medicines use among Pregnant Mothers Attending ANC at Woldia Comprehensive Specialized General Hospital, Ethiopia, March 2-April 2, 2021 (n = 61).

Indications for use	Herbs used	Plant recipe	Frequency	Percent (%)
Nausea/vomiting	Ginger/damakase	Blended	22	36.1
UTI	Damakase	Blended	5	8.2
Diarrhea	Flaxseed	Paste	4	6.6
Headache	Damakase	Mix with water	6	9.8
Pneumonia	Damakase	Mix with coffee	3	4.9
Common cold	Eucalyptus/tenaadam	Boiled	19	31.1
Pain	Neem/tenaadam	Paste	2	3.3

Table 5

Name of Herbs used among Pregnant Mothers Attending ANC at Woldia General Comprehensive Specialized Hospital, Ethiopia, March 2-April 2, 2021 (n = 61).

Scientific name	Traditional name	Parts used	Route of administration	Frequency	Percentage (%)
<i>Ocimum lamiiifolium</i>	Damakase	Leaves	Oral	20	32.8
<i>Rutachalepensis</i>	Tenaadam	Leaves	Oral	18	29.5
<i>Zingiber officinale</i>	Ginger	Rhizome	Oral	16	26.2
<i>Linum usitatissimum</i>	Flaxseed	Seeds	Oral	4	6.6
<i>Eucalyptus globulus</i>	Eucalyptus	Leaves	Inhalation	2	3.3
<i>Azadirachta indica</i>	Neem	Leaves	Topical	1	1.6

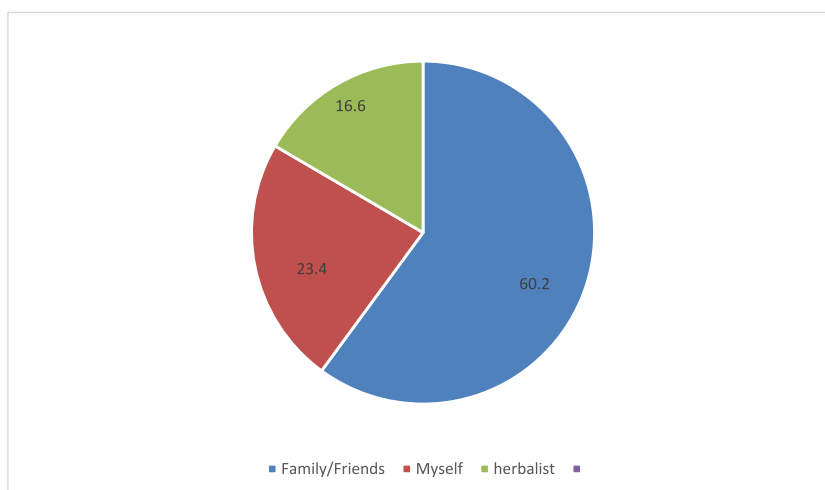


Fig. 1. Source of information on herbal medicine use for pregnant women at Woldia General Comprehensive Specialized Hospital, 2021.

3.4. Factors associated with herbal medicine use

In a bivariate logistic regression analysis, pregnant mothers who lived in rural areas were two times more likely to use herbal products during pregnancy than those who lived in urban settings (OR 2.51; 95% CI 1.35–3.54). Pregnant mothers who lived less than 5 km from a health facility were twice as likely as those who lived more than or equal to 5 km from the health facility to use herbal

Table 6

Factors associated with the use of Herbal Medicine among Pregnant Mothers Attending ANC in Woldia General Comprehensive Specialized Hospital, Ethiopia, March 2-April 2, 2021 (n = 270).

Variables	Herbal medicine use		COR (95% CI)	AOR (95% CI)	
	Yes = 61 (%)	No = 209 (%)			
Residence	Rural	43 (70.5)	102 (52.2)	2.51 (1.35–3.54) ^a	3.66 (1.83–4.74) ^a
	Urban	18 (29.5)	107 (47.8)	1.0	
Education level	Illiterate	19 (31.1)	58 (27.8)	1.01 (1.18–2.80) ^a	0.35 (0.16–8.71)
	Primary education	16 (26.2)	60 (28.7)	0.88 (0.44–2.12)	0.26 (0.11–5.3)
	Secondary education	12 (19.7)	45 (21.5)	0.88 (0.36–2.48)	0.12 (0.14–3.83)
	Higher education	14 (23.0)	46 (22.0)	1.0	
Perception	Effective	38 (62.3)	80 (38.3)	2.66 (2.21–7.04) ^a	2.20 (4.99–9.86) ^a
	Not effective	23 (37.7)	129 (61.7)	1.0	
Marital status	Married	56 (91.8)	191 (91.4)	1.06 (1.66–3.76) ^a	0.63 (0.26–1.51)
	Not married	5 (8.2)	18 (8.6)	1.0	
Stage of pregnancy	1st trimester	31 (50.8)	63 (30.1)	3.76 (1.45–13.79) ^a	2.56 (1.16–9.36) ^a
	2nd trimester	19 (31.2)	62 (29.7)	2.34 (1.63–5.78) ^a	2.60 (1.54–18.21) ^a
	3rd trimester	11 (18.0)	84 (40.2)	1.0	
Gravidity	Primigravida	26 (42.6)	78 (37.3)	1.25 (1.84–4.52) ^a	0.67 (0.14–7.29)
	Multi-gravida	35 (57.4)	131 (62.7)	1.0	
Distance from HF	≥5 km	36 (59.0)	84 (40.2)	2.14 (1.41–3.85) ^a	2.90 (1.52–12.65) ^a
	<5 km	25 (41.0)	125 (59.8)	1.0	
Previous HM use	Yes	40 (65.6)	119 (56.9)	1.44 (1.26–8.43) ^a	3.23 (2.74–7.56) ^a
	No	21 (34.4)	90 (43.1)	1.0	

^a P-value statistically significant (<0.05); HM herbal medicine; HF health facility.

products during pregnancy (OR 2.14; 95% CI 1.41–3.85). In a multi-variant logistic regression analysis, mothers who perceived the use of herbal medicines as effective were two times more likely to use herbal products than those whose perception of herbal medicines was not effective during pregnancy (AOR 2.20; 95% CI 4.99–9.86). The other bivariate and multivariate logistic regression analyses with the use of herbal medicines among pregnant mothers are summarized in [Table 6](#).

4. Discussion

In the current study, the prevalence of herbal medicine use among pregnant mothers who attended ANC visits was 22.6%. This is similar to a previous study done in Norway, in which 22.5% of pregnant mothers used herbal medicine [28]. However, the prevalence of herbal medicine use among pregnant mothers in this study was lower than in the study conducted in the Gondar referral and teaching hospital, which revealed that the prevalence of herbal medicine use was 48.6% [12]. In 2018, 70% of pregnant mothers took herbs, and in 2022, 71.80% of pregnant women consumed herbs, according to a study conducted in Bangladesh [9,29]. A similar study conducted in Uganda also suggested that 70.4% of pregnant women used herbs during their most recent pregnancy, which is higher than this study's [30]. This variation in the prevalence of herbal medicine use could emanate from the differences in socio-cultural contexts, methodologies, disease distribution, study settings, and access.

The result of this study showed that the common cold and nausea/vomiting were the top two indications for which pregnant mothers use herbal medicines. This is consistent with a study conducted in Harar town's public hospital [13] and Jimma University Specialized Hospital [31] in which common cold and nausea/vomiting were among the most common indications for which pregnant women used herbal medicines. Likewise, a study conducted at selected hospitals in Jos, Nigeria, also revealed that headache and the common cold were among the common indications for which the pregnant mothers used herbal medicines, which supported our findings [32]. Due to dynamic physiological changes, most pregnant women are affected by nausea and vomiting, a common cold, headaches, and/or other minor disease conditions. So consulting a clinician before the herbal medicine use is important for pregnant mothers and their unborn children.

This finding also revealed that damakase (*Ocimum lamiifolium*), tenaadam (*Rutachalepensis*), and ginger (*Zingiber officinale*) were the top three herbs used by pregnant mothers. This is concordant with the studies done in Harar Hospital [13] and Hossan Town [27] in Ethiopia. The result of this study is also in line with the studies conducted in Bangladesh [9,29]. A similar study in Alexandria [33] found that ginger was the most commonly used herb, but in Virginia [34] peppermint was the most commonly used herb in pregnant women. As a result, there was no consistency in the most frequently used herb types in different regions. This might be due to the difference in geographic distribution and accessibility in different regions. Of these herbs, ginger (*Zingiber officinale*) was the most studied one. Different studies on ginger showed that it is safe and has no harmful effects on pregnant women or the fetus [22,35]. The safety issue for the other herbs used by pregnant mothers in this research still needs further study.

This study showed that more than half of the study participants (62.3%) who used herbal medicines during pregnancy perceived that herbal medicines were effective. This was lower than the study conducted in Malaysia, in which 81.5% of pregnant mothers perceived herbal medicines used during pregnancy were effective [36]. Similarly, a study conducted in South Africa [20] revealed that 90.0% of pregnant mothers perceived that herbal medicines were effective in treating ailments during pregnancy. This might be due to the variation in the level of education and awareness of the respondents in the different study settings. The odds of pregnant women who thought herbal medicine was effective were 2.2 times higher than those who thought it was ineffective. This is concordant with previous findings in Nairobi, Kenya [37]. Furthermore, most pregnant women can visit a health facility one or more times during their pregnancy, and healthcare professionals should take advantage of this opportunity to educate pregnant women about the various flaws and side effects of herbal medicines.

In our study, there were comparable numbers of pregnant mothers from rural (53.7%) and urban (47.3%) settings attending ANC. Moreover, the use of herbal medicine in rural settings during pregnancy was 3.66 times higher as compared to urban settings (AOR 3.66; 95% CI 1.83–4.74). This finding was concordant with another study conducted in Nigeria [38]. This might be due to the low educational status, low income, lack of sufficient health facilities, and relatively poor awareness about the risk of herbal medicine use among pregnant women in rural areas as compared to pregnant women in urban areas.

Similarly, mothers who lived more than 5 km from the nearest health institution during pregnancy were more likely to be herbal medicated than those who lived less than 5 km from the nearest health institution. This finding was supported by a previous study conducted in Nairobi, Kenya [37]. This could be because the distance between health institutions increases the cost of transportation and the time required to access health services. Being too far away from healthcare facilities makes it difficult for pregnant women to receive conventional care. As a result, herbal product use has been an alternative to their illness during pregnancy.

The result of this study showed a statistically significant association between previous herbal medicine use and current herbal medicine use ($P < 0.05$) in multivariate logistic regression analysis. This is consistent with other studies conducted at the public hospitals of Harar Town [13] and in the Democratic Republic of the Congo [31]. This could be because previous herbal medicine users had more experience than those who hadn't used herbal medicine before.

Our finding revealed that pregnant mothers who were in the first and second trimesters consumed more herbal medicine as compared to their third-trimester counterparts. This result is in line with the study done in Nigeria [23]. This might be due to the mothers in the first and second trimesters being concerned for fetal safety since the first and second trimesters are very critical periods for fetal organogenesis and maturation [39]. Additionally, mothers in the third trimester assumed that the fetus was already developed and herbal medicine had no role, but in the first and second trimesters, mothers assumed herbal products were important for the fetus' development and growth. However, this result differs from another study done in Sierra Leone, which found the highest rate of herbal medicine use was in the third trimester [40]. The discrepancy could be due to the difference in the social, cultural, and traditional

perspectives of the different study areas.

4.1. Strength and limitations

The 99% response rate is its strength. The study was conducted only among pregnant mothers who attended ANC, which might affect its generalizability. In addition, the impact of seasonal variation on the use of herbal medicine was not considered since the study was cross-sectional. As far as the data collectors are concerned, information bias might also be a problem.

5. Conclusions

In this study, nearly one-fourth of pregnant mothers who had ANC follow-up used herbal medicines. Pregnant women who lived in rural areas and were 5 km from the hospital were heavily reliant on herbal medicine. Pregnant mothers in the first and second trimesters consume more herbs. The most commonly used herbal medicines during pregnancy in this study were damakase, tenaadam, ginger, flaxseed, and eucalyptus. Moreover, more than half of the common indications to use herbal medicine were nausea or vomiting and common cold. Based on these findings, the safety and efficacy of the most commonly used herbal products for the future well-being of pregnant women and fetuses should be investigated. In addition, the direct relationship between herbal medicine use and pregnancy outcomes should be further investigated. Policymakers should also use this finding to set standardized herbal medicine use policies and guidelines for pregnant mothers.

Author contribution statement

Girmaw F: Conceived and designed the experiments; Wrote the paper.
 Girmaw F, Ashagrie G: Performed the experiments; Analyzed and interpreted the data.
 Baye T, Kassaw AT: Contributed reagents, materials, analysis tools or data.

Data availability statement

Data will be made available on request.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

We would like to thank data collectors, staff of WGCSH, Woldia University pharmacy staff, and study participants for their willingness to participate in our study.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.heliyon.2023.e18408>.

References

- [1] A.R. Abduelkarem, H. Mustafa, Use of over-the-counter medication among pregnant women in Sharjah, United Arab Emirates, *J. Pregnancy* (2017) 2017.
- [2] World Health Organization, *Global Report on Traditional and Complementary Medicine*, World Health Organization, Geneva, 2019.
- [3] S.M. Illamola, O.U. Amaeze, L.V. Krepkova, A.K. Birnbaum, A. Karanam, K.M. Job, V.V. Bortnikova, C.M. Sherwin, E.Y. Enioutina, Use of herbal medicine by pregnant women: what physicians need to know, *Front. Pharmacol.* 10 (2020) 1483.
- [4] World Health Organization, *Traditional, Complimentary and Integrative Medicine*, 2020.
- [5] M.M.L. El-Kashif, S.E. El-tahry, An assessment of the factors influencing the use of over-the-counter medication during the second trimester of pregnancy, *Egypt Int. J. Nurs. Sci.* 8 (6) (2018) 99–107.
- [6] World Health Organization, *General Guidelines for Methodologies on Research and Evaluation of Traditional Medicine*, World Health Organization, 2000.
- [7] World Health Organization, *General Guidelines for Methodologies on Research and Evaluation of Traditional Medicine*, 2017.
- [8] D.A. Kennedy, A. Lupattelli, G. Koren, H. Nordeng, Herbal medicine use in pregnancy: results of a multinational study, *BMC Compl. Alternative Med.* 13 (1) (2013) 1.
- [9] M. Ahmed, J.H. Hwang, M.A. Hasan, D. Han, Herbal medicine use by pregnant women in Bangladesh: a cross-sectional study, *BMC Compl. Alternative Med.* 18 (1) (2018) 1–9.
- [10] S.M. Ahmed, H. Nordeng, J. Sundby, Y.A. Aragaw, H.J. de Boer, The use of medicinal plants by pregnant women in Africa: a systematic review, *J. Ethnopharmacol.* 224 (2018) 297–313.
- [11] H.G. Hall, D.L. Griffiths, L.G. McKenna, The use of complementary and alternative medicine by pregnant women: a literature review, *Midwifery* 27 (6) (2011) 817–824.

- [12] A.B. Mekuria, D.A. Erku, B.M. Gebresillassie, E.M. Birru, B. Tizazu, A. Ahmedin, Prevalence and associated factors of herbal medicine use among pregnant women on antenatal care follow-up at University of Gondar referral and teaching hospital, Ethiopia: a cross-sectional study, *BMC Compl. Alternative Med.* 17 (1) (2017) 1–7.
- [13] A. Jambo, G. Mengistu, M. Sisay, F. Amare, D. Edessa, Self-medication and contributing factors among pregnant women attending antenatal care at public hospitals of Harar town, Ethiopia, *Front. Pharmacol.* (2018) 1063.
- [14] J.M. Wilkinson, Effect of ginger tea on the fetal development of Sprague-Dawley rats, *Reprod. Toxicol.* 14 (6) (2000) 507–512.
- [15] J. Bercaw, B. Maheshwari, H. Sangi-Haghpeykar, The use during pregnancy of prescription, over-the-counter, and alternative medications among Hispanic women, *Birthright* 37 (3) (2010 Sep) 211–218.
- [16] J. Adams, Growing popularity of complementary and alternative medicine during pregnancy and implications for healthcare providers, *Expet Rev. Obstet. Gynecol.* 6 (4) (2011) 365–366.
- [17] D.L. Hepner, M. Harnett, S. Segal, W. Camann, A.M. Bader, L.C. Tsen, Herbal medicine use in parturients, *Anesth. Analg.* 94 (3) (2002) 690–693.
- [18] A. Vitalone, O. Ailkanjari, F. Durazzi, M. Guizzetti, V. Aleandri, The use of herbal products during pregnancy: which is the risk perception, *Am. J. Phytomed. Clin. Ther.* 9 (1) (2021).
- [19] M.C. Mothupi, Use of herbal medicine during pregnancy among women with access to public healthcare in Nairobi, Kenya: a cross-sectional survey, *BMC Compl. Alternative Med.* 14 (1) (2014) 1–8.
- [20] D.A. Forster, A. Denning, G. Wills, M. Bolger, E. McCarthy, Herbal medicine use during pregnancy in a group of Australian women, *BMC Pregnancy Childbirth* 6 (1) (2006) 1–9.
- [21] E. Ernst, Herbal medicinal products during pregnancy: are they safe? *BJOG An Int. J. Obstet. Gynaecol.* 109 (3) (2002) 227–235.
- [22] D.A. Kennedy, A. Lupattelli, G. Koren, H. Nordeng, Safety classification of herbal medicines used in pregnancy in a multinational study, *BMC Compl. Alternative Med.* 16 (1) (2016) 1–9.
- [23] United Nations Children's Fund (UNICEF), Maternal and Newborn Health Disparities Country Profiles, 2018.
- [24] S.M. Ahmed, J. Sundby, Y.A. Aragaw, et al., Self-Medication and safety profile of medicines used among pregnant women in a tertiary teaching hospital in Jimma, Ethiopia: a cross-sectional study, *Int. J. Environ. Res. Publ. Health* 17 (2020) 3993.
- [25] T.W. Brhanie, H. Sisay, Prevalence of iron deficiency anemia and determinants among pregnant women attending antenatal care at Woldia hospital, Ethiopia, *J. Nutr. Disord. Ther.* 6 (4) (2016) 2161, 0509.
- [26] F. Lapi, A. Vannacci, M. Moschini, F. Cipollini, M. Morsuillo, E. Gallo, G. Banchelli, E. Cecchi, M. Di Pirro, M.G. Giovannini, M.T. Cariglia, Use, attitudes and knowledge of complementary and alternative drugs (CADs) among pregnant women: a preliminary survey in Tuscany, *Evid. base Compl. Alternative Med.* 7 (4) (2010) 477–486.
- [27] T. Laelago, T. Yohannes, F. Lemango, Prevalence of herbal medicine use and associated factors among pregnant women attending antenatal care at public health facilities in Hossana Town, Southern Ethiopia: facility based cross sectional study, *Arch. Publ. Health* 74 (1) (2016) 1–8.
- [28] O.D. Nnaemeka, N.C. Phyllis, O.C. Chinaza, The use of herbal medicines in pregnancy: a cross-sectional analytic study, *IJSRDMS* 3 (2) (2021) 66–72.
- [29] S. Jahan, Z.M. Mozumder, D.K. Shill, Use of herbal medicines during pregnancy in a group of Bangladeshi women, *Heliyon* 8 (1) (2022), e08854.
- [30] L. Muteebwa, A. Ssetaala, D. Muramuzi, A. Nanvubya, Y. Mayanja, Factors Associated with Herbal Medicine Use in Pregnancy Among Postnatal Mothers in Mbarara Regional Referral Hospital in Western Uganda, 2022.
- [31] P.M. Mbarambara, P.B. Songa, L.M. Wansubi, P.M. Mututa, B.B. Minga, C.K. Bisangamo, Self-medication practice among pregnant women attending antenatal care at health centers in Bukavu, Eastern DR Congo, *Int. J. Innovat. Appl. Stud.* 16 (1) (2016) 38.
- [32] A. Emmanuel, G. Achema, B.B. Afoi, R. Maroof, Self-medication Practice Among Pregnant Women Attending Antenatal Clinic in Selected Hospitals in Jos, Nigeria, 2014.
- [33] Y.I. Orief, N.F. Farghaly, M.I. Ibrahim, Use of herbal medicines among pregnant women attending family health centers in Alexandria, *Middle East Fertil. Soc. J.* 19 (1) (2014) 42–50.
- [34] D.D. Glover, M. Amonkar, B.F. Rybeck, T.S. Tracy, Prescription, over-the-counter, and herbal medicine use in a rural, obstetric population, *Am. J. Obstet. Gynecol.* 188 (4) (2003) 1039–1045.
- [35] E. Viljoen, J. Visser, N. Koen, A. Musekiwa, A systematic review and meta-analysis of the effect and safety of ginger in the treatment of pregnancy-associated nausea and vomiting, *Nutr. J.* 13 (1) (2014) 1–4.
- [36] A.A. Rahman, S.A. Sulaiman, Z. Ahmad, W.N. Daud, A.M. Hamid, Prevalence and pattern of use of herbal medicines during pregnancy in Tumpat district, Kelantan, *Malays. J. Med. Sci.: MJMS* 15 (3) (2008) 40.
- [37] C.A. Varga, D.J. Veale, Isihlambezo: utilization patterns and potential health effects of pregnancy-related traditional herbal medicine, *Soc. Sci. Med.* 44 (7) (1997) 911–924.
- [38] T.O. Fakeye, R. Adisa, I.E. Musa, Attitude and use of herbal medicines among pregnant women in Nigeria, *BMC Compl. Alternative Med.* 9 (2009) 1–7.
- [39] F.G. Cunningham, N.F. Grant, K.J. Leveno, L.C. Gilstrap, J.C. Hauth, K.D. Wenstrom, *Williams Obstetrics, Fetal Growth, and Development*, McGraw-Hill, New York, 2005, pp. 54–57.
- [40] P.B. James, A.J. Bah, M.S. Tommy, J. Wardle, A. Steel, Herbal medicines use during pregnancy in Sierra Leone: an exploratory cross-sectional study, *Women Birth* 31 (5) (2018) e302–e309.