

BMJ Open

BMJ Open is committed to open peer review. As part of this commitment we make the peer review history of every article we publish publicly available.

When an article is published we post the peer reviewers' comments and the authors' responses online. We also post the versions of the paper that were used during peer review. These are the versions that the peer review comments apply to.

The versions of the paper that follow are the versions that were submitted during the peer review process. They are not the versions of record or the final published versions. They should not be cited or distributed as the published version of this manuscript.

BMJ Open is an open access journal and the full, final, typeset and author-corrected version of record of the manuscript is available on our site with no access controls, subscription charges or pay-per-view fees (<http://bmjopen.bmj.com>).

If you have any questions on BMJ Open's open peer review process please email info.bmjopen@bmj.com

BMJ Open

Medicinal plants used among pregnant women in a tertiary teaching hospital in Jimma, Ethiopia: a cross-sectional study

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2020-046495
Article Type:	Original research
Date Submitted by the Author:	03-Nov-2020
Complete List of Authors:	Ahmed, Seid Mussa; University of Oslo, Faculty of Medicine, Institute of Health and Society, Department of Community Medicine and Global Health; Jimma University, Institute of Health, Faculty of Health Sciences, School of Pharmacy, Division of Social and Administrative Pharmacy Sundby, Johanne; University of Oslo, Faculty of Medicine, Institute of Health and Society, Department of Community Medicine and Global Health Aragaw, Yesuf; Jimma University, Institute of Health, Faculty of Medical Sciences, Department of Obstetrics and Gynaecology Nordeng, Hedvig; University of Oslo Faculty of Mathematics and Natural Sciences, Department of Pharmacy, Pharmacoepidemiology and Drug Safety Research Group
Keywords:	COMPLEMENTARY MEDICINE, Maternal medicine < OBSTETRICS, Adverse events < THERAPEUTICS, PRIMARY CARE, PUBLIC HEALTH

SCHOLARONE™
Manuscripts



I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our [licence](#).

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which [Creative Commons](#) licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

1
2
3 1 **Medicinal plants used among pregnant women in a tertiary teaching hospital in Jimma,**
4
5 2
6 **Ethiopia: a cross-sectional study**
7
8 3
9

10 4 Seid Mussa Ahmed ^{1,2*}, Johanne Sundby ¹, Yesuf Ahmed Aragaw ³, Hedvig Nordeng ⁴

11
12 5 ¹Department of Community Medicine and Global Health, Institute of Health and Society,
13
14 6 Faculty of Medicine, University of Oslo, Norway;

15
16
17 7 ²Division of Social and Administrative Pharmacy, School of Pharmacy, Faculty of Health
18
19 8 Sciences, Institute of Health, Jimma University, Ethiopia;

20
21 9 ³Department of Obstetrics and Gynaecology, Faculty of Medical Sciences, Institute of Health,
22
23 10 Jimma University, Ethiopia;

24
25
26 11 ⁴Pharmacoepidemiology and Drug Safety Research Group, Department of Pharmacy, Faculty
27
28 12 of Mathematics and Natural Sciences, University of Oslo, Norway
29
30

31
32
33
34 14 * Corresponding author

35
36 15 E-mail: seidma@studmed.uio.no

37
38 16 Postal address: P.O box 1130, Blindern, 0318 OSLO, Norway

39
40 17 Fax number: +47-22850590

41
42 18 Telephone (Office): +47-22850688

43
44 19 16-digit ORCID: 0000-0003-3426-5296

45
46
47 20 E-mail addresses:

48
49 21 SMA: seidma@studmed.uio.no

50
51 22 HN: h.m.e.nordeng@farmasi.uio.no

52
53 23 JS: johanne.sundby@medisin.uio.no

54
55 24 YAA: yesufahmed47@yahoo.com

56
57 25 **Word count: 4030**
58
59
60

1
2
3 **26 Abstract**
4

5 **27 Objective** The aim of this study was to investigate and describe the use of medicinal plants
6
7 during pregnancy among women admitted in the Maternity and Gynaecology wards at Jimma
8
9 University Medical Centre (JUMC) in the southwest Ethiopia.
10

11
12 **30 Design** Cross-sectional study
13

14
15 **31 Setting** Maternity and Gynaecology wards at JUMC.
16

17 **32 Participants** 1,117 hospitalized pregnant women or postpartum women
18

19 **33 Main outcome measures** our primary outcomes of interest were the prevalence of use, types
20
21 of medicinal plants used and their utilization among pregnant women.
22

23
24 **35 Methods:** Data were collected through structured face-to-face interviews of pregnant women
25
26 or postpartum women and review of patient medical records between February and June 2017.
27

28
29 **37 Results:** Overall, 28.6% of the women reported use of at least one medicinal plant during
30
31 pregnancy. Twenty-seven different types of medicinal plants were used. The most commonly
32
33 used medicinal plants were *Linum usitatissimum* L. (flaxseed– use with caution) 22.0%,
34
35 *Ocimum lamiifolium* L. (*damakessie*– safety unknown) 3.6%, and *Carica papaya* L. (papaya–
36
37 use with caution) 3.1%. The most common reasons for use was preparation, induction or
38
39 shortening of labour. Lack of access to health facility (mainly health posts), admission to
40
41 maternity ward, *khat* chewing, and alcohol consumption were the strongest predictors of
42
43 medicinal plants use during pregnancy (OR >2). Only five medicinal plants used by women
44
45 had sufficient evidence to be classified as safe to use in pregnancy.
46
47

48
49 **46 Conclusions:** Almost a third of women at the tertiary hospital in Ethiopia reported use of
50
51 medicinal plants during pregnancy, most frequently to prepare, induce, reduce the intensity or
52
53 shorten duration of labour. Increased awareness about potential benefits or risks of medicinal
54
55 plants use during pregnancy among health care professionals and patients, and increased access
56
57
58
59
60

1
2
3 50 to childbirth providing health care facilities are important in order to promote safer pregnancies
4
5 51 and better health outcomes for women and their unborn children.
6
7
8 52
9
10 53

11 54 **Strengths and limitations of this study**

- 13 55 • It was the first study in Ethiopia that used large sample size, assessed the use of
14 56 medicinal plants among pregnant women in an in-patient setting and attempted to
15 57 classify the medicinal plants
- 18 58 • Face to face interviews permitted the women to ask clarifying questions and ensured
19 59 completeness and comprehension.
- 22 60 • Although it was conducted in a large tertiary teaching hospital in southwest Ethiopia,
23 61 it may not be representative of the entire country, nor women who access healthcare
24 62 in secondary or primary care.
- 25 63 • Data were collected based on self-report of pregnant women and thus depended on
26 64 her recall and accuracy of reporting, as well as her knowledge about these medicinal
27 65 plants, therefore, medicinal plant use early in pregnancy was probably underreported.
- 28 66 • Among the post-partum women, there may be a risk of recall bias as women with
29 67 negative pregnancy outcomes may try to recall use to a greater extent than women
30 68 with a healthy infant.
31 69

71 **Background**

72 Medicinal plants have been used for preventive and therapeutic purposes since time
73 immemorial [1]. Medicinal plants refer to a variety of plants that have medicinal characteristics
74 [2]. The World Health Organization estimates that 65–80% of the world's population in
75 developing countries depend on medicinal plants for primary healthcare [3]. Women are
76 recognized to be the main users of medicinal plants, and this widespread use also extends into
77 pregnancy [4, 5].

78
79 Ethiopia is a landlocked country with a population of approximately 110 million [6]. Around
80 80% of the population in Ethiopia use traditional medicine, of which over 95% are of plant
81 origin [7]. The extensive use of medicinal plants in the country is often linked to an array of
82 unique flora [7], cultural acceptability of healers and local pharmacopoeias, the belief that
83 medicinal plants are natural and thus safer to use and are physically accessible and
84 economically affordable [4, 5, 8].

85
86 Maternal mortality (353 deaths per 1000,000 live births) and neonatal mortality (28 deaths per
87 1,000 live births) in Ethiopia are among the highest in the world [9]. In most African countries
88 like Ethiopia, modern health care facilities and medicine are inaccessible or unaffordable [4,
89 10]. For this reason, many women rely on medicinal plants for their primary healthcare needs
90 as an accessible and lower cost alternative [4] and only seek professional health services when
91 the situation worsens [10].

92
93 Studies conducted in Ethiopia reported prevalence of medicinal plants use in pregnancy
94 ranging from 2% to 73% [4], with ginger being the most commonly used plant, and nausea and
95 vomiting in pregnancy (NVP) and common cold the most common reasons for use [8, 10, 11].

1
2
3 96 Many sociodemographic characteristics including residence place, marital status, family size,
4
5 97 education level, age, and employment status were found to be strong predictors of use [4, 11-
6
7 98 14]. Prevalence figures ranging from 4% to 100% were reported in other African countries [4].
9
10 99 Studies in developed countries where medicinal plant traditions may play a less strong role also
11
12 100 reported a widespread use of medicinal plants in pregnancy, with Australia 11% - 56% [15],
13
14 101 the US and Canada 4% - 96% [15, 16], and Europe 0.9% - 69% [15, 17].
16
17 102

18
19 103 Concerns have been raised about safety of medicinal plants during pregnancy [4, 17-20]. A
20
21 104 recent multinational study reported that only 22% of the medicinal plants used by pregnant
22
23 105 women were found safe to use in pregnancy [20]. Similarly, a study from Asia showed that
24
25 106 only 39% of the most commonly used medicinal plants by expectant women were safe to use
26
27 107 in pregnancy [18].
28
29 108

30
31 109 Although medicinal plants play a significant role in traditional medicine during pregnancy,
32
33 110 childbirth and postpartum care [4, 19], research on their use in the management of pregnancy
34
35 111 related illnesses is still largely limited [4, 11, 21]. The aims of this study were therefore to
36
37 112 determine the prevalence of use and types of medicinal plants used among pregnant women
38
39 113 admitted in the Maternity and Gynaecology wards at Jimma University Medical Centre
40
41 114 (JUMC), Southwest Ethiopia. This included identifying women's information on the most
42
43 115 commonly used medicinal plants, the reasons for use, and factors associated with such use. The
44
45 116 secondary aims were to assess women safety concerns and, who recommended use of the
46
47 117 medicinal plants during pregnancy.
48
49 118

56 119 **Subjects and methods**

58 120 **Study design and setting**

1
2
3 121 A hospital based cross-sectional study was conducted in the Maternity and Gynaecology wards
4
5 122 at Jimma University Medical Centre (JUMC). JUMC is one of the oldest and largest public
6
7 123 teaching University hospitals in the country located in Jimma city, 350 kilometres south-west
8
9 124 of Addis Ababa (the capital city of Ethiopia) [22, 23]. The referral hospital provides tertiary
10
11 125 level medical care for about 20 million people coming from the whole south-west Ethiopia
12
13 126 [22]. Obstetrics and Gynaecology department of the medical centre has a patient load of
14
15 127 approximately 7,600 inpatients and 11,600 outpatients each year with bed capacity of around
16
17 128 265 [23].
18
19
20
21
22
23

24 130 Obstetrics and Gynaecology department has two inpatient wards; Gynaecology ward and
25
26 131 Maternity ward (which includes maternity, labor and delivery ward and maternity operation
27
28 132 theatre) [22]. Obstetric patients with 28 weeks of pregnancy or higher as well as women in
29
30 133 labour are admitted in the maternity ward. On the one hand, women with a gestational length
31
32 134 of less than 28 weeks are cared for at the gynaecology ward. The gynaecology ward also
33
34 135 manages and treats gynaecological disorders in non-pregnant women.
35
36
37
38
39
40

41 137 **Study population and sample size**

42
43 138 Hospitalized pregnant or postpartum women in the Maternity and Gynaecology wards at JUMC
44
45 139 were invited to participate in the study during normal working hours. Participants were
46
47 140 informed about the aim and procedures of the study and written informed consent was obtained
48
49 141 from each study participant, using a random, but convenience sample. Pregnant or postpartum
50
51 142 patients aged ≥ 18 years admitted in the Maternity/Labour and Gynaecology wards at the time
52
53 143 of data collection and willing to participate were included in the study. On the other hand,
54
55 144 women who were too ill to participate, hard of hearing, unable to speak or mentally disabled,
56
57
58
59
60

1
2
3 145 under 18 years of age, admitted for less than four hours, and non-pregnant women admitted in
4
5 146 the gynaecology ward were excluded from the study.
6
7
8 147

9
10 148 Single population proportion Kish formula [24] was used to determine the sample size based
11
12 149 on the following assumptions; 50% expected prevalence medicinal plant use (since there is no
13
14 150 previous study conducted on the prevalence of medicinal plant use among hospitalized
15
16 151 pregnant patients prior to admission), 5% level significance, 80% power, and an error margin
17
18 152 of 3%. After adding a 5% non-response rate, a final sample size of 1,121 pregnant women was
19
20 153 required.
21
22
23

24 154

25

26 155 **Data collection and procedures**

27

28 156 Hospitalized pregnant and post-partum women were consecutively interviewed from February
29
30 157 to June 2017. A pre-tested interview guided structured questionnaire, based on interviews, and
31
32 158 data extraction form were used for data collection. All interviews were conducted by trained
33
34 159 data collectors, with close supervision of one of the investigators. The questionnaire contains
35
36 160 questions about the women's background, pregnancy-related illnesses, and use of medicinal
37
38 161 plants.
39
40
41
42 162

43
44 163 After a thorough review of the literature [8, 11, 17, 19, 21, 25-27], the survey questionnaire
45
46 164 was developed in English and then translated into Amharic and Afan Oromo languages (the
47
48 165 predominant local languages) to suit the target population. The questionnaires were translated
49
50 166 back into English by other persons to confirm the validity. Lecturers fluent in English and their
51
52 167 own local language from Jimma University with previous experience of translating
53
54 168 questionnaires performed the translation and back translation of the study questionnaire. The
55
56 169 data collection tool was then pilot tested on a sample of 30 participants at *Shenen Ghibe* district
57
58
59
60

1
2
3 170 hospital found in Jimma city, and based on the pre-test results, list of 25 commonly used
4
5 171 medicinal plants and open-ended questions were included. Plant scientific names were verified
6
7
8 172 with The Plant List (www.theplantlist.org). Final version of the questionnaire contained 63
9
10 173 items, with multiple choice, and open-ended questions (Supplementary table 1).

11
12 174

13
14 175 Treatment related characteristics, pregnancy characteristics, pregnancy outcomes and other
15
16 176 medical information were retrieved from patients' medical record using data extraction forms.
17
18 177 Following the pre-test, the data extraction form required minor revisions to improve
19
20 178 understandability and order (Supplementary table 2).

21
22 179

23 24 25 26 180 **Measures**

27 28 181 *Women's background characteristics*

29
30 182 Socio-demographic information including age, religion, residence place, occupation, family
31
32 183 size, ethnic group, marital status, educational level, access to modern health facility and
33
34 184 walking distance to the facility were collected.

35
36 185

37 38 186 *Maternal diseases, pregnancy-related illness and treatments*

39
40 187 Detailed information about the woman's obstetrics and gynaecology history, history of adverse
41
42 188 pregnancy outcome, past medical history and medication experience, and social drug use were
43
44 189 included. Pregnant women were specifically asked about 24 common pregnancy ailments and
45
46 190 related symptoms: Common cold/flu, pain in back, neck, or shoulder, headache,
47
48 191 heartburn/reflux problems, abdominal cramps/ache, preparation for labour, induction of labour,
49
50 192 expel retained placenta, postpartum bathing, wellbeing and nourishing foetus, leg/foot swelling,
51
52 193 gestational hypertension, gestational diabetes, gastritis/burning sensation, constipation, general
53
54 194 wellbeing, nausea, vomiting, emergency illnesses, urinary tract infection, depression, joint pain,
55
56
57
58
59
60

1
2
3 195 sleeping problems and mental wellbeing. Participants were also asked whether they had used
4
5 196 any treatment against ailments or pregnancy related conditions, whether they had had any other
6
7 197 diseases or illnesses, and, if yes, the name of any treatment received.
8
9

10 198

11 199 *Use of medicinal plant*

12 200 Study participants were specifically asked about the use in pregnancy of 25 commonly used
13
14 201 medicinal plants: *Linum usitatissimum* L., *Ocimum lamiifolium* L., *Zingiber officinale* Roscoe.,
15
16 202 *Allium sativum* L., *Trigonella foenum-graecum* L., *Nigella sativa* L., *Ruta chalepensis* L.,
17
18 203 *Eucalyptus globulus* Labill., *Cinnamomum verum* J.Presl, *Taverniera abyssinica* A. Rich,
19
20 204 *Artemisia abyssinica* Sch.Bip. ex A.Rich., *Croton macrostachyus* Hochst., *Echinops kebericho*
21
22 205 Mesfin, *Hagenia abyssinica* (Bruce ex Steud.) J.F.Gmel., *Vernonia amygdalina* Del., *Brassica*
23
24 206 *nigra* (L.) K.Koch, *Zehneria scabra* Sond., *Artemisia afra* Jacq. ex Willd., *Lepidium sativum*
25
26 207 L., *Carica papaya* L., *Foeniculum vulgare* Mill., *Coriandrum sativum* L., *Ocimum basilicum*
27
28 208 L., *Datura stramonium* L., and *Securidaca longipedunculata* Fresen. The above listed
29
30 209 medicinal plants were selected based on previous ethnopharmacological studies in Ethiopia
31
32 210 and elsewhere in Africa [8, 11, 28, 29] and were presented to the women by mentioning the
33
34 211 local names of the plants. The women were also asked if they had used any other medicinal
35
36 212 plant during pregnancy, labour or breastfeeding.
37
38
39
40
41
42
43
44

45 213

46 214 Details of use of medicinal plants was assessed by a series of questions including use of
47
48 215 medicinal plant during pregnancy, type of medicinal plant used, reason for use, and utilization
49
50 216 (*part of plant used, method of preparation, mode of use, type of solvent, type of flavouring,*
51
52 217 *dosage form, dosage, measures of formulation, route of administration, frequency of*
53
54 218 *administration, duration of treatment, and episodes of use*). Women were also asked about who
55
56 219 recommended them the use of medicinal plants in pregnancy.
57
58
59
60

220

Information about women's safety concerns and experiences with use of medicinal plants in pregnancy was collected, and we included questions about beliefs about harmfulness, precautions to be taken and whether she had experienced any side effects or adverse effects after use of medicinal plants in pregnancy.

225

Reference text books [30-32] and literature reviews [4, 18, 20] were used to evaluate safety of the medicinal plants in pregnancy, and classify them into four safety categories, namely safe to use in pregnancy, use with caution, potentially harmful and information unavailable for use in pregnancy. Information from animal studies were used if human studies were lacking. If a medicinal plant preparation was composed of two or more plants, each plant was individually evaluated and classified.

232

In addition to the face-to-face interview questionnaire, information about pregnancy characteristics, pregnancy outcomes and other obstetrics information including gestational age, parity, gravidity, mode of delivery and length of hospital stay were collected using a data extraction form. Moreover, maternal and perinatal outcomes of the current pregnancy were collected. Data were extracted through review of patients' medical cards.

238

239 **Statistical analysis**

The final data were checked for completeness, and responses were entered into and analysed using the Statistical Package for the Social Sciences (SPSS) software version 25.0 for Windows (IBM® SPSS® Statistics, Armonk). Respondents were categorized as users if they used at least one type of medicinal plant in their index pregnancy, whereas others were categorized as non-users. Routine meals and vitamin supplements were excluded.

245
246 Descriptive statistics were used to calculate the prevalence (%) of medicinal plants use in
247 pregnancy, reasons for use and information sources. Univariate and multivariate logistic
248 regression analysis was used to identify significant factors associated with medicinal plant use.
249 Logistic regression was expressed as crude and adjusted odds ratios (ORs) with 95%
250 confidence intervals (CIs). First, the univariate logistic regression model was fit for all
251 explanatory variables. From this, the multivariate model was built using purposeful selection
252 of candidate variables based on a bivariate $p \leq 0.05$. We then fit a reduced model by removing
253 variables having no role ($p > 0.05$). A p-value of < 0.05 was considered statistically significant.

254

255 **Patient and public involvement**

256 Although there is a community representative in the Jimma University Institute of health
257 Institutional Review Board (IRB), no patients or public were involved in the conception,
258 design, conduct, and planning of this study.

259

260 **Results**

261 From 1,137 pregnant or post-partum women invited to participate, responses from four were
262 incomplete, and 16 declined to participate in the study resulting in 1,117 participants in the
263 final dataset (response rate 98.6%). The median age was 25 years (interquartile range 22–30
264 years) and slightly more than half (53.3%), lived in an urban area. The majority were married
265 (95.5%), had access to health facility (mainly health post) (99.1%), and lived in an area within
266 walking distance to the nearest health facility not more than 30 minutes (66.4%). A substantial
267 number were Muslims (65.4%), from Oromo ethnic group (69.7%), and had a household size
268 less than five (65.4%). Many study participants were illiterate (34.0%) or either attended

269 primary school or only able to read & write (42.3%); and were housewife (46.9%) or farmer
270 (23.4%) by occupation (Table 1).

271

272 **Table 1.** Characteristics of women according to medicinal plant use during pregnancy at
273 JUMC, Ethiopia.

274

275 Nearly three out of ten women had used one or more medicinal plant during their current
276 pregnancy (28.6%), with an average of 1.5 medicinal plants per woman (range 1 to 8). The
277 majority of women 206 (64.6%) used one, 78 (24.5%) took two, 25 (7.8%) took three, and 7
278 (2.2%) took four types of medicinal plants.

279 *L. usitatissimum* (flaxseed) (77.1%), *O. lamiifolium* ('damakesie') (12.5%) and *C.*
280 *papaya* (*papaya*) (11.0%) were the three most commonly used medicinal plants (Table 2;
281 Supplementary table 3A). The most common reasons for the use of medicinal plants were to
282 induce labour or to reduce the intensity and shorten duration of labour (women call it
283 "reduction of labour" - "ምጥ ለማምጣት ወይም የምጥ ጥንካሬንና እርዝማኔን ለመቀነስ" in Amharic)
284 (60.2%) common cold/flu (20.4%) and preparation of labour (women call 'it softens the uterus'
285 - "ማህጸን ያለሰልሳል ፣ ስለዚህ ምጥ አይከብድም" in Amharic) (15.7%), (Table 3). Flaxseed was the
286 major plant employed to induce labour or to reduce the intensity and shorten duration of labour
287 (93.2%) and to prepare for labour (44%). Ginger (35.4%) was the commonly used plant for
288 common cold/flu management. Most of the medicinal plants were used during labour (32.2%)
289 followed by third trimester (27.2%) or in the entire pregnancy (19.8%). Approximately three
290 quarters of the medicinal plants were purchased at market places (76.5%). A significant
291 proportion of respondents (68.3%) also collected it through family members. The large
292 majority of women were recommended to use medicinal plants by their family members
293 (75.2%).

1
2
3 2944
5 **Table 2.** Pregnancy disorders treated with medicinal plants at JUMC, Ethiopia, n=319.
6
7

8 296

9
10 297 Seeds were the major medicinal plant parts used (57.6%), dry plant material was the
11
12 298 most common plant condition (60.1%), sugar was the most common excipient (27.8%) and
13
14
15 299 oral was the predominant route of administration (89.7%).
1617
18 300 The most common dosages were measurements by water glass units (51.7%). The most
19
20 301 common dosage was one water glass dose (47.5%), once per day frequency (54.8%), and “as
21
22 302 many months as needed during pregnancy” duration of treatment (32.9%). Approximately half
23
24 303 of the respondents reported one episode of medicinal plant use (46.0%), whereas nearly one-
25
26 304 third reported use at several occasions during pregnancy 155 (32.0%) (Supplementary table 4).
27
28

29 305

30
31 306 **Table 3.** Overview of the most frequently used medicinal plants during pregnancy at JUMC,
32
33
34 307 Ethiopia.
35

36 308

37
38 309 **Factors associated with medicinal plant use**
3940
41 310 Women in the maternity wards, not having access to a nearby health facility, having
42
43 311 secondary school education, having chronic illness, using conventional medicines and social
44
45 312 drugs (*khat* chewers and alcohol consumers) were more likely to use medicinal plants in
46
47 313 pregnancy (Table 1). Use of medicinal plants during pregnancy was not significantly associated
48
49 314 with previous adverse pregnancy outcome, length of hospital stay, family size and gestational
50
51 315 age.
52
53

54 316

55
56 317 **Safety classification of the medicinal plants**
57
58
59
60

1
2
3 318 From the 27 medicinal plants used by women, five were classified as safe to use, three as
4
5 319 requiring caution to use, eight as potentially harmful to use in pregnancy and information on
6
7
8 320 eleven medicinal plants was not available in the current literature (Supplementary table 3B).
9

321

322 **Women's safety concerns and experiences**

323 Table 4 presents women's self-reported safety concerns and experiences with medicinal plants
324 in pregnancy. Safety concerns with use in pregnancy was most commonly reported for *bisana*
325 (*C. macrostachyus*) and *etse fares* (*D. stramonium*), each by five women. Four women
326 reported drinking milk as antidote (“ጣርከሻ” in Amharic) against adverse effects from *Z.*
327 *officinale*, *T. abyssinica*, *H. abyssinica*, and *C. verum*. Two women reported ingestion of *P.*
328 *anisum* soup/suspension as countermeasure for poisoning from *Z. officinale* and *C. verum*.
329 Eight women used *L. usitatissimum* for wellbeing and nourishing of the foetus. One woman
330 reported the use of *O. lamiifolium* to improve foetal movements and breathing. *O. lamiifolium*,
331 *Z. officinale*, and *A. sativum* were also reported to be useful for general foetal wellbeing. Fear
332 of complications to the foetus (44.5%) and religious prohibition (25.9%) were the common
333 reasons for avoiding use of medicinal plants during pregnancy.

334

335 **Table 4.** Pregnant women's self-reported safety concerns and experiences with medicinal
336 plants at JUMC, Ethiopia

337

338 **Discussion**

339 Knowledge; both lay and professional, about medicinal plants use in pregnancy is essential to
340 provide optimal maternal/foetal care. To the best of our knowledge, this paper is the first to
341 study medicinal plant use during pregnancy among women in hospitalised setting in Ethiopia.
342 This study provides extensive insight into types of medicinal plants, prevalence of use and

1
2
3 343 reasons for use, as well as women's safety concerns and precautions on the medicinal plants
4
5 344 they use in pregnancy. These findings are important to health care personnel, researchers,
6
7 345 policy makers, and pregnant women themselves. Nearly a third of women (28.6%) reported
8
9 346 use of at least one medicinal plant during pregnancy or at childbirth. Prior studies report
10
11 347 prevalence of use of medicinal plants in pregnancy ranging from 0.9% to 96.0% [4, 15].
12
13 348 Variation in prevalence may be explained by several factors including differences in study
14
15 349 populations and settings as well as data collection methods and definitions of medicinal plants.
16
17 350 In some studies, all forms of herbal meal preparations and nutritional supplements were
18
19 351 counted [4] whereas in others, like our study, a more restrictive definition of medicinal plant
20
21 352 use was used. In addition, differences in traditional practices, cultures and beliefs about health,
22
23 353 may contribute to important difference in prevalence of use of medicinal plants.
24
25
26
27
28
29
30

31 354
32
33 355 The most frequently used medicinal plants during pregnancy were flaxseed (use with caution),
34
35 356 *damakessie* (safety unknown) and papaya (use with caution, it is considered potentially unsafe
36
37 357 in large amounts only) (Table 3, Supplementary table 3A). Our finding is inconsistent with
38
39 358 previous studies reported in Africa in which *Z. officinale*, *A. sativum* and *C. pepo* were the
40
41 359 commonly used plants [4]. The pattern of medicinal plant use is also divergent from latest
42
43 360 findings from Ethiopia [12, 13]. This may be due to the fact that unlike previous studies, most
44
45 361 participants in our study were women in their final stage of pregnancy and might most probably
46
47 362 recall the medicinal plants they took in relation to childbirth to a better extent than plants used
48
49 363 earlier in pregnancy. This difference in pattern of use from other corners of Ethiopia and
50
51 364 regions elsewhere may be due to difference in climate, geographical location (which will affect
52
53 365 the types of plants commonly grow in that area) and/or disease prevalence.
54
55
56
57
58
59
60

1
2
3 367 Flaxseed is by far the most commonly used medicinal plant, mainly used for induction,
4
5 368 reduction, quickening or preparation for labour (Table 3). A recent study from Ethiopia had
6
7 369 also found similar reason for its use [14]. In other African countries, however, seed oil from *R.*
8
9 370 *communis* was the most frequently used medicinal plant product to stimulate labour [4]. The
10
11 371 most probable reasons for the disparity in the type of medicinal plant used for labour induction
12
13 372 may be differences in geographical distribution of plants and cultural beliefs.
14
15 373

16
17 374 In line with previous studies [33, 34], women reported side effects and safety concerns related
18
19 375 to use of flaxseed in relation to labour (Table 4). A precautionous consumption of flaxseed is
20
21 376 recommended in pregnancy and lactation due to its side effects and adverse effects when
22
23 377 consumed in excessive quantity [34]. In remote rural areas in Ethiopia where access to health
24
25 378 facilities is limited, use of *L. usitatissimum* may be perceived as the best option to induce or
26
27 379 shorten labour.
28
29 380

30
31 381 *O. lamiifolium* was the second most used medicinal plant during pregnancy in our study. It was
32
33 382 mainly used for treatment of an illness called “*Mitch*” alone or with other medicinal plants
34
35 383 (Table 2). “*Mitch*” is a culturally common illness in Ethiopia and is a local name given to a
36
37 384 febrile illness characterized by headache, fever, rash, inflammation, joint pain, back pain,
38
39 385 chills, sweat, loss of appetite, *Herpes labialis*, muscle spasm and in severe cases, diarrhoea [1,
40
41 386 35]. “*Mitch*” develops when strong sunlight strikes a part of the body that is sweating or
42
43 387 unclean [36], and in general after engaging in tasks that expose one to strong smells, or smoke
44
45 388 [1, 37]. Our study found that “*Mitch*” also affects female reproductive organs when it is
46
47 389 exposed to excessive sunlight, which they refer it to as “*Yemahitsen Mitch*” (“gynaecologic
48
49 390 *mitch*”) (Table 2). In general our result agrees with the findings of Ethiopians at home [14]
50
51 391 and in diaspora [1] regarding “*Mitch*” and its treatment. Studies of the leaf extract of *O.*
52
53
54
55
56
57
58
59
60

1
2
3 392 *lamiifolium* have shown analgesic effects in mice [38] that support its traditional use against
4
5 393 *Mitch. O. lamiifolium* is considered relatively safe and has not demonstrated any sign of acute
6
7
8 394 toxicity up to the dose of 2000 mg/kg body weight in experimental mice [39].
9

10 395
11
12 396 *C. papaya* and *Z. officinale* were the third and the fourth commonly used plants respectively.
13
14 397 Several women in this study claimed that papaya softens their birth canal (“uterus”) making
15
16 398 them healthy and ready for childbirth (Table 3). Moreover, they claimed that consumption of
17
18 399 cold papaya would soothe their gastrointestinal tract relieving them from heartburn, gastritis
19
20 400 and cramps (Table 2). Animal studies suggest that unlike its abortifacient property at larger
21
22 401 dose, normal consumption of ripe papaya during pregnancy may not pose any developmental
23
24 402 toxicity and teratogenicity [40].
25
26
27
28
29 403

30 404 Although previous studies, also in Ethiopia, showed that pregnant women commonly use
31
32 405 ginger for treating NVP [1, 4, 5, 19, 28], our study found that it was mainly used for common
33
34 406 colds and flu in pregnancy. This could be due to the fact that previous studies involved mainly
35
36 407 women in their earlier stages of pregnancy in which NVP is common. Concerning safety,
37
38 408 evidences suggest that ginger did not have harmful maternal or neonatal effects [1, 4]. Its side
39
40 409 effects reported in our study were also similar with previous reports [1].
41
42
43
44
45 410

46
47 411 Several socio-demographic factors were associated with use of medicinal plants in pregnancy
48
49 412 (Table 1). We found that women who did not have access to health facility (incl. health posts)
50
51 413 were seven times more likely to use medicinal plants than their counterparts. This is in line
52
53 414 with other studies showing that in Africa people use traditional medicine when facilities are
54
55 415 either unavailable or unaffordable [4, 21]. Similarly, women admitted in maternity ward were
56
57 416 three-fold as likely to use medicinal plants as their counterparts. Most women in the maternity
58
59
60

1
2
3 417 ward were in their final stage of pregnancy and might be using more medicinal plants for
4
5 418 childbirth than those admitted in gynaecology ward in which hyperemesis and abortion cases
6
7 419 predominate. Similarly, women who used *khat* or consumed alcohol as well as conventional
8
9 420 medicine were twice or more as likely to use medicinal plants as their counterparts, and may
10
11 421 either indicate a higher willingness to intake different substances in pregnancy and/or higher
12
13 422 morbidity. Since interactions between medicinal plants and conventional medicines may occur
14
15 423 and potentially may cause complications [4, 14, 41] , caution with concomitant use should be
16
17 424 recommended. Health care personnel at the wards were often not informed; neither involved
18
19 425 in decisions nor aware about the women's use of medicinal plants in relation to childbirth. As
20
21 426 pregnancy is a time of particular vulnerability, cautious use of medicinal plants is necessary
22
23 427 and health-care professionals should ask women about their use and provide them evidence-
24
25 428 based information.
26
27
28
29
30
31
32

33 430 **Conclusion**

34
35 431 Almost a third of women at the tertiary hospital in Ethiopia used medicinal plants during
36
37 432 pregnancy, most frequently to prepare, induce, reduce the intensity or shorten duration of
38
39 433 labour. The most important factors associated with use of medicinal plants in pregnancy were
40
41 434 lack of access to health care facilities, hospitalization in the maternity ward and social drug
42
43 435 use. Given that women use unsafe plants during pregnancy, increased awareness about
44
45 436 potential benefits or risks of medicinal plants use during pregnancy among health care
46
47 437 professionals and patients, and increased access to health care facilities are important in order
48
49 438 to promote safer pregnancies and better health outcomes for women and their unborn babies.
50
51
52
53
54
55

56 440 **Footnotes**

57
58
59
60

1
2
3 441 **Acknowledgements:** We are grateful to the pregnant women admitted at JUMC who
4
5 442 generously shared with us information about their medicinal plant use. The authors owe a debt
6
7 443 of gratitude to the enumerators who skilfully collected the data. We would like to thank
8
9 444 Norwegian PhD School in Pharmaceutical Sciences for the travel grant assistance for the data
10
11 445 collection. Special thanks go to the Norwegian Loan Fund (Lånekassen) for granting
12
13 446 scholarship for the PhD student (SMA) in the University of Oslo. The authors are also indebted
14
15 447 to Dr. Ibrahimu Mdala for assistance with data analysis.
16
17
18
19
20

21 449 **Contributors:** SMA and HN conceived the idea for the study and its design. SMA collected,
22
23 450 analysed and interpreted data and drafted the manuscript. YAA and JS participated in study
24
25 451 coordination. SMA and HN revised and finalized the manuscript. SMA, HN, JS and YAA
26
27 452 critically reviewed the manuscript and contributed intellectual content. All authors read and
28
29 453 approved the final manuscript.
30
31
32

33 454 **Funding:** This research received no specific grant from any funding agency in the public,
34
35 455 commercial or not-for-profit sectors.
36

37 456 **Competing interests:** None declared.
38

39 457 **Patient consent for publication:** Not required.
40

41 458 **Ethics approval:** This study was approved by Jimma University Institute of health
42
43 459 Institutional Review Board (IRB) (ref. no. IHRPGC 7206/07) in Ethiopia, and Regional
44
45 460 Committees for Medical and Health Research Ethics (REK Sør-Øst B) (Ref.no. 2015/2135) in
46
47 461 Norway.
48
49

50 462 **Data availability statement:** Data are available upon reasonable request.
51

52 463 **Supplementary data**
53

54 464 Supplementary table 1: Survey questionnaire for medicinal plants used among pregnant women
55
56 465 admitted at JUMC, Ethiopia
57
58
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

466 Supplementary table 2: Data extraction form used among pregnant women admitted at JUMC,

467 Ethiopia

468 Supplementary table 3: Medicinal plants used among pregnant women admitted at JUMC,

469 Ethiopia

470 Supplementary table 4: Overview of the utilization pattern of the most frequently used

471 medicinal plants among pregnant women admitted at JUMC, Ethiopia

472

For peer review only

473 **Table 1.** Characteristics of women according to medicinal plant use during pregnancy at JUMC,
474 Ethiopia

Characteristics	No. (%) 1117 (100) ^a	Medicinal plant use during pregnancy		Crude OR [95% CI] ^b	Adjusted OR [95% CI] ^c
		Yes	No		
		No. (%) 319 (28.6)	No. (%) 798 (71.4)		
Place of Residence					
Urban	595 (53.3)	165 (51.7)	430 (53.9)	1	-
Rural	522 (46.7)	154 (48.3)	368 (46.1)	1.09 [0.84-1.41]	
Age (years)^d					
≤ 20	223 (20.0)	52 (16.3)	171 (21.4)	1	1
21-25	388 (34.7)	116 (36.4)	272 (34.1)	1.40 [0.96-2.05]	1.30 [0.88-1.94]
26-30	320 (28.7)	102 (32.0)	218 (27.3)	1.54 [1.04-2.27]	1.42 [0.94-2.14]
≥ 31	186 (16.7)	49 (15.4)	137 (17.2)	1.18 [0.75-1.85]	1.17 [0.73-1.87]
Marital status					
Married	1071 (95.9)	314 (98.4)	757 (94.9)	1	1
Others ^e	46 (4.1)	5 (1.6)	41 (5.1)	0.29 [0.12-0.75]	0.39 [0.14-1.09]
Religion					
Islam	731 (65.4)	201 (63.0)	530 (66.4)	1	
Orthodox	305 (27.3)	99 (31.0)	206 (25.8)	1.27 [0.95-1.69]	-
Protestant/Others ^f	81 (7.3)	19 (6.0)	62 (7.8)	0.81 [0.47-1.39]	
Educational level^g					
Illiterate	378 (34.0)	98 (30.7)	280 (35.1)	1	1
Primary /read & write	470 (42.3)	138 (43.3)	332 (41.6)	1.19 [0.88-1.61]	1.22 [0.88-1.68]
Secondary school	162 (14.6)	56 (17.6)	106 (13.3)	1.51 [1.02-2.25]	1.54 [1.01-2.36]
Post-secondary school	102 (9.2)	27 (8.5)	75 (9.4)	1.03 [0.63-1.69]	1.06 [0.62-1.79]
Occupation					
House wife	524 (46.9)	142 (44.5)	382 (47.9)	1	-
Farmer	261 (23.4)	82 (25.7)	179 (22.4)	1.23 [0.89-1.71]	
Trader/Merchant	163 (14.6)	49 (15.4)	114 (14.3)	1.16 [0.79-1.70]	
Government employee	95 (8.5)	30 (9.4)	65 (8.1)	1.24 [0.77-1.99]	
Others ^h	74 (6.6)	16 (5.0)	58 (7.3)	0.74 [0.41-1.33]	
Ethnic Group					
Oromo	779 (69.7)	224 (70.2)	555 (69.5)	1	1
Amhara	87 (7.8)	21 (6.6)	66 (8.3)	0.79 [0.47-1.32]	0.83 [0.48-1.45]
Yem	81 (7.3)	24 (7.5)	57 (7.1)	1.04 [0.63-1.72]	1.14 [0.66-1.97]
Dawuro	70 (6.3)	12 (3.8)	58 (7.3)	0.51 [0.27-0.97]	0.64 [0.33-1.25]
Others ⁱ	100 (9.0)	38 (11.9)	62 (7.8)	1.52 [0.99-2.34]	1.57 [1.00-2.48]
Access to health facility^j					
Yes	1107 (99.1)	313 (98.1)	794 (99.5)	1	1
No	10 (0.9)	6 (1.9)	4 (0.5)	3.81 [1.07-13.58]	6.92 [1.77-27.10]
Walking distance to the nearest health facility					
Close, ≤30 min.	731 (66.4)	203 (63.6)	528 (66.2)	1	-
Somewhat far, 31-60 min.	245 (22.3)	67 (21.0)	178 (22.3)	0.98 [0.71-1.35]	
Far, >60 min.	125 (11.4)	43 (13.5)	82 (10.3)	1.36 [0.91-2.04]	
Gravidity^k					
Primigravida	431 (38.6)	307 (38.5)	124 (38.9)	1	-
Multigravida	686 (61.4)	491 (61.5)	195 (61.1)	0.98 [0.75-1.28]	
Gestational age					
Preterm pregnancy	231 (20.7)	60 (18.8)	171 (21.4)	1	1
Term pregnancy	735 (65.8)	208 (65.2)	527 (66.0)	1.13 [0.81-1.57]	0.80 [0.52-1.25]
Post term pregnancy	62 (5.6)	27 (8.5)	35 (4.4)	2.20 [1.23-3.93]	1.65 [0.85-3.20]
Others ^l	89 (8.0)	24 (7.5)	65 (8.1)	1.05 [0.61-1.83]	0.72 [0.38-1.36]
Patient type					

Gynaecology ward	125 (11.2)	22 (6.9)	103 (12.9)	1	1
Maternity ward	992 (88.8)	297 (93.1)	695 (87.1)	2.00 [1.24-3.23]	2.80 [1.43-5.48]
Chronic illness ^m					
No	1061 (95.0)	294 (92.2)	767 (96.1)	1	1
Yes	56 (5.0)	25 (7.8)	31 (3.9)	2.10 [1.22-3.62]	1.83 [1.04-3.24]
Conventional medicine use ⁿ					
No	817 (73.1)	209 (65.5)	608 (76.2)	1	1
Yes	300 (26.9)	110 (34.5)	190 (23.8)	1.68 [1.27-2.23]	1.83 [1.36-2.46]
Chew Khat (<i>Catha edulis</i>) ^o					
No	1052 (94.2)	289 (90.6)	763 (95.6)	1	1
Yes	65 (5.8)	30 (9.4)	35 (4.4)	2.26 [1.36- 3.75]	2.53 [1.46-4.39]
Alcohol consumption					
No	1071 (95.9)	297 (93.1)	774 (97.0)	1	1
Yes	46 (4.1)	22 (6.9)	24 (3.0)	2.39 [1.32-4.33]	2.43 [1.28-4.62]
Past adverse pregnancy outcome					
No/not applicable	994 (89.0)	275 (86.2)	719 (90.1)	1	-
Yes	123 (11.0)	44 (13.8)	79 (9.9)	1.51 [1.00-2.28]	

475

476

477

478

479

480

481

482

483

484

485

486

487

488

489

490

491

^aNumbers may not add up to 1117 due to missing values, ^bCI, confidence interval, OR, odds ratio; Significant findings are in bold ($P < 0.05$); ^cAdjusted for age, marital status, educational level, ethnic group, access to health facility, gestational age, patient type, chronic illness, conventional medicine use, chew *khat*, alcohol consumption; ^dMedian age 25 years, interquartile range 22–30 years; ^eOthers includes single 41(3.7%), divorced 4(0.4%), widowed 1(0.1%); ^fProtestant/Others includes Protestant 74(6.6), Catholic 2(0.2%), Waqqefeta 1(0.1%), missing 4(0.4); ^gRead & write: no formal education but can read and write due to literacy campaigns, traditional religious institution and informal peer learning, Primary school: Grade 1–8, Secondary school: Grade 9–12; Post-secondary school: Technical and vocational school, college or university; ^hOthers includes daily labourers 24(2.1), students 22(2.0), private institution workers 18(1.6), other sectors 10(0.9%); ⁱOthers includes Gurage 41(3.7), Silte 30(2.7), Kaffa 16(1.4), Tigre 3(0.3), Wolayita 3(0.3), mixed ethnic backgrounds 7(0.6); ^jAccess to health facility means access to either primary, secondary or tertiary levels of healthcare; it mainly represents access to health posts; ^kGravidity includes the current pregnancy; ^lWomen are in the first, second or third trimester of pregnancy but exact week of pregnancy is not known; ^mIncludes hypertension, diabetes mellitus, asthma, cardiac diseases, chronic gastritis/peptic ulcer, HIV, chronic renal failure, chronic liver disease, etc.; ⁿRefers to self-medication with conventional medicine before hospitalization; ^o*Khat (Catha edulis)* plant leaves are chewed by people for their stimulant action

492 **Table 2.** Pregnancy disorders treated with medicinal plants at JUMC, Ethiopia, n=319

Variables	Number (%) ^a	Most common medicinal plants (number of citations)
Induction and “reduction” of labour ^b	192 (60.2)	<i>Linum usitatissimum</i> (Flaxseed) (179) <i>Trigonella foenum-graecum</i> (Fenugreek) (6) <i>Carica papaya</i> (Papaya) (4)
Common cold/flu	65 (20.4)	<i>Zingiber officinale</i> (Ginger) (23) <i>Allium sativum</i> (Garlic) (13) <i>Eucalyptus globulus</i> (<i>Nech-bahir zaf</i>) (12)
Preparation for labour	50 (15.7)	<i>Linum usitatissimum</i> (Flaxseed) (22) <i>Carica papaya</i> (Papaya) (17) <i>Trigonella foenum-graecum</i> (Fenugreek) (11)
Abdominal cramps/ache	30 (9.4)	<i>Nigella sativa</i> (Black seed) (10) <i>Allium sativum</i> (Garlic) (5) <i>Carica papaya</i> (Papaya) (4)
Headache/Migraine	27 (8.5)	<i>Nigella sativa</i> (Black seed) (10) <i>Ocimum lamiifolium</i> (<i>Damakessie</i>) (8) <i>Allium sativum</i> (Garlic) (3)
Heartburn/reflux problems	27 (8.5)	<i>Linum usitatissimum</i> (Flaxseed) (16) <i>Carica papaya</i> (Papaya) (5)
Mitch ^c	24 (7.5)	<i>Ocimum lamiifolium</i> (<i>Damakessie</i>) (18)
Gastritis/burning sensation	22 (6.9)	<i>Linum usitatissimum</i> (Flaxseed) (19)
Constipation/obstipation	17 (5.3)	<i>Linum usitatissimum</i> (Flaxseed) (16)
General wellbeing	15 (4.7)	<i>Allium sativum</i> (Garlic) (5) <i>Ruta chalepensis</i> (Fringed rue) (3)
Nausea	11 (3.4)	<i>Zingiber officinale</i> (Ginger) (4) <i>Ruta chalepensis</i> (Fringed rue) (4)
Helminths	6 (1.9)	<i>Carica papaya</i> (Papaya) (2) <i>Hagenia abyssinica</i> (<i>Kosso</i>) (2)
Leg/foot Swelling	5 (1.6)	<i>Linum usitatissimum</i> (Flaxseed) (1) <i>Cinnamomum verum</i> (Cinnamon) (1) <i>Croton macrostachyus</i> (<i>Bisena</i>) (1) <i>Veronia amygdalina</i> (<i>Grawa</i>) (1) B'auu (1)
Prevent bad smell	5 (1.6)	<i>Ocimum lamiifolium</i> (<i>Damakessie</i>) (5)
Strong craving	5 (1.6)	<i>Linum usitatissimum</i> (Flaxseed) (1) <i>Carica papaya</i> (Papaya) (1) <i>Nigella sativa</i> (Black seed) (1) <i>Ruta chalepensis</i> (Fringed rue) (1) <i>Zingiber officinale</i> (Ginger) (1)
Emergency illnesses	4 (1.3)	<i>Ocimum lamiifolium</i> (<i>Damakessie</i>) (3)
Postpartum bathing	4 (1.3)	<i>Eucalyptus globulus</i> (<i>Nech-bahir zaf</i>) (3)
Vomiting	3 (0.9)	<i>Zingiber officinale</i> (Ginger) (2)
<i>Yemahitsen mitch</i> ^c (‘gynaecologic mitch’)	3 (0.9)	<i>Croton macrostachyus</i> (<i>Bisena</i>) (1) <i>Ocimum lamiifolium</i> (<i>Damakessie</i>) (1) <i>Pycnostachys abyssinica</i> (<i>Yeroo</i>) (1)
Depression	3 (0.9)	<i>Echinops kebericho</i> (<i>Kebericho</i>) (1) <i>Ruta chalepensis</i> (Fringed rue) (1) <i>Cinnamomum verum</i> (Cinnamon) (1)
Wellbeing and nourishing the foetus	3 (0.9)	<i>Linum usitatissimum</i> (Flaxseed) (2) <i>Trigonella foenum-graecum</i> (Fenugreek) (1)
Cough	2 (0.6)	<i>Nigella sativa</i> (Black seed) (1) <i>Saccharum officinarum</i> (Sugar crystals) (1)
<i>Birdd</i> ^d	2 (0.6)	<i>Allium sativum</i> (Garlic) (1) <i>Nigella sativa</i> (Black seed) (1)
Diarrhoea	2 (0.6)	<i>Ocimum lamiifolium</i> (<i>Damakessie</i>) (1) <i>Taverniera abyssinica</i> (<i>Dingetegn</i>) (1)

Variables	Number (%) ^a	Most common medicinal plants (number of citations)
Joint pain (<i>kurtimatt</i>)	2 (0.6)	<i>Allium sativum</i> (Garlic) (1) <i>Nigella sativa</i> (Black seed) (1)
Sleeping problems	2 (0.6)	<i>Artemisia abyssinica</i> (<i>Chikugn</i>) (2)
Mental wellbeing	2 (0.6)	<i>Ruta chalepensis</i> (Fringed rue) (2)
Evil eye	2 (0.6)	<i>Artemisia afra</i> (<i>Ariti</i>) (1) <i>Veronia amygdalina</i> (<i>Grawa</i>) (1)
Others ^e	15 (4.7)	<i>Linum usitatissimum</i> (Flaxseed) (3) <i>Allium sativum</i> (Garlic) (3) <i>Ocimum lamiiifolium</i> (<i>Damakessie</i>) (3)

^aTotal percentage may exceed 100% due to multiple responses

^b**Reduction of labour:** Includes reduced intensity and shortened duration of labour.

^c**'Mitch':** A febrile illness believed to develop when strong sunlight strikes a part of the body that is sweating or unclean.

^d**'Bird':** An illness typified by a feeling of chills, arthralgia, myalgia, generalized body weakness, pain (particularly chest pain) and coughing. In general, it is characterized by pneumonia/flu-like symptoms.

^eOthers includes make labour simple, stomach rambling, quicken labour, prevent '*megagna*', fever, facilitation of digestion, tonsillitis, pregnancy associated body/physical illnesses, skin rashes ('*Shifta*'), abdominal distension/bloating, throat congestion ('*Guroroyen siyafinegn*'), malaria, appetizer, upper extremity fatigability, for any illness, each with a frequency of one.

503 **Table 3.** Overview of the most frequently used medicinal plants during pregnancy at JUMC, Ethiopia

Medicinal plant (English name) (local name) Preparation method	Number of users (n = 319), n (28.6%)	Most common indications (No. of citations)
<i>Linum usitatissimum</i> L. (Flaxseed or Linseed) (<i>Telba</i>) Flax seeds are roasted, pounded, thoroughly mixed with water and consumed in soup form.	246 (77.1)	Induction or “reduction” of labour (179) ^a Prepare for labour (22) Heartburn/reflux problems (19) Constipation/obstipation (16) Gastritis/burning sensation (14) Abdominal cramps or ache (2)
<i>Ocimum lamiifolium</i> L. (No common English name) (<i>Damakessie</i>) Adding minced fresh leaves or steeping in leaves in tea, coffee, milk or decoction or maceration of minced root are drunk, or fresh leaves are put in nostrils and sniffed	40 (12.5)	Mitch (19) ^b Common cold/flu (10) Headaches/Migraine (8) Prevent bad smell (5) Emergency cases/illnesses (3) Nausea (2)
<i>Carica papaya</i> L. (Papaya) (<i>Papaya</i>) Ripened fresh fruit is eaten or its juice is extracted and then drunk	35 (11.0)	Prepare for labour (17) Heartburn/reflux problems (5) Induce labour (4) Abdominal cramps or ache (4) Gastritis/burning sensation (3) Helminths (2)
<i>Zingiber officinale</i> Roscoe. (Ginger) (<i>Zingibil</i>) Drinking aqueous decoction or maceration, or drinking minced root with water or tea	29 (9.1)	Common cold/flu (23) Nausea (4) Vomiting (2) Abdominal cramps (2)
<i>Allium sativum</i> L. (Garlic) (<i>Nech shinkrut</i>) Drinking minced cloves with tea, coffee, milk or eating raw cloves with Ethiopian bread, ‘ <i>Injera</i> ’	28 (8.8)	Common cold/flu (13) General wellbeing (5) Abdominal cramps (5) Headaches/Migraine (3) <i>Birdd</i> (2) ^c
<i>Trigonella foenum-graecum</i> L. (Fenugreek) (<i>Abish</i>) Drink aqueous maceration of seeds or consume roasted and powdered seeds in soup form	24 (7.5)	Prepare for labour (11) Induce labour (6) Gastritis/burning sensation (4)
<i>Nigella sativa</i> L (Black seed) (<i>Tikur Azmud</i>) Drinking few drops of the seed oil with tea, coffee, milk or sniffing the oil drops	21 (6.4)	Headaches/Migraine (10) Abdominal cramps or ache (7) Common cold/flu (6)
<i>Ruta chalepensis</i> L. (Fringed rue) (<i>Tenadam</i>) Adding minced fresh leaves or steeping in leaves in tea, coffee, or milk and then drunk or fresh leaves squeezed, and then drunk	15 (4.7)	Nausea (4) General wellbeing (3) Headaches/Migraine (2) Mental wellbeing (2) Abdominal cramps (2)
<i>Eucalyptus globulus</i> Labill. (“Eucalyptus”) (<i>Nech-bahir zaf</i>) Leaves are boiled in water, patient fumigated and the vapour is inhaled	13 (4.1)	Common cold/flu (12) Postpartum bathing (3) Mitch (2)

504 **a**“Reduction of labour”: Includes reduced intensity and shortened duration of labour; **b**“*Mitch*”: A febrile illness believed to
505 develop when strong sunlight strikes a part of the body that is sweating or unclean; **c**“*Birdd*”: An illness typified by a feeling
506 of chills, arthralgia, myalgia, generalized body weakness, pain (particularly chest pain) and coughing. In general, it is
507 characterized by pneumonia/flu-like symptoms

508 **Table 4.** Pregnant women's self-reported safety concerns and experiences with medicinal plants at
 509 JUMC, Ethiopia, n=319

Medicinal plants (MPs), reported reasons for contraindication (No. of citations)	MPs, reported precautions (No. of citations)	MPs, reported Side effects (No. of citations)	MPs, reported adverse drug reactions (No. of citations)
Flaxseed: Cause uterine contractions, miscarriage or premature labour (2), Dries up breastmilk (1)	Flaxseed ^a : Aloe vera is bitter and makes flaxseed preparation unpalatable (1), the woman should stay away from sunlight while /after taking flaxseed preparation (1)	Flaxseed: Nausea (4), Postpartum shivering (1), Diarrhoea (1), Vomiting (1), Loss of appetite (1),	Flaxseed: Severe postpartum shivering (1), Loss of consciousness (1), Uterine rupture (1), Still birth (1)
<i>Kosso</i> ^b : Causes uterine stimulation (4)	<i>Kosso</i> : <i>Kosso</i> protects the mother from outside person's 'tila' as it may kill her (1), After taking <i>Kosso</i> , the woman should stay at home for 2 days protected from outside person's 'tila' (1) ^c	<i>Kosso</i> : Diarrhoea (2)	<i>Kosso</i> : Severe diarrhoea (2)
<i>Dingetegna</i> : harmful during pregnancy, reason unknown (1) ^d	<i>Dingetegna</i> ^e : the woman who took <i>dingetegna</i> should stay at home, outsiders should not be allowed to get in for fear of their 'tila' (1)	<i>Dingetegna</i> : Diarrhoea (2), Vomiting (1)	<i>Dingetegna</i> : Severe diarrhoea (2)
<i>Damakessie</i> : Causes uterine stimulation (1)	<i>Damakessie</i> ^f : After applying MPs stay at home, going outside is forbidden (1) ^g	<i>Damakessie</i> : Loss of appetite (1), Bitter (after) taste (1), Sneezing (1)	Chikugn ^h : Anencephaly: giving birth to a headless neonate (1)
<i>Tej Sar</i> ⁱ : Causes uterine stimulation (1), harmful during pregnancy, reason unknown (1) ^d	Cinnamon ^j : inflammatory to the stomach, thus eat food before taking cinnamon (1)	Cinnamon: Heart burn (1)	Cinnamon: Severe heart burn (1)
Ensila ^k : Causes uterine stimulation (1), harmful during pregnancy, reason unknown (1) ^d	Garlic: larger dose of garlic is irritant, thus eat food before taking it (1)	Garlic: Discomfort to foetus (1), Gastric irritation (1), Loss of appetite (1)	Garlic: Harm to the foetus (1), Bad mouth smell (1), Severe heart burn (1)
Grawa ^l : Causes uterine stimulation (2) harmful during pregnancy, reason unknown (1) ^d	Ginger: stomach irritant, thus eat food before taking ginger (1), beware since ginger decreases appetite (1) and induces fever (1)	Ginger: Gastric irritation (2), Heart burn (2), Discomfort to foetus (1)	Ginger: Harm to foetus (1), Severe heart burn (1)
Black seed: Generally not good for the woman and the foetus, thus better not to take it during pregnancy (1)	Yeroo ^m : After applying MPs stay at home, going outside is forbidden (1) ^g	Black seed: Gastric irritation (3), Loss of appetite (1)	-----
Bisana ⁿ : causes uterine stimulation (2), harmful to the foetus (1), generally not good for the foetus (1), its smell deteriorates health of pregnant women (1)	Bisana ^o : After applying MPs stay at home, going outside is forbidden (1) ^g	"Eucalyptus" ^p : Decrease in appetite (1)	-----
Kebericho: Generally not good for the foetus(1)	Kebericho ^q : Kebericho interacts with <i>damakessie</i> and worsen the <i>Mitch</i> ^r disease (1)	Sugar ^s : Eye irritation (1)	-----
<i>Etse Fares</i> ^t : Harmful to the foetus (1), Causes uterine stimulation (3), Generally not good for pregnant woman and the foetus (1)	Fringed rue: Kebericho should not be taken with rue because it will worsen the nausea (1), beware since it induces fever (1), There is a plant interacting with rue, but forgot its name (1)	Fringed rue: Loss of appetite (1)	-----
'Baruda' plant ^u : Causes uterine stimulation (1)	-----	-----	-----

Endod ^v : Causes uterine stimulation (1)	-----	-----	-----
Metere ^w : Harmful to the foetus (1)	-----	-----	-----
Feto ^x : Causes uterine stimulation (1)	-----	-----	-----

510 ^aAfter consuming Flaxseed (*L. usitatissimum*) preparation the woman should stay at home, exposure to sunlight results in
511 *Mitch* disease, ^b*H. abyssinica*, ^c'Tila', loosely translated means the shade of a person that is believed to have pernicious effect,
512 ^dThe plant is harmful during pregnancy, but the woman does not know the reason for contraindication, ^e*T. abyssinica*, ^gStay at
513 home after applying the ^f Damakessie (*O. lamiifolium*) / ^mYeroo (*P. abyssinica*) / ^oBisana (*C. macrostachyus*) mixture
514 formulation, going outside is forbidden; Otherwise there is relapse of the disease; ^h*A. abyssinica*, ⁱ*Cymbopogon citratus* (DC.)
515 Stapf, ^j*C. verum*, ^k*F. vulgare*, ^l*V. amygdalina*, ⁿ*C. macrostachyus*, ^p*E. globulus*, ^q*E. kebericho*, ^r*Mitch*: A febrile illness believed
516 to develop when strong sunlight strikes a part of the body that is sweating or unclean; ^s*Saccharum officinarum* L., ^t*Datura*
517 *stramonium* L., ^uinserting the root in to the vagina and/or drink its juice, ^v*Phytolacca dodecandra* L'Hér., ^w*Glinus lotoides* L.,
518 ^x*L. sativum*, ^{b, x}(particularly use of *Kosso* with *Feto* causes severe uterine stimulation).

520 References

- 521 1. Hailemeskel B, Fullas F, Habte A, Al-Matari RA, Brewer D. A review of natural
522 remedies commonly used by Ethiopian immigrants in the USA. *Curr Res Integr Med*.
523 2017; 2: 31-36.
- 524 2. Jamshidi-Kia F, Lorigooini Z, Amini-Khoei H. Medicinal plants: Past history and
525 future perspective. *J Herbmед Pharmacol*. 2018; 7: 1-7.
- 526 3. Mazzari ALDA, Prieto JM. Herbal medicines in Brazil: pharmacokinetic profile and
527 potential herb-drug interactions. *Front Pharmacol*. 2014; 5: 162.
- 528 4. Ahmed SM, Nordeng H, Sundby J, Aragaw YA, de Boer HJ. The use of medicinal
529 plants by pregnant women in Africa: A systematic review. *J Ethnopharmacol*. 2018;
530 224: 297-313.
- 531 5. Shewamene Z, Dune T, Smith CA. The use of traditional medicine in maternity care
532 among African women in Africa and the diaspora: a systematic review. *BMC*
533 *Complement Altern Med*. 2017; 17: 382.
- 534 6. United States Central Intelligence Agency (CIA). The World Fact Book, Africa:
535 Ethiopia. <https://www.cia.gov/library/publications/the-world-factbook/geos/et.html>
536 (2018). Accessed 13 Feb 2019.

- 1
2
3 537 7. Ethiopian Public Health Institute (EPHI). Traditional and Modern Medicine Research.
4
5 538 <http://www.ephi.gov.et/index.php/research/traditional-modern-medicine> (2018).
6
7
8 539 Accessed 25 Feb 2019.
9
10 540 8. Laelago T, Yohannes T, Lemango F. Prevalence of herbal medicine use and
11
12 541 associated factors among pregnant women attending antenatal care at public health
13
14 542 facilities in Hossana town, southern Ethiopia: facility based cross sectional study.
15
16 543 Arch Public Health. 2016; 74: 7.
17
18 544 9. United Nations Children's Fund (UNICEF). Maternal and Newborn Health Disparities
19
20 545 country profiles. [https://data.unicef.org/resources/maternal-newborn-health-](https://data.unicef.org/resources/maternal-newborn-health-disparities-country-profiles/)
21
22 546 [disparities-country-profiles/](https://data.unicef.org/resources/maternal-newborn-health-disparities-country-profiles/) (2018). Accessed 05 Sept 2019.
23
24
25 547 10. Ahmed SM, Sundby J, Aragaw YA, Abebe F. Self-Medication and Safety Profile of
26
27 548 Medicines Used among Pregnant Women in a Tertiary Teaching Hospital in Jimma,
28
29 549 Ethiopia: A Cross-Sectional Study. Int J Environ Res Public Health. 2020; 17:3993.
30
31 550 11. Bayisa B, Tatiparthi R, Mulisa E. Use of herbal medicine among pregnant women on
32
33 551 antenatal care at Nekemte Hospital, Western Ethiopia. Jundishapur J Nat Pharm Prod.
34
35 552 2014; 9: e17368.
36
37
38 553 12. Jambo A, Mengistu G, Sisay M, Amare F, Edessa D. Self-Medication and
39
40 554 Contributing Factors Among Pregnant Women Attending Antenatal Care at Public
41
42 555 Hospitals of Harar Town, Ethiopia. Front Pharmacol. 2018; 9: 1063.
43
44
45 556 13. Mekuria AB, Erku DA, Gebresillassie BM, Birru EM, Tizazu B, Ahmedin A.
46
47 557 Prevalence and associated factors of herbal medicine use among pregnant women on
48
49 558 antenatal care follow-up at University of Gondar referral and teaching hospital,
50
51 559 Ethiopia: a cross-sectional study. BMC Complement Altern Med. 2017; 17: 86.
52
53
54
55
56
57
58
59
60

- 1
2
3 560 14. Nega SS, Bekele HM, Meles GG, Nordeng H. Medicinal Plants and Concomitant Use
4
5 561 with Pharmaceutical Drugs Among Pregnant Women. *J Altern Complement Med.*
6
7 562 2019; 25: 427-434.
- 8
9
10 563 15. Hall HG, Griffiths DL, McKenna LG. The use of complementary and alternative
11
12 564 medicine by pregnant women: A literature review. *Midwifery.* 2011, 27: 817-824.
- 13
14
15 565 16. Westfall RE. Herbal healing in pregnancy: women's experiences. *J Herb*
16
17 566 *Pharmacother.* 2003; 3: 17-39.
- 18
19 567 17. Kennedy DA, Lupattelli A, Koren G, Nordeng H. Herbal medicine use in pregnancy:
20
21 568 results of a multinational study. *BMC Complement Altern Med.* 2013; 13:355.
- 22
23
24 569 18. Ahmed M, Hwang JH, Choi S, Han D. Safety classification of herbal medicines used
25
26 570 among pregnant women in Asian countries: a systematic review. *BMC Complement*
27
28 571 *Altern Med.* 2017; 17: 489.
- 29
30
31 572 19. Ahmed M, Hwang JH, Hasan MA, Han D. Herbal medicine use by pregnant women
32
33 573 in Bangladesh: a cross-sectional study. *BMC Complement Altern Med.* 2018; 18: 333.
- 34
35
36 574 20. Kennedy DA, Lupattelli A, Koren G, Nordeng H. Safety classification of herbal
37
38 575 medicines used in pregnancy in a multinational study. *BMC Complement Altern Med.*
39
40 576 2016; 16: 102.
- 41
42
43 577 21. Godlove MJ: Prevalence of herbal medicine use and associated factors among
44
45 578 pregnant women attending antenatal clinic at Mbeya Referral Hospital in 2010 (M.Sc.
46
47 579 Thesis). Muhimbili University of Health and Allied Sciences, Dar es salaam,
48
49 580 Tanzania. <http://hdl.handle.net/123456789/41> (2011). Accessed 03 Oct 2018.
- 50
51
52 581 22. Segni H, Ayana D, Jarso H. Prevalence of Hyperemesis Gravidarum and Associated
53
54 582 Factors Among Pregnant Women at Jimma University Medical Center, South West
55
56 583 Ethiopia: A Cross-Sectional Study. *EC Gynaecology.* 2016, 3: 376-387.
- 57
58
59
60

- 1
2
3 584 23. Jimma University: Jimma University Specialized hospital.
4
5 585 <http://www.ju.edu.et/jimma-university-specialized-hospital-jush> (2017). Accessed 13
6
7
8 586 Sept 2018.
- 9
10 587 24. Kish L. Survey Sampling. New York, NY, USA: John Wiley & Sons, Inc.; 1965.
- 11
12 588 25. Mureyi DD, Monera TG, Maponga CC. Prevalence and patterns of prenatal use of
13
14 589 traditional medicine among women at selected harare clinics: a cross-sectional study.
15
16 590 BMC Complement Altern Med. 2012; 12: 164.
- 17
18
19 591 26. Mkize GT: An Assessment of Use of Traditional Medicine in Pregnancy &
20
21 592 Associated Factors Among Black South African Women Delivering in Bertha Gxowa
22
23 593 Hospital (M.Sc. Thesis). University of the Witwatersrand, Johannesburg, South
24
25 594 Africa. <http://wiredspace.wits.ac.za/handle/10539/17340?show=full> (2015). Accessed
26
27 595 25 Apr, 2019.
- 28
29
30 596 27. Onyiaapat JLE: Complementary and Alternative Medicine Use among Pregnant
31
32 597 Women in Udi Local Government Area of Enugu State, Nigeria (M.Sc. thesis).
33
34 598 University of Nigeria, Enugu Campus, Nigeria.
35
36 599 <http://repository.unn.edu.ng/handle/123456789/5641> (2014). Accessed 25 Apr 2019.
- 37
38
39 600 28. Gall A, Shenkute Z. Ethiopian Traditional and Herbal Medications and Their
40
41 601 Interactions with Conventional Drugs.
42
43 602 <https://ethnomed.org/clinical/pharmacy/ethiopian-herb-drug-interactions> (2009).
44
45 603 Accessed 17 Oct 2018.
- 46
47
48 604 29. Gedif T, Hahn H-J. The use of medicinal plants in self-care in rural central Ethiopia. J
49
50 605 Ethnopharmacol. 2003; 87: 155-161.
- 51
52
53 606 30. Mills E, Duguo J-J, Perri D, Koren G. Herbal medicines in pregnancy and lactation:
54
55 607 An evidence-based approach. London ; New York: Taylor & Francis; 2006.
- 56
57
58
59
60

- 1
2
3 608 31. Mills SY, Bone K. The Essential Guide to Herbal Safety. St. Louis, Mo: Elsevier
4
5 609 Churchill Livingstone; 2005.
6
7
8 610 32. Gardner ZE, McGuffin M. American herbal products association's botanical safety
9
10 611 handbook. 2nd ed. Boca Raton, FL: American Herbal Products Association, CRC
11
12 612 Press; 2013.
13
14
15 613 33. Zamawe C, King C, Jennings HM, Mandiwa C, Fottrell E. Effectiveness and safety of
16
17 614 herbal medicines for induction of labour: a systematic review and meta-analysis. BMJ
18
19 615 Open. 2018; 8 :e022499.
20
21 616 34. Gokhale S, Sahu AN. Pharmacological properties of flaxseed, *Linum usitatissimum*
22
23 617 Linn., as a potential medicinal plant: An overview. World J Pharm Sci. 2016, 4: 207-
24
25 618 215.
26
27
28 619 35. Hodes RM, Teferedegne B. Traditional beliefs and disease practices of Ethiopian
29
30 620 Jews. Isr J Med Sci. 1996; 32: 561-7.
31
32
33 621 36. Hodes R. Cross-cultural medicine and diverse health beliefs. Ethiopians abroad. West
34
35 622 J Med. 1997; 166: 29-36.
36
37
38 623 37. Kifle H, Seyoum A, Asres K, Mazumder A, Bucar F. Composition, antimicrobial and
39
40 624 free-radical scavenging properties of the essential oil of Damakese (*Ocimum*
41
42 625 *lamiifolium*): A popular home remedy in Ethiopia. Int J Essen Oil Ther. 2007; 1: 110 -
43
44 626 116.
45
46
47 627 38. Debella A, Makonnen E, Abebe D, Teka F, Kidanemariam AT. Pain management in
48
49 628 mice using the aqueous and ethanol extracts of four medicinal plants. East Afr Med J.
50
51 629 2003; 80: 435-439.
52
53
54 630 39. Kefe A, Giday M, Mamo H, Erko B. Antimalarial properties of crude extracts of
55
56 631 seeds of *Brucea antidysenterica* and leaves of *Ocimum lamiifolium*. BMC
57
58 632 Complement Altern Med. 2016; 16: 118.
59
60

- 1
2
3 633 40. Oderinde O, Noronha C, Oremosu A, Kusemiju T, Okanlawon OA. Abortifacient
4
5 634 properties of aqueous extract of *Carica papaya* (Linn) seeds on female Sprague-
6
7 635 Dawley rats. Niger Postgrad Med J. 2002; 9: 95-8.
8
9
10 636 41. El Hajj M, Holst L. Herbal Medicine Use During Pregnancy: A Review of the
11
12 637 Literature With a Special Focus on Sub-Saharan Africa. Front Pharmacol. 2020, 11:
13
14 638 866.
15
16
17
18 639

For peer review only

Interviewer administered questionnaire

Medicinal plants used among pregnant women admitted in Jimma University Medical Center maternity and gynaecology wards in Jimma city, Ethiopia

Background and purpose

This is an invitation for you to participate in a research conducted with the objective of assessing medicinal plants used among pregnant women admitted in Jimma University Medical Center (JUMC) maternity and gynecology wards in Jimma city, Ethiopia. Although medicinal plants play a significant role in traditional medicine during pregnancy, childbirth and postpartum care, little is known about the extent and types of medicinal plants used during pregnancy in Ethiopia. The aim of this study is therefore to investigate and describe medicinal plants used during pregnancy, the reasons for use and the utilization pattern among women admitted at the maternity and gynecology wards. As the study is directly related to women seeking care in the maternity and gynaecology ward of this hospital, you are one of the candidates who can participate in the study. Thus, you are kindly requested to participate in the present research and provide the information required from you.

What does the study involve?

Concerning the study process, first we will ask you questions about your background including questions about your age, religion, residence place, occupation, family size, ethnic group, marital status, educational level, access to modern health facility and walking distance to the facility. Next, we will ask you about maternal diseases, pregnancy-related illness and treatments, use of medicinal plant, information about women's safety concerns and experiences with use of medicinal plants in pregnancy. We will further collect data about your chronic illness and medication history, self-medication with conventional drugs, and social drug use during pregnancy.

Potential advantages and disadvantages

The results obtained from this study are useful in order to develop better strategies to minimize medicinal plant use related problems and reduce maternal morbidity and mortality. There is no any disadvantage in participating in this study, except the time that it takes to answer the study questions.

What will happen to your personal information?

The data that are registered about you will only be used in accordance with the purpose of the study as described above. All the data will be processed without name, personal identification number or other directly recognisable type of information. A code number links you to your data and only the authorized study staff will have access to this list. There will be no way of linking your individual responses to the final result of the study findings. For documentation and follow-up purposes, the data will be kept until 14.01.2024. The data will be stored as de-identified data, i.e. a file with key identifiable information stored separately from the file containing other data. The data will be anonymized within 6 months after this date. It will not be possible to identify you in the results of the study when these are published.

Voluntary participation

Participation in this study is voluntary. You can withdraw your consent to participate in the study at any time and without stating any particular reason. This will not have any consequences for your further treatment. If you wish to participate, please sign the declaration of consent at the bottom of this page. In case if you are not able to give written consent (i.e. due to literacy and /or cultural reasons), your oral consent will be sought and documented as equal to a written consent. There are no consequences for women who decide not to participate in this study. The patient's decision to participate or not will have no impact on the treatment(s) that she receives.

If you have questions concerning the study, you may contact the research team:

Mr. Seid Mussa Ahmed

Telephone: +251911820125 (Mobile phone), +251471111979 (Office phone)

Email: seid.mussa@ju.edu.et / seidma@studmed.uio.no

School of Pharmacy, Faculty of health sciences, Jimma Institute of Health,
Jimma University, Jimma, Ethiopia;

Dr. Yesuf Ahmed Aragaw

Telephone: +251911004736 (Mobile phone), +251 471110867(Office phone)

Email: yesuf.aragaw@ju.edu.et / yesufahmed47@yahoo.com

Department of Obstetrics and Gynaecology, Faculty of Medical Sciences,
Jimma Institute of Health, Jimma University, Jimma, Ethiopia;

Right to access and material storage

If you agree to participate in the study, you are entitled to have access to the information registered about you. You are further entitled to correct any mistakes in the information we have registered. If you withdraw from the study, no further information or material will be collected about you. Data that have already been collected will not be deleted.

Funding

Mr. Seid Mussa is a PhD student in the University of Oslo. He is a recipient of scholarship from the Norwegian Loan Fund (Lånekassen).

Information about the outcome of the study

You, as a participant in this study, are entitled to receive information about the outcome/result of the study.

Consent for participation in the study

I am willing to participate in the study. _____
(Signed by the study participant, date)

Third party consent when this is warranted, either in addition to or in place of the participant's consent. _____
(Signed by a close relative/partner/friend, date)

I confirm that I have given information about the study. _____
(Signed, role in the study, date)

Instructions for enumerators

- Many questions allow multiple answers. Unless specifically instructed in the question, do not prompt and simply encircle the answers that the woman mentions
- For open ended questions please write down the pregnant woman's response legibly

Part I. Socio-demographics characteristics of respondents

1.1. Study ID code _____

1.2. What is your age? _____

1.3. What is your place of residence?

- A. Urban
- B. Rural

1.4. What is your educational level?

- A. Illiterate
- B. Only read and write
- C. Primary 1st cycle (1-4)
- D. Primary 2nd cycle (5-8)
- E. Secondary school (9-12)
- F. Post-secondary school
- G. Others, specify _____

1.5. What is your marital status?

- A. Married
- B. Single
- C. Divorced
- D. Widowed

1.6. What is your ethnic group?

- A. Oromo
- B. Amhara
- C. Gurage
- D. Dawuro
- E. Silte
- F. Yem
- G. Tigre

1
2
3 H. Others, specify _____
4

5 **1.7. What is your religion?**

6 A. Islam

7 B. Orthodox

8 C. Protestant

9 D. Catholic

10 E. Others, specify _____
11

12 **1.8. What is your occupation?**

13 A. Farmer

14 B. Daily labourer

15 C. Trader/Merchant

16 D. Government employee

17 E. House wife

18 F. Student

19 G. Private institution worker

20 H. Others, specify _____
21

22 **1.9. How many family members do you have (including yourself)? _____**

23 **1.10. Do you have access to any modern health facility (especially in 5 to 10 km**
24 **distance from your residence)? (If no skip to Q 2.1) A. Yes B. No**

25 **1.11. How many minutes walking distance is it to your nearest health facility? _____**
26

27 **Part II. Maternal diseases, pregnancy-related illness and treatments**
28

29 **2.1. Are you pregnant? A. Yes B. No**

30 2.1.1. If yes, in which week of pregnancy (gestation age) are you? _____

31 2.1.2. If no, how many days has passed since delivery? _____
32

33 **2.2. How many children do you have from before the current pregnancy? _____**

34 **2.3. How many times have you been pregnant (i.e. Gravida)? _____**

35 **2.4. The number of times your pregnancies reaching viable gestational**
36 **age (including live births and stillbirths, i.e. parity) _____**

37 **2.5. For how many days did you stay in the hospital? _____**

38 **2.6. History of any adverse pregnancy outcome? (If no skip to Q 3.1)**

39 A. Yes B. No

40 **2.7. What type (s) of adverse pregnancy outcome?**
41

- 1
2
3 A. Down syndrome
4
5 B. Cleft lip/ palate
6
7 C. Neural tube defect
8
9 D. Cardiac defect
10
11 E. More than one/ mixed [please explain] _____
12
13 F. Others, specify _____
14

15 **Part III. Chronic illness and medication**

16
17
18
19 **3.1. Do you have chronic illness? (If no skip to Q 4.1)** A. Yes B. No

20
21 **3.2. What is the chronic illness?** _____

- 22 A. Hypertension
23
24 B. Diabetes mellitus
25
26 C. Asthma
27
28 D. Cardiac diseases
29
30 E. Liver disease
31
32 F. Chronic renal failure
33
34 G. Tuberculosis (TB)
35
36 H. Human immunodeficiency viruses (HIV)
37
38 I. Others, specify _____

39
40 **3.3. Do you take drugs for the management of chronic illness? (If no skip to Q 3.5)**

A. Yes B. No

41
42 **3.4. What type of drugs are you taking?** _____

43
44 **3.5. Are you currently attending chronic illness follow-up clinic?** A. Yes B. No

45
46 **Part IV. Self-medication with conventional medicines**

47
48
49
50 **4.1. Have you ever-employed self-medication with conventional medicines during**
51 **pregnancy? (If no skip to Q 5.1)** A. Yes B. No

52
53 **4.2. Which drugs did you use for self-medication?**

- 54
55 A. NSAIDs (write drug name (s)) _____
56
57 B. Dermatologicals (write drug name (s)) _____
58
59 C. Antibiotics (write drug name (s)) _____
60
61 D. Others, Specify _____

1
2
3 **4.3. If you use antibiotics for self-medication, which antibiotics do you use?**
4 **(Please write down all the antibiotics medications the pregnant woman mentions)**
5
6
7 _____
8
9 _____
10
11 _____
12

13
14 **4.4. Had you received any advice /counselling on self-medications drugs? (If no skip to**
15 **Q 5.1)**

16 **A. Yes B. No**

17
18 **4.5. For which of the following points you had received advice?**

- 19
20 **A. Tolerable side effects of drugs**
21
22 **B. Adverse drug reactions which requires prescribers visit**
23
24 **C. Management of missed dose**
25
26 **D. How to take the medication**
27
28 **E. Others specify _____**
29

30
31 **Part V. Social drug use during pregnancy**

32
33
34 **5.1. Do you smoke cigarette? (If no skip to Q 5.2.) A. Yes B. No**

35
36 5.1.1. How many cigarettes do you smoke per day? _____

37
38 5.1.2. For how many years have you smoked? _____

39
40 **5.2. Do you drink alcohol? (If no skip to Q 5.3.) A. Yes B. No**

41
42 5.2.1. Which type of alcohol do you drink? _____

43
44 5.2.2. What millilitre per day do you drink? _____

45
46 5.2.3. For how many years have you drunk? _____

47
48 **5.3. Do you chew *Khat*? (If no skip to Q 6.1.) A. Yes B. No**

49
50 5.3.1. What is the average weight in grams that you chew daily? _____

51
52 5.3.2. For how many years have you chewed? _____

53
54 **5.4. Any other social drug you used? _____**

55
56 **Part VI. General questions about medicinal plants used during pregnancy**

57
58 **6.1. Have you used any medicinal plants to manage your current pregnancy illness?**
59 **(If no skip to Q. 6.8, and after that thank the woman and stop the interview)**
60

1
2
3 A. Yes B. No
4

5 **6.2. What is your source of medicinal plants?** _____
6

- 7 A. Market places
8 B. Traditional healers (herbalist)
9
10 C. Garden
11
12 D. Shop
13
14 E. Neighbor
15
16 F. Others, specify _____

17 **6.3. Who helps you in the collection of the medicinal plants?**
18

- 19 A. Family members (mother, father, husband, grandmother, etc.)
20
21 B. Neighbours
22
23 C. Friends
24
25 D. My-self
26
27 E. Others, specify _____

28 **6.4. Who recommended you to use medicinal plants during pregnancy?**

- 29 A. Family members (mother, father, husband, grandmother, etc.)
30
31 B. Neighbours
32
33 C. Friends
34
35 D. My-self
36
37 E. Others, specify _____

38 **6.5. If anyone recommended you, did you get information how to use medicinal plants?**

- 39 A. Yes
40
41 B. No
42
43 C. Others, specify _____
44

45 **6.6. Were you satisfied with medicinal plant treatment outcomes? (If YES, skip to Q.**

46 **6.8)**

47 A. Yes B. No
48

49 **6.7. Why you were not satisfied?**

- 50
51 6.7.1. Got abortion A. Yes B. No
52
53 6.7.2. Uterine hyper-stimulation A. Yes B. No
54
55 6.7.3. Fetal distress A. Yes B. No
56
57 6.7.4. Stillbirth A. Yes B. No
58
59 6.7.5. Uterine rupture A. Yes B. No
60
6.7.6. Any other reason, specify _____

1
2
3
4
5 **6.8. Will you use medicinal plants in your future pregnancy?** A. Yes B. No
6
7

8
9 **6.9. If your answer is No to Q 6.1, why didn't you use medicinal plants in pregnancy?**

- 10 A. Fear of complications to the baby
11 B. Religious belief
12 C. Not aware of their use in pregnancy
13 D. Counseled by the health worker
14 E. Others, specify _____
15
16
17
18

19 **6.10. Outcomes of previous pregnancy for non-users of medicinal plants?**

- 20 A. Alive
21 B. Neonatal death
22 C. Stillbirth
23 D. Abortion
24 E. Others, specify _____
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Part VII. Details of medicinal plants used among pregnant women

Instructions for enumerators: please interview and fill the following table carefully for those women who claimed that they are using medicinal plants during pregnancy, (that is those who said “yes” to question number 6.1)

	Questions on medicinal plants and medicinal plant utilization <i>(Please write the appropriate response accordingly or letters of the corresponding variable option or the variable option itself under each medicinal plant the woman mentions in the “Information about medicinal plants used by the woman” column on the right side of this page)</i> NB: Multiple responses are possible throughout this part	Information about medicinal plants used by the woman <i>(If the woman mentions more types of medicinal plants, please use additional questionnaire and record the same code number to the second questionnaire)</i>					
7.1	<p>Could you tell me any medicinal plant that you have used in your pregnancy, for the management of your pregnancy illnesses or for the benefit of the foetus or for any other related purpose?</p> <p>NB: Please read the following medicinal plants for the interviewee and write down any Name of the plant(s) (local name and the language used) from the below list or other medicinal plants that she mentions</p> <p>1. Damakessie 8. Dingetegna 14. Ariti 20. Qarafa 2. Zingibil 9. Chikugn 15. Feto 21. Temenhie 3. Nech shinkrut 10. Bisena/Misan 16. Papaya 22. Etsefaris/astenagr 4. Abish a 17. Ensilal 23. Areg Riesa 5. Tikur Azmud 11. Kebericho 18. Dimbelal 24. Senafitch 6. Tena-Adam 12. Kosso 19. Telba 25. Besobila 7. Nech-bahr zaf 13. Grawa</p>	1.	2.	3.	4.	5	6

7.2	<p>For which type of pregnancy illness, do you use the medicinal plant?</p> <p><i>NB: please read the following pregnancy related illnesses to the woman and write down any from the below list or other ailments that she mentions</i></p> <table border="0"> <tr> <td>1. Pain (in back, neck or shoulder)</td> <td>9. Joint pain</td> <td>16. Insomnia/Sleeping problems</td> </tr> <tr> <td>2. Headaches/Migraine</td> <td>10. Common cold/flu</td> <td>17. Expel retained placenta</td> </tr> <tr> <td>3. Heartburn/reflux problems</td> <td>11. Constipation/obstipation</td> <td>18. Prepare for labour</td> </tr> <tr> <td>4. Gastritis/burning sensation</td> <td>12. Gestational hypertension (Preeclampsia)</td> <td>19. Leg/foot swelling</td> </tr> <tr> <td>5. Urinary tract infection</td> <td>13. Gestational diabetes</td> <td>20. Wellbeing and nourishing foetus</td> </tr> <tr> <td>6. Nausea</td> <td>14. Abdominal cramps/ache</td> <td>21. General wellbeing</td> </tr> <tr> <td>7. Vomiting</td> <td>15. Postpartum bathing</td> <td>22. Mental wellbeing</td> </tr> <tr> <td>8. Induction of labour</td> <td></td> <td>23. Emergency illnesses</td> </tr> <tr> <td></td> <td></td> <td>24. Depression</td> </tr> </table>	1. Pain (in back, neck or shoulder)	9. Joint pain	16. Insomnia/Sleeping problems	2. Headaches/Migraine	10. Common cold/flu	17. Expel retained placenta	3. Heartburn/reflux problems	11. Constipation/obstipation	18. Prepare for labour	4. Gastritis/burning sensation	12. Gestational hypertension (Preeclampsia)	19. Leg/foot swelling	5. Urinary tract infection	13. Gestational diabetes	20. Wellbeing and nourishing foetus	6. Nausea	14. Abdominal cramps/ache	21. General wellbeing	7. Vomiting	15. Postpartum bathing	22. Mental wellbeing	8. Induction of labour		23. Emergency illnesses			24. Depression						
1. Pain (in back, neck or shoulder)	9. Joint pain	16. Insomnia/Sleeping problems																																
2. Headaches/Migraine	10. Common cold/flu	17. Expel retained placenta																																
3. Heartburn/reflux problems	11. Constipation/obstipation	18. Prepare for labour																																
4. Gastritis/burning sensation	12. Gestational hypertension (Preeclampsia)	19. Leg/foot swelling																																
5. Urinary tract infection	13. Gestational diabetes	20. Wellbeing and nourishing foetus																																
6. Nausea	14. Abdominal cramps/ache	21. General wellbeing																																
7. Vomiting	15. Postpartum bathing	22. Mental wellbeing																																
8. Induction of labour		23. Emergency illnesses																																
		24. Depression																																
7.3	<p>In which trimester of pregnancy do you use it?</p> <p>A. First trimester</p> <p>B. Second trimester</p> <p>C. Third trimester</p> <p>D. Throughout pregnancy</p> <p>E. Others, specify _____</p>																																	
7.4	<p>For how many episodes (how many times) do you take it during your pregnancy?</p> <p>A. Once</p> <p>B. Twice</p>																																	

	C. Trice						
	D. Every time when I feel sick						
	E. Others, specify _____						
7.5	What part of the plant do you use?						
	A. Flower						
	B. Fruit						
	C. Seed						
	D. Leaf						
	E. Root						
	F. Stem						
	G. Bark: which one? i) Root bark ii) Stem bark iii) Both types of barks						
	H. Others, specify _____						
7.6	What is the Mode of use?						
	A. Dried						
	B. Fresh						
	C. Both Fresh and Dried						
7.7	7.7.1. What dosage forms of the medicinal plant do you use?						
	A. Solid (powder, granules, etc.)						
	B. Liquid (suspension, emulsion, solution, etc.)						
	C. Semisolid (ointment, cream, etc.)						
	D. Gaseous (smoking, inhalation, etc.)						
	E. Others, specify _____						

	7.7.2. What preparation methods do you use for each medicinal plant (please ask the woman and write down details of preparation procedures for each medicinal plant)						
	A. Maceration						
	B. Decoction						
	C. Infusion (tea form)						
	D. Squeezing						
	E. Powdering						
	F. Others, specify _____						
7.8	7.8.1. Is there any drug or medicinal plant or other additive mixed with this medicinal plant during formulation? A. Yes B. No						
	7.8.2. If Yes, please mention it with the importance of its incorporation _____						
7.9	What is the route of administration, with a brief explanation if possible? A. Oral B. Topical C. Nasal D. Inhalation E. Others, specify _____						
7.10	Medicinal plants formulation related questions: 7.10.1. What is the dosage? (please write details) _____ 7.10.2. What is the frequency of administration per day? (please write details) _____ 7.10.3. What is the duration of treatment? (please write details) _____						
7.11	What is the solvent you used for the preparation? A. Water B. Oil C. Coffee						

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46

	D. Tea						
	E. Milk						
	F. Soup						
	G. Others, specify _____						
7.12	7.12.1. Is there any contraindications or any dietary restriction imposed during medicinal plants treatment? A. Yes B. No						
	7.12.2. If yes, please tell me details _____						
7.13	7.13.1. Do you have any information about precautions to be taken during treatment? A. Yes B. No						
	7.13.2. If yes, please tell me details _____						
7.14	7.14.1. Have you encountered/experienced any side effects during treatment? A. Yes B. No						
	7.14.2. If yes, please tell me details _____						
7.15	7.15.1. Have you encountered/experienced any adverse effects during treatment? A. Yes B. No						
	7.15.2. If yes, please tell me details _____						
7.16	7.16.1. Is there any antidotes to the adverse (unwanted) effects of the medicinal plant? A. Yes B. No						
	7.16.2. If yes, please tell me details _____						

7.17	7.17.1. Is there any interactions (medicinal plants -conventional medicine and/ or medicinal plants - medicinal plants interaction) you experienced/expected during treatment?						
	7.17.2. If yes, please tell me details _____						
7.18	7.18.1. Have you ever used medicinal plant for foetal advantage purpose? A. Yes B. No						
	7.18.2. If yes, which medicinal plant?						
	7.18.3. What is the proposed advantage of the medicinal plant for the foetus? _____						
7.19	7.19.1. Is there any medicinal plants contraindicated during pregnancy? A. Yes B. No						
	7.19.2. If yes, why? please tell me details _____						
7.20	7.20.1. Is there any medicinal plants contraindicated during lactation? A. Yes B. No						
	7.20.2. If yes, why? please tell me details _____						
7.21	Anything you want to tell us before we conclude the interview? _____						

I thank you for your time and cooperation!

Data collector: Name _____ **Signature** _____ **date** _____

Additional table 2: Data extraction form for patient medical record review

Basic admission details and patient characteristics:

- Study Id ; Admission ward: Maternity/labour ; Gynaecology
- Age ; Weight ; Height
- Admission date Discharge date Duration of hospitalization
- Gestational age (in weeks)
- Gravidity: ; Parity
- Type of patient: Antenatal Postnatal
- Type of delivery: Vaginal delivery Cesarean delivery
- Breast feeding :Yes No
- Known drug allergies: Yes No ; Type of drug allergy

Details of admission (including vital signs):

Pregnancy outcomes and other obstetrics data (live birth, stillbirth, twin birth, postpartum haemorrhage, congenital abnormalities/birth defects, hypertension/eclampsia/HELLP, diabetes, placental abruption, etc.):

Any other maternal and perinatal outcomes:

Relevant laboratory results and investigations (Renal function test, Liver function test, Complete Blood Count (CBC), Echocardiography, Lipid Profile, Cardiac function, Electrolyte test, Glycaemic level, etc.):

Data collector: Name _____ **Signature** _____

Supplementary table 3A: Safety classification of medicinal plants used among pregnant women admitted in JUMC, Ethiopia

Type of medicinal plant used	Safety class*	Number of users (N=319)	Percentage#
<i>Linum usitatissimum</i> L. (Telba)	Caution	246	77.1
<i>Ocimum lamiifolium</i> L. (Damakessie)	Unavailable	40	12.5
<i>Carica papaya</i> L. (Papaya)	Caution	35	11.0
<i>Zingiber officinale</i> Roscoe. (Zingibil)	Safe	29	9.1
<i>Allium sativum</i> L. (Nech shinkrut)	Safe	28	8.8
<i>Trigonella foenum-graecum</i> L. (Abish)	Harmful	24	7.5
<i>Nigella sativa</i> L. (Tikur Azmud)	Unavailable	21	6.4
<i>Ruta chalepensis</i> L. (Tenadam)	Harmful	15	4.7
<i>Eucalyptus globulus</i> Labill. (Nech-bier zaf)	Safe	13	4.1
<i>Cinnamomum verum</i> J.Presl (Qarafa)	Harmful	4	1.3
<i>Taverniera abyssinica</i> A. Rich. (Dingetegna)	Unavailable	3	0.9
<i>Artemisia abyssinica</i> Sch.Bip. ex A.Rich. (Chikugn)	Harmful	3	0.9
<i>Croton macrostachyus</i> Hochst. (Bisena/Misana)	Harmful	3	0.9
<i>Echinops kebericho</i> Mesfin (Kebericho)	Harmful	3	0.9
<i>Hagenia abyssinica</i> (Bruce ex Steud.) J.F.Gmel. (Kosso)	Harmful	2	0.6
<i>Vernonia amygdalina</i> Del. (Grawa)	Unavailable	2	0.6
<i>Saccharum officinarum</i> L. (Sugar cane)	Safe	2	0.6
<i>Brassica nigra</i> (L.) K.Koch (Senafitch)	Unavailable	1	0.3
<i>Zehneria scabra</i> Sond. (Areg Riesa)	Unavailable	1	0.3
<i>Artemisia afra</i> Jacq. ex Willd. (Ariti)	Harmful	1	0.3
<i>Lepidium sativum</i> L. (feto)	Unavailable	1	0.3
<i>Guizotia abyssinica</i> (L.f.) Cass. (Nug)	Unavailable	1	0.3
<i>Vicia faba</i> L. (faba Beans)	Unavailable	1	0.3
<i>Ananas comosus</i> (L.) Merr. (Annanas)	Caution	1	0.3
<i>Phoenix dactylifera</i> L. (Temir)	Safe	1	0.3
<i>Pycnostachys abyssinica</i> Fresen. (Yeroo)	Unavailable	1	0.3
Bahuu/B'auu (Oromiffa language name)	Unavailable	1	0.3

***Safe:** safe to use in pregnancy; **Caution:** requires cautious to use in pregnancy; **Unavailable;** information on safety to use in pregnancy was not available in the current literature;

Harmful: potentially harmful to use in pregnancy [Contraindicated]; #Total percentage may exceed 100% due to multiple responses

Supplementary table 3B: Description of Safety classification of the used medicinal plants

Classification	Description
Safe to use in pregnancy	Available human evidence suggests the medicinal plant can be safely used in pregnancy
Use with Caution	Available human evidence for the medicinal plant is limited so it should not be used without consulting a qualified health care practitioner
Potentially harmful to use in pregnancy	Available evidence has shown adverse impacts on pregnancy or fetus following the use of the medicinal plant
Information unavailable	No reference was found regarding use of the medicinal plant in pregnancy

Source [adapted from]: Kennedy DA, Lupattelli A, Koren G, Nordeng H. Safety classification of herbal medicines used in pregnancy in a multinational study. *BMC Complement Altern Med.* 2016; 16: 102.

Supplementary table 4: Overview of the utilization pattern of the most frequently used medicinal plants during pregnancy in JUMC, Ethiopia

Utilization properties (No. of citations) *

Scientific name, English name, Number of users, (n = 319)	Part of plant	Plant condition	Solvent	Excipients and reason for addition**	Routes of administration	Dose and measure of formulation	Frequency***	Duration of treatment***	Number of occasions of use in pregnancy****
<i>L. usitatissimum</i> (Flaxseed) (N=246)	Seed (244)	Dried (234) Fresh or dried (10) Fresh (2)	Water (192) Soup (53)	Sugar (86), sweetener Salt (6), flavourant Butter (2), flavourant Yogurt (1), flavourant Sugar or Salt (1), sweetener/flavourant/	Oral (245) Topical (1)	1 WGJC (176) 1 CC (38) ANSA (7) 2 WGJC (7) 1 TSP (4)	Once (151) Twice (60) Every time (20) Trice (9) 1 to 2 times (3)	During labour (92) Every time (40) Two months (39) Three months (19) Two days (17)	Once (138) Twice (44) Many times (38) Trice (19)
<i>O. lamifolium</i> (No common English name) (N=40)	Leaf (39)	Fresh (30) Fresh or dried (8)	Water (27) NSD (8)	-	Oral (18) Nasal/Inhalati on (13)	ANSA (13) 1 CC (11) 1 to 2 CC (4)	Once (19) Every time (16)	Every time (22) One day (8)	Many times (17) Once (16)
<i>C. papaya</i> (Papaya) (N=35)	Fruit (32) Stem or Root Bark (2)	Fresh (32) Fresh or dried (2)	Water (6) NSD (29)	Sugar (8), sweetener Annans (1), for better effect	Oral (35)	1 WGJC (22) ANSA (9)	Once (24) Twice (5) Every time (3)	During labour (17) Two months (6) Every time (5)	Once (22) Many times (8)
<i>Z. officinale</i> (Ginger) (N=29)	Root or tuber (27)	Fresh or dried (14) Dried (9) Fresh (6)	Water (17) Tea (6)	Garlic (1), for better effect	Oral (27) Nasal/Inhalati on (2)	1 CC (11) ANSA (7) 1 WGJC (4)	Once (11) Every time (9) Twice (5)	Every time (19) One day (5)	Many times (21) Once (4)
<i>A. sativum</i> (Garlic) (N=28)	Root or tuber (28)	Fresh or dried (16) Dried (7) Fresh (5)	Water (14) NSD (7)	Honey (2), sweetener Ginger (1), for better effect	Oral (27)	ANSA (9) 1 CC (5) 1 head of garlic (3)	Every time (11) Once (9) Twice (5)	Every time (18) One day (3)	Many times (22)
<i>T. foenum-graecum</i> (Fenugreek) (N=24)	Seed (21)	Dried (22)	Water (19) Soup (5)	Sugar (2), sweetener	Oral (23)	1 WGJC (16) 1 CC (5) ANSA (2)	Once (13) Twice (8) Every time (3)	During labour (14) 3 months (4) Every time (3)	Once (19) Many times (4)
<i>N. sativa</i> (Black seed) (N=21)	Oil (11) Seed (9)	Oil (11) Dried (7)	Water (7) NSD (8)	Cheese (1), flavourant	Oral (16)	ANSA (4) 1 TSP (3)	Every time (10) Once (6)	Every time (17) One day (3)	Many times (13)
<i>R. chalepensis</i> (Fringed rue) (N=15)	Leaf (15)	Fresh (12) Fresh or dried (3)	Water (11) Coffee (4)	Garlic (1), for better effect	Oral (15)	1 WGJC (6) 1 CC (4) ANSA (4)	Once (9) Every time (5)	Every time (10) Two days (2)	Many times (9) Once (4)
<i>E. globulus</i> (“Eucalyptus”/ blue gum) (N=13)	Leaf (12)	Fresh (12)	Water (11)	<i>O. lamifolium</i> and <i>Leucas martinicensis</i> (Jacq.) R.Br. (1), for better effect <i>O. lamifolium</i> (1), for better effect	Nasal/Inhalati on (10)	ANSA (12)	Every time (9) Once (4)	Every time (7) One day (5)	Many times (9) Once (3)

Abbreviations: WGJC: water glass/water jug cup (≈250mL), 1WGJC: One water glass/water jug cup, CC: Coffee cup, ANSA: take as ‘needed in safe amount’ using any appropriate measuring device for the appropriate duration the woman believes, SSp: Soup Spoon, NSD: No solvent needed, TSP: Teaspoon full. *Numbers may not add up due to missing values. **For better effect: Added to produce either synergistic or additive effect. ***Every time: a duration or frequency of treatment whereby the pregnant woman takes the MP for many frequencies per day that she believes is appropriate for a period of time until she feels cured. ****use for a given duration is taken as one occasion, for example use of the medicinal plant for a week, one month, two months, three months or more duration is taken as one occasion. On the other hand, if a woman uses for 2 weeks in the first month of pregnancy, and in the 2nd, 3rd, 4th and 5th months of pregnancy, each for one-week duration then the number of occasions will be five.

Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the STROBE cross sectional reporting guidelines, and cite them as:

von Elm E, Altman DG, Egger M, Pocock SJ, Gotsche PC, Vandembroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies.

		Page
	Reporting Item	Number
Title and abstract		
Title	#1a Indicate the study's design with a commonly used term in the title or the abstract	1

1	Abstract	#1b	Provide in the abstract an informative and balanced summary	2
2				
3			of what was done and what was found	
4				
5				
6	Introduction			
7				
8				
9				
10	Background /	#2	Explain the scientific background and rationale for the	5
11	rationale		investigation being reported	
12				
13				
14				
15	Objectives	#3	State specific objectives, including any prespecified	5
16			hypotheses	
17				
18				
19				
20	Methods			
21				
22				
23	Study design	#4	Present key elements of study design early in the paper	5, 6
24				
25				
26	Setting	#5	Describe the setting, locations, and relevant dates, including	5, 6
27			periods of recruitment, exposure, follow-up, and data	
28			collection	
29				
30				
31	Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of	6, 7
32			selection of participants.	
33				
34				
35				
36				
37				
38				
39				
40		#7	Clearly define all outcomes, exposures, predictors, potential	7-10
41			confounders, and effect modifiers. Give diagnostic criteria, if	
42			applicable	
43				
44				
45				
46				
47	Data sources /	#8	For each variable of interest give sources of data and details	8-10
48	measurement		of methods of assessment (measurement). Describe	
49			comparability of assessment methods if there is more than	
50			one group. Give information separately for for exposed and	
51			unexposed groups if applicable.	
52				
53				
54				
55				
56				
57				
58				
59				
60				

1	Bias	#9	Describe any efforts to address potential sources of bias	7, 10
2				
3				
4	Study size	#10	Explain how the study size was arrived at	7
5				
6				
7	Quantitative	#11	Explain how quantitative variables were handled in the	10, 11
8	variables		analyses. If applicable, describe which groupings were	
9			chosen, and why	
10				
11				
12				
13				
14				
15	Statistical	#12a	Describe all statistical methods, including those used to	10, 11
16	methods		control for confounding	
17				
18				
19				
20	Statistical	#12b	Describe any methods used to examine subgroups and	10, 11
21	methods		interactions	
22				
23				
24				
25				
26	Statistical	#12c	Explain how missing data were addressed	n/a
27	methods			
28				
29				
30				
31	Statistical	#12d	If applicable, describe analytical methods taking account of	10, 11
32	methods		sampling strategy	
33				
34				
35				
36	Statistical	#12e	Describe any sensitivity analyses	n/a
37	methods			
38				
39				
40				
41				
42	Results			
43				
44				
45	Participants	#13a	Report numbers of individuals at each stage of study—eg	11
46			numbers potentially eligible, examined for eligibility,	
47			confirmed eligible, included in the study, completing follow-	
48			up, and analysed. Give information separately for for	
49			exposed and unexposed groups if applicable.	
50				
51				
52				
53				
54				
55				
56				
57	Participants	#13b	Give reasons for non-participation at each stage	11
58				
59				
60				

1	Participants	#13c	Consider use of a flow diagram	n/a
2				
3				
4	Descriptive data	#14a	Give characteristics of study participants (eg demographic,	n/a
5			clinical, social) and information on exposures and potential	
6			confounders. Give information separately for exposed and	
7			unexposed groups if applicable.	
8				
9				
10				
11				
12				
13				
14	Descriptive data	#14b	Indicate number of participants with missing data for each	11
15			variable of interest	
16				
17				
18				
19	Outcome data	#15	Report numbers of outcome events or summary measures.	21
20			Give information separately for exposed and unexposed	
21			groups if applicable.	
22				
23				
24				
25				
26				
27	Main results	#16a	Give unadjusted estimates and, if applicable, confounder-	21
28			adjusted estimates and their precision (eg, 95% confidence	
29			interval). Make clear which confounders were adjusted for	
30			and why they were included	
31				
32				
33				
34				
35				
36				
37	Main results	#16b	Report category boundaries when continuous variables were	21
38			categorized	
39				
40				
41				
42	Main results	#16c	If relevant, consider translating estimates of relative risk into	n/a
43			absolute risk for a meaningful time period	
44				
45				
46				
47				
48	Other analyses	#17	Report other analyses done—e.g., analyses of subgroups	n/a
49			and interactions, and sensitivity analyses	
50				
51				
52				
53	Discussion			
54				
55				
56	Key results	#18	Summarise key results with reference to study objectives	15
57				
58				
59				
60				

1	Limitations	#19	Discuss limitations of the study, taking into account sources	3
2			of potential bias or imprecision. Discuss both direction and	
3			magnitude of any potential bias.	
4				
5				
6				
7				
8				
9	Interpretation	#20	Give a cautious overall interpretation considering objectives,	18
10			limitations, multiplicity of analyses, results from similar	
11			studies, and other relevant evidence.	
12				
13				
14				
15				
16	Generalisability	#21	Discuss the generalisability (external validity) of the study	18
17			results.	
18				
19				
20				
21				
22	Other Information			
23				
24				
25	Funding	#22	Give the source of funding and the role of the funders for the	19
26			present study and, if applicable, for the original study on	
27			which the present article is based	
28				
29				
30				
31				
32				

33 The STROBE checklist is distributed under the terms of the Creative Commons Attribution License
34 CC-BY. This checklist was completed on 31. October 2020 using <https://www.goodreports.org/>, a tool
35 made by the [EQUATOR Network](#) in collaboration with [Penelope.ai](#)
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

BMJ Open

Medicinal plants used among pregnant women in a tertiary teaching hospital in Jimma, Ethiopia: a cross-sectional study

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2020-046495.R1
Article Type:	Original research
Date Submitted by the Author:	09-Mar-2021
Complete List of Authors:	Ahmed, Seid Mussa; University of Oslo, Faculty of Medicine, Institute of Health and Society, Department of Community Medicine and Global Health; Jimma University, Institute of Health, Faculty of Health Sciences, School of Pharmacy, Division of Social and Administrative Pharmacy Sundby, Johanne; University of Oslo, Faculty of Medicine, Institute of Health and Society, Department of Community Medicine and Global Health Aragaw, Yesuf; Jimma University, Institute of Health, Faculty of Medical Sciences, Department of Obstetrics and Gynaecology Nordeng, Hedvig; University of Oslo Faculty of Mathematics and Natural Sciences, Department of Pharmacy, Pharmacoepidemiology and Drug Safety Research Group
Primary Subject Heading:	Complementary medicine
Secondary Subject Heading:	Health services research
Keywords:	COMPLEMENTARY MEDICINE, Maternal medicine < OBSTETRICS, Adverse events < THERAPEUTICS, PRIMARY CARE, PUBLIC HEALTH

SCHOLARONE™
Manuscripts



I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our [licence](#).

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which [Creative Commons](#) licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

1
2
3 **1 Medicinal plants used among pregnant women in a tertiary teaching hospital in Jimma,**
4
5 **2 Ethiopia: a cross-sectional study**
6
7
8
9

10 4 Seid Mussa Ahmed ^{1,2*}, Johanne Sundby ¹, Yesuf Ahmed Aragaw ³, Hedvig Nordeng ⁴

11
12 ¹Department of Community Medicine and Global Health, Institute of Health and Society,
13
14 Faculty of Medicine, University of Oslo, Norway;

15
16
17 ²Division of Social and Administrative Pharmacy, School of Pharmacy, Faculty of Health
18
19 Sciences, Institute of Health, Jimma University, Ethiopia;

20
21 ³Department of Obstetrics and Gynaecology, Faculty of Medical Sciences, Institute of Health,
22
23 Jimma University, Ethiopia;

24
25
26 ⁴Pharmacoepidemiology and Drug Safety Research Group, Department of Pharmacy, Faculty
27
28 of Mathematics and Natural Sciences, University of Oslo, Norway
29
30

31
32
33
34 * Corresponding author

35
36 E-mail: seidma@studmed.uio.no

37
38 Postal address: P.O box 1130, Blindern, 0318 OSLO, Norway

39
40 Fax number: +47-22850590

41
42 Telephone (Office): +47-22850688

43
44 16-digit ORCID: 0000-0003-3426-5296

45
46
47 E-mail addresses:

48
49 SMA: seidma@studmed.uio.no

50
51 HN: h.m.e.nordeng@farmasi.uio.no

52
53 JS: johanne.sundby@medisin.uio.no

54
55 YAA: yesufahmed47@yahoo.com
56
57
58
59
60

1
2
3 **26 Abstract**
4

5 **27 Objective** The aim of this study was to investigate and describe the use of medicinal plants
6
7
8 during pregnancy among women admitted in the Maternity and Gynaecology wards at Jimma
9
10 University Medical Centre (JUMC) in the southwest Ethiopia.

11
12 **30 Design** Cross-sectional study

13
14 **31 Setting** Maternity and Gynaecology wards at JUMC.

15
16 **32 Participants** 1,117 hospitalized pregnant women or postpartum women

17
18 **33 Main outcome measures** our primary outcomes of interest were the prevalence of use, types
19
20 of medicinal plants used and their utilization among pregnant women.
21
22

23
24 **35 Methods:** Data were collected through structured face-to-face interviews of pregnant women
25
26 or postpartum women and review of patient medical records between February and June 2017.
27

28
29 **37 Results:** Overall, 28.6% of the women reported use of at least one medicinal plant during
30
31 pregnancy. Twenty-seven different types of medicinal plants were used. The most commonly
32
33 used medicinal plants were *Linum usitatissimum* L. (flaxseed– use with caution) 22.0%,
34
35 *Ocimum lamiifolium* L. (*damakessie*– safety unknown) 3.6%, and *Carica papaya* L. (papaya–
36
37 use with caution) 3.1%. The most common reasons for use was preparation, induction or
38
39 shortening of labour. Lack of access to health facility (mainly health posts), admission to
40
41 maternity ward, *khat* chewing, and alcohol consumption were the strongest predictors of
42
43 medicinal plants use during pregnancy (OR >2). Only five medicinal plants used by women
44
45 had sufficient evidence to be classified as safe to use in pregnancy.
46
47

48
49 **46 Conclusions:** Almost a third of women at the tertiary hospital in Ethiopia reported use of
50
51 medicinal plants during pregnancy, most frequently to prepare, induce, reduce the intensity or
52
53 shorten duration of labour. Increased awareness about potential benefits or risks of medicinal
54
55 plants use during pregnancy among health care professionals and patients, and increased access
56
57
58
59
60

1
2
3 50 to childbirth providing health care facilities are important in order to promote safer pregnancies
4
5 51 and better health outcomes for women and their unborn children.
6
7
8 52
9
10 53

11
12 54 **Strengths and limitations of this study**
13

- 14
15 55 • It was the first study in Ethiopia that used large sample size, assessed the use of
16
17 56 medicinal plants among pregnant women in an in-patient setting and attempted to
18
19 57 classify the medicinal plants
20
21 58 • The data collectors, pharmacists and nurses, were from the study area with previous
22
23 59 data collection experience. Their knowledge about the healthcare system, culture,
24
25 60 local languages, and medicinal plants was vital for the face-to-face interviews with
26
27 61 the women and clearly contributed to improving the response rate and the quality of
28
29 62 collected data.
30
31 63 • Although it was conducted in a large tertiary teaching hospital in southwest Ethiopia,
32
33 64 it may not be representative of the entire country, nor women who access healthcare
34
35 65 in secondary or primary care.
36
37 66 • Data were collected based on self-report of pregnant women and thus depended on
38
39 67 her recall and accuracy of reporting, as well as her knowledge about these medicinal
40
41 68 plants, therefore, medicinal plant use early in pregnancy was probably underreported.
42
43 69 • Among the post-partum women, there may be a risk of recall bias as women with
44
45 70 negative pregnancy outcomes may try to recall use to a greater extent than women
46
47 71 with a healthy infant.
48
49
50
51
52
53
54 72
55
56
57
58
59
60

74 **Background**

75 Medicinal plants have been used for preventive and therapeutic purposes since time
76 immemorial [1]. Medicinal plants refer to a variety of plants that have medicinal characteristics
77 [2]. The World Health Organization estimates that 65–80% of the world's population in
78 developing countries depend on medicinal plants for primary healthcare [3]. Women are
79 recognized to be the main users of medicinal plants, and this widespread use also extends into
80 pregnancy [4, 5].

81
82 Ethiopia is a landlocked country with a population of approximately 110 million [6]. It is a
83 multi-ethnic, multicultural and multi-religious nation where Christians predominate in the
84 northern highlands and central Ethiopia and Muslims predominate in the north-east, east, south-
85 east and southwest [7]. More than 80% of the population lives in rural areas and 70% of the
86 population are employed in agriculture [6]. The birth rate is 31 births per 1000 inhabitants and
87 infant mortality rate is 35 deaths per 1000 live births [6]. Maternal mortality rate is high with
88 4 deaths per 1000 live births (world ranking 26th) [6]. Total fertility rate is 4 children born per
89 woman, and mother's mean age at first birth is 20 years [6]. Physician density is only one per
90 12,500 inhabitants [6]. Around 80% of the population in Ethiopia use traditional medicine, of
91 which over 95% are of plant origin [8]. The extensive use of medicinal plants in the country
92 is often linked to an array of unique flora [8], cultural acceptability of healers and local
93 pharmacopoeias, the belief that medicinal plants are natural and thus safer to use and are
94 physically accessible and economically affordable [4, 5, 9].

95
96 Maternal mortality (353 deaths per 1000,000 live births) and neonatal mortality (28 deaths per
97 1,000 live births) in Ethiopia are among the highest in the world and are associated with a range
98 of factors [10]. In most African countries like Ethiopia, modern healthcare facilities and

1
2
3 99 medicine are inaccessible or unaffordable [4, 11]. For this reason, many women rely on
4
5 100 medicinal plants for their primary healthcare needs as an accessible and lower cost alternative
6
7
8 101 [4] and only seek professional health services when the situation worsens [11].
9

10
11 102
12 103 Studies conducted in Ethiopia reported prevalence of medicinal plants use in pregnancy
13
14 104 ranging from 2% to 73% [4], with ginger being the most commonly used plant, and nausea and
15
16 105 vomiting in pregnancy (NVP) and common cold the most common reasons for use [9, 11, 12].
17
18 106 Many sociodemographic characteristics including residence place, marital status, family size,
19
20 107 education level, age, and employment status were found to be strong predictors of use [4, 12-
21
22 108 15]. Prevalence figures ranging from 4% to 100% were reported in other African countries [4].
23
24 109 Studies in developed countries where medicinal plant traditions may play a less strong role also
25
26 110 reported a widespread use of medicinal plants in pregnancy, with Australia 11% - 56% [16],
27
28 111 the US and Canada 4% - 96% [16, 17], and Europe 0.9% - 69% [16, 18].
29
30
31
32

33 112
34
35 113 Concerns have been raised about safety of medicinal plants during pregnancy [4, 18-21]. A
36
37 114 recent multinational study reported that only 22% of the medicinal plants used by pregnant
38
39 115 women were found safe to use in pregnancy [21]. Similarly, a study from Asia showed that
40
41 116 only 39% of the most commonly used medicinal plants by expectant women were safe to use
42
43 117 in pregnancy [19].
44
45
46

47 118
48
49 119 Although medicinal plants play a significant role in traditional medicine during pregnancy,
50
51 120 childbirth and postpartum care [4, 20], research on their use in the management of pregnancy
52
53 121 related illnesses is still largely limited [4, 12, 22]. The aims of this study were therefore to
54
55 122 determine the prevalence of use and types of medicinal plants used among pregnant women
56
57 123 admitted in the Maternity and Gynaecology wards at Jimma University Medical Centre
58
59
60

1
2
3 124 (JUMC), Southwest Ethiopia. This included identifying women's information on the most
4
5 125 commonly used medicinal plants, the reasons for use, and factors associated with such use. The
6
7
8 126 secondary aims were to assess women safety concerns and, who recommended use of the
9
10 127 medicinal plants during pregnancy.
11

128

129 **Subjects and methods**

130 **Study design and setting**

131 A hospital based cross-sectional study was conducted in the Maternity and Gynaecology wards
132 at Jimma University Medical Centre (JUMC). JUMC is one of the oldest and largest public
133 teaching University hospitals in the country located in Jimma city, 350 kilometres south-west
134 of Addis Ababa (the capital city of Ethiopia) [23, 24]. The referral hospital provides tertiary
135 level medical care for about 20 million people coming from the whole south-west Ethiopia
136 [23]. Obstetrics and Gynaecology department of the medical center has a patient load of
137 approximately 7,600 inpatients and 11,600 outpatients each year with bed capacity of around
138 265 [24].

139

140 Obstetrics and Gynaecology department has two inpatient wards; Gynaecology ward and
141 Maternity ward (which includes maternity, labour and delivery ward and maternity operation
142 theatre) [23]. Obstetric patients with 28 weeks of pregnancy or higher as well as women in
143 labour are admitted in the maternity ward. On the one hand, women with a gestational length
144 of less than 28 weeks are cared for at the gynaecology ward. The gynaecology ward also
145 manages and treats gynaecological disorders in non-pregnant women.

146

147 **Study population and sample size**

1
2
3 148 Hospitalized pregnant or postpartum women in the Maternity and Gynaecology wards at JUMC
4
5 149 were invited to participate in the study during normal working hours. Participants were
6
7
8 150 consecutively informed about the aim and procedures of the study and written informed consent
9
10 151 was obtained from each study participant. Pregnant or postpartum patients aged ≥ 18 years
11
12 152 admitted in the Maternity/Labour and Gynaecology wards at the time of data collection and
13
14 153 willing to participate were included in the study. On the other hand, women who were too ill
15
16 154 to participate, hard of hearing, unable to speak or mentally disabled, under 18 years of
17
18 155 age, admitted for less than four hours, and non-pregnant women admitted in the gynaecology
19
20 156 ward were excluded from the study.
21
22
23
24
25

26 158 Single population proportion Kish formula [25] was used to determine the sample size based
27
28 159 on the following assumptions; 50% expected prevalence medicinal plant use (since there is no
29
30 160 previous study conducted on the prevalence of medicinal plant use among hospitalized
31
32 161 pregnant patients prior to admission), 5% level significance, 80% power, and an error margin
33
34 162 of 3%. After adding a 5% non-response rate, a final sample size of 1,121 pregnant women was
35
36 163 required.
37
38
39
40
41

42 165 **Data collection and procedures**

43
44 166 Hospitalized pregnant and post-partum women were consecutively interviewed from February
45
46 167 to June 2017. A pre-tested interview guided structured questionnaire, based on interviews, and
47
48 168 data extraction form were used for data collection. Nine trained pharmacists and nurses from
49
50 169 the study area, with close supervision of one of the investigators, conducted all interviews and
51
52 170 data extractions. The questionnaire contains questions about the women's background,
53
54 171 pregnancy-related illnesses, and use of medicinal plants.
55
56
57
58
59
60

1
2
3 173 After a thorough review of the literature [9, 12, 22, 26, 27], with special focus on prior studies
4
5 174 in African countries, the authors developed the survey questionnaire. It was developed in
6
7 175 English and then translated into Amharic and Afan Oromo languages (the predominant local
8
9 176 languages) to suit the target population. The questionnaires were translated back into English
10
11 177 by other persons to confirm the validity. Lecturers fluent in English and their own local
12
13 178 language from Jimma University with previous experience of translating questionnaires
14
15 179 performed the translation and back translation of the study questionnaire. The data collection
16
17 180 tool was then piloted on a sample of 30 hospitalized pregnant or lactating women
18
19 181 at *Shenen Ghibe* district hospital found in Jimma city, and based on the results from the pilot,
20
21 182 list of 25 commonly used medicinal plants and open-ended questions were included. Plant
22
23 183 scientific names were verified with The Plant List (www.theplantlist.org). Final version of the
24
25 184 questionnaire contained 77 items, with multiple choice, and open-ended questions
26
27 185 (Supplementary table 1).
28
29
30
31
32

33 186
34
35 187 Treatment related characteristics, pregnancy characteristics, pregnancy outcomes and other
36
37 188 medical information were retrieved from patients' medical record using data extraction forms.
38
39 189 Following the pre-test, the data extraction form required minor revisions to improve
40
41 190 comprehension and order (Supplementary table 2).
42
43
44
45
46

192 **Measures**

193 *Use of medicinal plant*

194 Study participants were specifically asked about the use in pregnancy of 25 commonly used
195 medicinal plants: *Linum usitatissimum* L., *Ocimum lamiifolium* L., *Zingiber officinale* Roscoe.,
196 *Allium sativum* L., *Trigonella foenum-graecum* L., *Nigella sativa* L., *Ruta chalepensis* L.,
197 *Eucalyptus globulus* Labill., *Cinnamomum verum* J.Presl, *Taverniera abyssinica* A. Rich,

1
2
3 198 *Artemisia abyssinica* Sch.Bip. ex A.Rich., *Croton macrostachyus* Hochst., *Echinops kebericho*
4
5 199 Mesfin, *Hagenia abyssinica* (Bruce ex Steud.) J.F.Gmel., *Vernonia amygdalina* Del., *Brassica*
6
7 200 *nigra* (L.) K.Koch, *Zehneria scabra* Sond., *Artemisia afra* Jacq. ex Willd., *Lepidium sativum*
8
9 201 L., *Carica papaya* L., *Foeniculum vulgare* Mill., *Coriandrum sativum* L., *Ocimum basilicum*
10
11 202 L., *Datura stramonium* L., and *Securidaca longipedunculata* Fresen. The above listed
12
13 203 medicinal plants were selected based on previous ethnopharmacological studies in Ethiopia
14
15 204 and elsewhere in Africa [9, 12, 28, 29] and were presented to the women by mentioning the
16
17 205 local names of the plants. The women were also asked if they had used any other medicinal
18
19 206 plant during pregnancy, labour or breastfeeding.
20
21
22
23
24
25

26 208 Details of use of medicinal plants was assessed by a series of questions including use of
27
28 209 medicinal plant during pregnancy, type of medicinal plant used, reason for use, and utilization
29
30 210 (*part of plant used, method of preparation, mode of use, type of solvent, type of flavouring,*
31
32 211 *dosage form, dosage, measures of formulation, route of administration, frequency of*
33
34 212 *administration, duration of treatment, and episodes of use*). Women were also asked about who
35
36 213 recommended them the use of medicinal plants in pregnancy.
37
38
39
40
41

42 215 Information about women's safety concerns and experiences with use of medicinal plants in
43
44 216 pregnancy was collected, and we included questions about beliefs about harmfulness,
45
46 217 precautions to be taken and whether she had experienced any side effects or adverse effects
47
48 218 after use of medicinal plants in pregnancy.
49
50
51
52

53 220 Reference text books [30-32] and literature reviews [4, 19, 21] were used to evaluate safety of
54
55 221 the medicinal plants in pregnancy, and classify them into four safety categories, namely safe
56
57 222 to use in pregnancy, use with caution, potentially harmful and information unavailable for use
58
59
60

1
2
3 223 in pregnancy (Supplementary table 3). Information from animal studies were used if human
4
5 224 studies were lacking. If a medicinal plant preparation was composed of two or more plants,
6
7
8 225 each plant was individually evaluated and classified.
9

10 226

11
12 227 *Women's background characteristics*

13
14 228 Socio-demographic information including age, religion, residence place, occupation, family
15
16
17 229 size, ethnic group, marital status, educational level, access to modern health facility and
18
19 230 walking distance to the facility were collected.
20

21 231

22
23
24 232 *Maternal diseases, pregnancy-related illness and treatments*

25
26 233 Detailed information about the woman's obstetrics and gynaecology history, history of adverse
27
28 234 pregnancy outcome, past medical history and medication experience, and social drug use were
29
30
31 235 included. Pregnant women were specifically asked about 24 common pregnancy ailments and
32
33 236 related symptoms: Common cold/flu, pain in back, neck, or shoulder, headache,
34
35 237 heartburn/reflux problems, abdominal cramps/ache, preparation for labour, induction of labour,
36
37 238 expel retained placenta, postpartum bathing, wellbeing and nourishing foetus, leg/foot swelling,
38
39 239 gestational hypertension, gestational diabetes, gastritis/burning sensation, constipation, general
40
41
42 240 wellbeing, nausea, vomiting, emergency illnesses, urinary tract infection, depression, joint pain,
43
44 241 sleeping problems and mental wellbeing. Participants were also asked whether they had used
45
46 242 any treatment against ailments or pregnancy related conditions, whether they had had any other
47
48 243 diseases or illnesses, and, if yes, the name of any treatment received.
49

50 244

51
52
53
54 245 In addition to the face-to-face interview questionnaire, information about pregnancy
55
56 246 characteristics, pregnancy outcomes and other obstetrics information including gestational age,
57
58 247 parity, gravidity, mode of delivery and length of hospital stay were collected using a data
59
60

1
2
3 248 extraction form. Moreover, maternal and perinatal outcomes of the current pregnancy were
4
5 249 collected. Data were extracted through review of patients' medical cards.
6
7

8 250

9 10 251 **Statistical analysis**

11
12 252 The final data were checked for completeness, and responses were entered into and analysed
13
14 253 using the Statistical Package for the Social Sciences (SPSS) software version 25.0 for Windows
15
16 254 (IBM® SPSS® Statistics, Armonk). Respondents were categorized as users if they used at least
17
18 255 one type of medicinal plant in their index pregnancy, whereas others were categorized as non-
19
20 256 users. Routine meals and vitamin supplements were excluded.
21
22
23

24 257

25
26 258 Descriptive statistics were used to calculate the prevalence (%) of medicinal plants use in
27
28 259 pregnancy, reasons for use and information sources. Univariate and multivariate logistic
29
30 260 regression analysis was used to identify significant factors associated with medicinal plant use.
31
32 261 Logistic regression was expressed as crude and adjusted odds ratios (ORs) with 95%
33
34 262 confidence intervals (CIs). First, the univariate logistic regression model was fit for all
35
36 263 explanatory variables. From this, the multivariate model was built using purposeful selection
37
38 264 of candidate variables based on a bivariate $p \leq 0.05$. We then fit a reduced model by removing
39
40 265 variables having no role ($p > 0.05$). A p-value of < 0.05 was considered statistically significant.
41
42 266 Robustness of the multivariable model was checked using the Hosmer–Lemeshow test.
43
44
45
46

47 267

48 49 268 **Patient and public involvement**

50
51 269 Although there is a community representative in the Jimma University Institute of health
52
53 270 Institutional Review Board (IRB), no patients or public were involved in the conception,
54
55 271 design, conduct, and planning of this study.
56
57

58 272
59
60

273 Results

274 From 1,137 pregnant or post-partum women invited to participate, responses from four were
 275 incomplete, and 16 declined to participate in the study resulting in 1,117 participants in the
 276 final dataset (response rate 98.6%). The median age was 25 years (interquartile range 22–30
 277 years) and slightly more than half (53.3%), lived in an urban area. The majority were married
 278 (95.5%), had access to health facility (mainly health post) (99.1%), and lived in an area within
 279 walking distance to the nearest health facility not more than 30 minutes (66.4%). A substantial
 280 number were Muslims (65.4%), from Oromo ethnic group (69.7%), and had a household size
 281 less than five (65.4%). Many study participants were illiterate (34.0%) or either attended
 282 primary school or only able to read & write (42.3%); and were housewife (46.9%) or farmer
 283 (23.4%) by occupation (Table 1).

285 **Table 1.** Characteristics of women according to medicinal plant use during pregnancy at
 286 JUMC, Ethiopia.

288 In total, 28.6% women had used one or more medicinal plant during their current
 289 pregnancy, with an average of 1.5 medicinal plants per woman (range 1 to 8). The majority of
 290 women 206 (64.6%) used one, 78 (24.5%) took two, 25 (7.8%) took three, and 7 (2.2%) took
 291 four types of medicinal plants.

292 *L. usitatissimum* (flaxseed) (77.1%), *O. lamiifolium* ('damakesie') (12.5%) and *C.*
 293 *papaya* (*papaya*) (11.0%) were the three most commonly used medicinal plants (Table 2;
 294 Supplementary table 4). The most common reasons for the use of medicinal plants were to
 295 induce labour or to reduce the intensity and shorten duration of labour (women call it
 296 "reduction of labour" - "ምጥ ለማምጣት ወይም የምጥ ጥንካሬንና እርዝማኔን ለመቀነስ" in Amharic)
 297 (60.2%) common cold/flu (20.4%) and preparation of labour (women call 'it softens the uterus'

1
2
3 298 - “ማህጻን ያለሰለሳል ፣ ስለዚህ ምጥ አይከብድም” in Amharic) (15.7%), (Table 3). Flaxseed was the
4
5 299 major plant employed to induce labour or to reduce the intensity and shorten duration of labour
6
7 300 (93.2%) and to prepare for labour (44%). Ginger (35.4%) was the commonly used plant for
8
9 301 common cold/flu management. Most of the medicinal plants were used during labour (32.2%)
10
11 302 followed by third trimester (27.2%) or in the entire pregnancy (19.8%).

12
13
14 303 Among the 125 women admitted to the gynaecology wards, 106 (84.8%) were admitted due to
15
16 304 elective terminations and/or miscarriages and 19 (15.2%) were admitted due to various
17
18 305 pregnancy-related illnesses. Among the women with elective terminations and / or
19
20 306 miscarriages, 19 (17.9%) women used one or more medicinal plants during pregnancy (range
21
22 307 1-3): 16 used safe, 9 used medicinal plants requiring cautious, 5 potentially harmful and 11
23
24 308 safety unknown medicinal plants. The 5 women who used potentially unsafe medicinal plants
25
26 309 used *Trigonella foenum-graecum* (potential risk of uterine contraction and hypoglycemia),
27
28 310 *Ruta chalepensis* (potential risk of uterine contraction and emmenagogue),
29
30 311 *Cinnamomum verum* (potential risk of foetal malformation and uterine contraction), *Artemisia*
31
32 312 *abyssinica* (potential risk of toxicity, uterine contraction and emmenagogue), *Croton*
33
34 313 *macrostachyus* (potential risk of toxicity and uterine contraction), *Echinops kebericho*
35
36 314 (potential risk of cytotoxicity) and *Hagenia abyssinica* (potential risk of toxicity and uterine
37
38 315 contraction) (Supplementary table 4).
39
40
41
42
43
44
45
46

47 317 Approximately three quarters of the medicinal plants were purchased at market places
48
49 318 (76.5%). A significant proportion of respondents (68.3%) also collected it through family
50
51 319 members. The large majority of women were recommended to use medicinal plants by their
52
53 320 family members (75.2%).
54
55
56
57

58 322 **Table 2.** Pregnancy disorders treated with medicinal plants at JUMC, Ethiopia, n=319.
59
60

323

Seeds were the major medicinal plant parts used (57.6%), dry plant material was the most common plant condition (60.1%), sugar was the most common excipient (27.8%) and oral was the predominant route of administration (89.7%).

327

The most common dosages were measurements by water glass units (51.7%). The most common dosage was one water glass dose (47.5%), once per day frequency (54.8%), and “as many months as needed during pregnancy” duration of treatment (32.9%). Approximately half of the respondents reported one episode of medicinal plant use (46.0%), whereas nearly one-third reported use at several occasions during pregnancy 155 (32.0%) (Supplementary table 5).

332

Table 3. Overview of the most frequently used medicinal plants during pregnancy according to number of users and the most common indications at JUMC, Ethiopia.

335

336 **Factors associated with medicinal plant use**

337

Women in the maternity wards, not having access to a nearby health facility, having secondary school education, having chronic illness, using conventional medicines and social drugs (*khat* chewers and alcohol consumers) were more likely to use medicinal plants in pregnancy (Table 1). Use of medicinal plants during pregnancy was not significantly associated with previous adverse pregnancy outcome, length of hospital stay, family size and gestational age.

343

344 **Safety classification of the medicinal plants**

345

From the 27 medicinal plants used by women, five were classified as safe to use, three as requiring caution to use, eight as potentially harmful to use in pregnancy and information on

1
2
3 347 eleven medicinal plants was not available in the current literature. The names and safety
4
5 348 classification of the 27 individual medicinal plants are presented in Supplementary table 4.
6
7
8 349 Of those pregnant women who used medicinal plants, 14.4% used safe, 12.2% harmful, 3.4%
9
10 350 both safe and harmful and 69.9% used one or more medicinal plants that requires cautious use
11
12 351 or safety information unavailable. Many women who used safe or harmful medicinal plants
13
14 352 have also used one or more plants that requires cautious use or safety information unavailable.
15
16

17 353

19 354 **Women's safety concerns and experiences**

21 355 Table 4 presents women's self-reported safety concerns and experiences with medicinal plants
22
23 356 in pregnancy. Safety concerns with use in pregnancy was most commonly reported for *bisana*
24
25 357 (*C. macrostachyus*) and *astenagir* (*D. stramonium*), each by five women. Four women
26
27 358 reported drinking milk as antidote (“ግህጽ” in Amharic) against adverse effects from *Z.*
28
29 359 *officinale*, *T. abyssinica*, *H. abyssinica*, and *C. verum*. Two women reported ingestion of *P.*
30
31 360 *anisum* soup/suspension as countermeasure for poisoning from *Z. officinale* and *C. verum*.
32
33 361 Eight women used *L. usitatissimum* for wellbeing and nourishing of the foetus. One woman
34
35 362 reported the use of *O. lamiifolium* to improve foetal movements and breathing. *O. lamiifolium*,
36
37 363 *Z. officinale*, and *A. sativum* were also reported to be useful for general foetal wellbeing. Fear
38
39 364 of complications to the foetus (44.5%) and religious prohibition (25.9%) were the common
40
41 365 reasons for avoiding use of medicinal plants during pregnancy.
42
43
44
45
46

47 366

49 367 **Table 4.** Pregnant women's self-reported safety concerns and experiences with medicinal

51 368 plants at JUMC, Ethiopia

53 369

56 370 **Discussion**

57

58

59

60

1
2
3 371 Knowledge; both lay and professional, about medicinal plants use in pregnancy is essential to
4
5 372 provide optimal maternal/foetal care. To the best of our knowledge, this paper is the first to
6
7 373 study medicinal plant use during pregnancy among women in an inpatient setting in Ethiopia.
8
9
10 374 This study provides extensive insight into types of medicinal plants, prevalence of use and
11
12 375 reasons for use, as well as women's safety concerns and precautions on the medicinal plants
13
14 376 they use in pregnancy. These findings are important to health care personnel, researchers,
15
16 377 policy makers, and pregnant women themselves. Nearly a third of women (28.6%) reported
17
18 378 use of at least one medicinal plant during pregnancy or at childbirth. Prior studies report global
19
20 379 prevalence of use of medicinal plants in pregnancy ranging from 0.9% to 96.0% [4, 16]. Studies
21
22 380 from Africa, however, report prevalence of medicinal plant use in pregnancy ranging from 2%
23
24 381 (Ethiopia) to 100% (Kenya) [4]. Variation in prevalence may be explained by several factors
25
26 382 including differences in study populations and settings, study inclusion and exclusion criteria
27
28 383 as well as data collection methods and definitions of medicinal plants. In some studies, all
29
30 384 forms of herbal meal preparations and nutritional supplements were counted [4] whereas in
31
32 385 others, like our study, a more restrictive definition of medicinal plant use was used. In addition,
33
34 386 differences in traditional practices, cultures and beliefs about health, may contribute to
35
36 387 important difference in prevalence of use of medicinal plants.
37
38
39
40
41
42
43
44

45 389 The most frequently used medicinal plants during pregnancy were flaxseed (use with caution),
46
47 390 *damakessie* (safety unknown) and papaya (use with caution, it is considered potentially unsafe
48
49 391 in large amounts only) (Table 3, Supplementary table 4). Our finding is inconsistent with
50
51 392 previous studies reported in Africa in which *Z. officinale*, *A. sativum* and *C. pepo* were the
52
53 393 commonly used plants [4]. The pattern of medicinal plant use is also divergent from latest
54
55 394 findings from Ethiopia [13, 14]. This may be due to the fact that unlike previous studies, most
56
57 395 participants in our study were women in their final stage of pregnancy and might most probably
58
59
60

1
2
3 396 recall the medicinal plants they took in relation to childbirth to a better extent than plants used
4
5 397 earlier in pregnancy. This difference in pattern of use from other corners of Ethiopia and
6
7 398 regions elsewhere may be due to difference in climate, geographical location (which will affect
8
9 399 the types of plants commonly grow in that area) and/or disease prevalence.
10
11

12 400

13
14 401 Flaxseed is by far the most commonly used medicinal plant, mainly used for induction,
15
16 402 reduction, quickening or preparation for labour (Table 3). A recent study from Ethiopia had
17
18 403 also found similar reason for its use [15]. In other African countries, however, seed oil from *R.*
19
20 404 *communis* was the most frequently used medicinal plant product to stimulate labour [4]. The
21
22 405 most probable reasons for the disparity in the type of medicinal plant used for labour induction
23
24 406 may be differences in geographical distribution of plants and cultural beliefs.
25
26
27

28 407

29
30 408 In line with previous studies [33, 34], women reported side effects and safety concerns related
31
32 409 to use of flaxseed in relation to labour (Table 4). A cautious consumption of flaxseed is
33
34 410 recommended in pregnancy and lactation due to its side effects and adverse effects when
35
36 411 consumed in excessive quantity [34]. In remote rural areas in Ethiopia where access to health
37
38 412 facilities is limited, use of *L. usitatissimum* may be perceived as the best option to induce or
39
40 413 shorten labour.
41
42
43

44 414

45
46 415 *O. lamiifolium* was the second most used medicinal plant during pregnancy in our study. It was
47
48 416 mainly used for treatment of an illness called “*Mitch*” alone or with other medicinal plants
49
50 417 (Table 2). “*Mitch*” is a culturally common illness in Ethiopia and is a local name given to a
51
52 418 febrile illness characterized by headache, fever, rash, inflammation, joint pain, back pain,
53
54 419 chills, sweat, loss of appetite, *Herpes labialis*, muscle spasm and in severe cases, diarrhoea [1,
55
56 420 35]. “*Mitch*” develops when strong sunlight strikes a part of the body that is sweating or
57
58
59
60

1
2
3 421 unclean [36], and in general after engaging in tasks that expose one to strong smells, or smoke
4
5 422 [1, 37]. Our study found that “*Mitch*” also affects female reproductive organs when it is
6
7 423 exposed to excessive sunlight, which they refer it to as “*Yemahitsen Mitch*” (“gynaecologic
8
9 424 *mitch*”) (Table 2). In general our result agrees with the findings of Ethiopians at home [15]
10
11 425 and in diaspora [1] regarding “*Mitch*” and its treatment. Studies of the leaf extract of *O.*
12
13 426 *lamiifolium* have shown analgesic effects in mice [38] that support its traditional use against
14
15 427 *Mitch*. *O. lamiifolium* is considered relatively safe and has not demonstrated any sign of acute
16
17 428 toxicity up to the dose of 2000 mg/kg body weight in experimental mice [39].
18
19
20
21 429
22
23
24 430 *C. papaya* and *Z. officinale* were the third and the fourth commonly used plants respectively.
25
26 431 Several women in this study claimed that papaya softens their birth canal (“*uterus*”) making
27
28 432 them healthy and ready for childbirth (Table 3). Moreover, they claimed that consumption of
29
30 433 cold papaya would soothe their gastrointestinal tract relieving them from heartburn, gastritis
31
32 434 and cramps (Table 2). Animal studies suggest that unlike its abortifacient property at larger
33
34 435 dose, normal consumption of ripe papaya during pregnancy may not pose any developmental
35
36 436 toxicity and teratogenicity [40].
37
38
39
40 437
41
42 438 Although previous studies, also in Ethiopia, showed that pregnant women commonly use
43
44 439 ginger for treating NVP [1, 4, 5, 20, 28], our study found that it was mainly used for common
45
46 440 colds and flu in pregnancy. This could be due to the fact that previous studies involved mainly
47
48 441 women in their earlier stages of pregnancy in which NVP is common. Concerning safety,
49
50 442 evidences suggest that ginger did not have harmful maternal or neonatal effects [1, 4]. Its side
51
52 443 effects reported in our study were also similar with previous reports [1].
53
54
55
56 444
57
58
59
60

1
2
3 445 Several socio-demographic factors were associated with use of medicinal plants in pregnancy
4
5 446 (Table 1). We found that women who did not have access to health facility (incl. health posts)
6
7 447 were seven times more likely to use medicinal plants than their counterparts. This is in line
8
9 448 with other studies showing that in Africa people use traditional medicine when facilities are
10
11 449 either unavailable or unaffordable [4, 22]. Similarly, women admitted in maternity ward were
12
13 450 three-fold as likely to use medicinal plants as their counterparts. Most women in the maternity
14
15 451 ward were in their final stage of pregnancy and might be using more medicinal plants for
16
17 452 childbirth than those admitted in gynaecology ward in which hyperemesis and abortions
18
19 453 predominate. Similarly, women who used *khat* or consumed alcohol as well as conventional
20
21 454 medicine were twice or more as likely to use medicinal plants as their counterparts, and may
22
23 455 either indicate a higher willingness to intake different substances in pregnancy and/or higher
24
25 456 morbidity. Since interactions between medicinal plants and conventional medicines may occur
26
27 457 and potentially may cause complications [4, 15, 41] , caution with concomitant use should be
28
29 458 recommended. Health care personnel at the wards were often not informed; neither involved
30
31 459 in decisions nor aware about the women's use of medicinal plants in relation to childbirth. As
32
33 460 pregnancy is a time of particular vulnerability, cautious use of medicinal plants is necessary
34
35 461 and health-care professionals should ask women about their use and provide them evidence-
36
37 462 based information.
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

463
464 Despite the size and extensive data collection, this study has several limitations that should be
465 taken into consideration. Firstly, JUMC is a tertiary referral hospital with a larger proportion
466 of women with pregnancy complications. Our findings may not be representative of women in
467 secondary or primary care. Secondly, as this study was based in southwest Ethiopia,
468 participants were mostly Muslims and from the Oromo ethnic group. These groups had a lower
469 use of medicinal plants in pregnancy compared to participants who were Orthodox and from

1
2
3 470 the Dawuro ethnic group. Our results will consequently not be generalizable to the entire
4
5 471 country. This finding underpins the importance of including ethnic and religious background
6
7 472 information in studies on medical plants, as it will have large impacts on utilization and
8
9 473 reporting patterns. Thirdly, data were collected based on pregnant women's self-report and thus
10
11 474 depended on their accuracy of recall and reporting as well as willingness to disclose utilization.
12
13 475 It may well be that the use of medicinal plants is underestimated due to poor recall or
14
15 476 underreporting. This may be especially important during face-to-face interviews for certain
16
17 477 medicinal herbs, recreational or illicit drugs that are culturally unacceptable. Actual medicinal
18
19 478 plant use in pregnancy may therefore be higher in real life, and/or different in other populations
20
21 479 and regions in Ethiopia.
22
23
24
25
26
27
28

480

481 **Conclusion**

482 Almost a third of women at the tertiary hospital in Ethiopia used medicinal plants during
483 pregnancy, most frequently to prepare, induce, reduce the intensity or shorten duration of
484 labour. Seeds and dry plant material was mostly used, sugar the most common excipient and
485 oral route of administration was predominant. The most frequently used medicinal plants were
486 *Linum usitatissimum* L. (flaxseed– use with caution) (22.0%), *Ocimum lamiifolium* L.
487 (damakessie– safety unknown) (3.6%), and *Carica papaya* L. (papaya– use with caution)
488 (3.1%). *O. lamiifolium* was mainly used for treatment of an illness a culturally common illness
489 in Ethiopia called “Mitch”, a febrile illness believed to develop after exposure to excessive
490 sunlight. Few women reported safety concerns regarding medicinal plant use in pregnancy.
491 The most important factors associated with use of medicinal plants in pregnancy were lack of
492 access to health care facilities, hospitalization in the maternity ward and social drug use.
493 Given that women use unsafe plants during pregnancy, increased awareness about potential
494 benefits or risks of medicinal plants use during pregnancy among health care professionals and

1
2
3 495 patients, and increased access to health care facilities are important in order to promote safer
4
5 496 pregnancies and better health outcomes for women and their unborn children.
6
7
8 497

9
10 498 **Footnotes**

11
12 499 **Acknowledgements:** We are grateful to the pregnant women admitted at JUMC who
13
14 500 generously shared with us information about their medicinal plant use. The authors owe a debt
15
16 501 of gratitude to the enumerators who skilfully collected the data. We would like to thank
17
18 502 Norwegian PhD School in Pharmaceutical Sciences for the travel grant assistance for the data
19
20 503 collection. Special thanks go to the Norwegian Loan Fund (Lånekassen) for granting
21
22 504 scholarship for the PhD student (SMA) in the University of Oslo. The authors are also indebted
23
24 505 to Dr. Ibrahimu Mdala for assistance with data analysis.
25
26
27
28 506

29
30 507 **Contributors:** SMA and HN conceived the idea for the study and its design. SMA collected,
31
32 508 analysed and interpreted data and drafted the manuscript. YAA and JS participated in study
33
34 509 coordination. SMA and HN revised and finalized the manuscript. SMA, HN, JS and YAA
35
36 510 critically reviewed the manuscript and contributed intellectual content. All authors read and
37
38 511 approved the final manuscript.
39
40

41
42 512 **Funding:** This research received no specific grant from any funding agency in the public,
43
44 513 commercial or not-for-profit sectors.
45

46
47 514 **Competing interests:** None declared.
48

49 515 **Patient consent for publication:** Not required.
50

51 516 **Ethics approval:** This study was approved by Jimma University Institute of health
52
53 517 Institutional Review Board (IRB) (ref. no. IHRPGC 7206/07) in Ethiopia, and Regional
54
55 518 Committees for Medical and Health Research Ethics (REK Sør-Øst B) (Ref.no. 2015/2135) in
56
57 519 Norway.
58
59
60

1
2
3 520 **Data availability statement:** Data are available upon reasonable request.
4

5 521 **Supplementary data**
6
7

8 522 Supplementary table 1: Consent form and questionnaire for medicinal plants used during
9 pregnancy at JUMC, Ethiopia
10 523

11 524 Supplementary table 2: Data extraction form for pregnancy characteristics and admission
12 details at JUMC, Ethiopia
13 525

14 526 Supplementary table 3: Definitions of safety categories of medicinal plants used during
15 pregnancy at JUMC, Ethiopia
16 527

17 528 Supplementary table 4: Overview of medicinal plants used during pregnancy according to
18 safety classification and number of users at JUMC, Ethiopia
19 529

20 530 Supplementary table 5: Overview of the utilization pattern of the most frequently used
21 medicinal plants during pregnancy at JUMC, Ethiopia
22 531

23 532
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

533 **Table 1.** Characteristics of women according to medicinal plant use during pregnancy at JUMC,
534 Ethiopia

Characteristics	No. (%)	Medicinal plant use during pregnancy		Crude OR [95% CI] ^b	Adjusted OR [95% CI] ^c
		Yes No. (%) 319 (28.6)	No No. (%) 798 (71.4)		
Place of Residence					
Urban	595 (53.3)	165 (51.7)	430 (53.9)	1	-
Rural	522 (46.7)	154 (48.3)	368 (46.1)	1.09 [0.84-1.41]	
Age (years)^d					
≤ 20	223 (20.0)	52 (16.3)	171 (21.4)	1	1
21-25	388 (34.7)	116 (36.4)	272 (34.1)	1.40 [0.96-2.05]	1.30 [0.88-1.94]
26-30	320 (28.7)	102 (32.0)	218 (27.3)	1.54 [1.04-2.27]	1.42 [0.94-2.14]
≥ 31	186 (16.7)	49 (15.4)	137 (17.2)	1.18 [0.75-1.85]	1.17 [0.73-1.87]
Marital status					
Married	1071 (95.9)	314 (98.4)	757 (94.9)	1	1
Others ^e	46 (4.1)	5 (1.6)	41 (5.1)	0.29 [0.12-0.75]	0.39 [0.14-1.09]
Religion					
Islam	731 (65.4)	201 (63.0)	530 (66.4)	1	
Orthodox	305 (27.3)	99 (31.0)	206 (25.8)	1.27 [0.95-1.69]	-
Protestant/Others ^f	81 (7.3)	19 (6.0)	62 (7.8)	0.81 [0.47-1.39]	
Educational level^g					
Illiterate	378 (34.0)	98 (30.7)	280 (35.1)	1	1
Primary /read & write	470 (42.3)	138 (43.3)	332 (41.6)	1.19 [0.88-1.61]	1.22 [0.88-1.68]
Secondary school	162 (14.6)	56 (17.6)	106 (13.3)	1.51 [1.02-2.25]	1.54 [1.01-2.36]
Post-secondary school	102 (9.2)	27 (8.5)	75 (9.4)	1.03 [0.63-1.69]	1.06 [0.62-1.79]
Occupation					
House wife	524 (46.9)	142 (44.5)	382 (47.9)	1	-
Farmer	261 (23.4)	82 (25.7)	179 (22.4)	1.23 [0.89-1.71]	
Trader/Merchant	163 (14.6)	49 (15.4)	114 (14.3)	1.16 [0.79-1.70]	
Government employee	95 (8.5)	30 (9.4)	65 (8.1)	1.24 [0.77-1.99]	
Others ^h	74 (6.6)	16 (5.0)	58 (7.3)	0.74 [0.41-1.33]	
Ethnic Group					
Oromo	779 (69.7)	224 (70.2)	555 (69.5)	1	1
Amhara	87 (7.8)	21 (6.6)	66 (8.3)	0.79 [0.47-1.32]	0.83 [0.48-1.45]
Yem	81 (7.3)	24 (7.5)	57 (7.1)	1.04 [0.63-1.72]	1.14 [0.66-1.97]
Dawuro	70 (6.3)	12 (3.8)	58 (7.3)	0.51 [0.27-0.97]	0.64 [0.33-1.25]
Others ⁱ	100 (9.0)	38 (11.9)	62 (7.8)	1.52 [0.99-2.34]	1.57 [1.00-2.48]
Access to health facility^j					
Yes	1107 (99.1)	313 (98.1)	794 (99.5)	1	1
No	10 (0.9)	6 (1.9)	4 (0.5)	3.81 [1.07-13.58]	6.92 [1.77-27.10]
Walking distance to the nearest health facility					
Close, ≤30 min.	731 (66.4)	203 (63.6)	528 (66.2)	1	-
Somewhat far, 31-60 min.	245 (22.3)	67 (21.0)	178 (22.3)	0.98 [0.71-1.35]	
Far, >60 min.	125 (11.4)	43 (13.5)	82 (10.3)	1.36 [0.91-2.04]	
Gravidity^k					
Primigravida	431 (38.6)	307 (38.5)	124 (38.9)	1	-
Multigravida	686 (61.4)	491 (61.5)	195 (61.1)	0.98 [0.75-1.28]	
Gestational age					
Preterm pregnancy	231 (20.7)	60 (18.8)	171 (21.4)	1	1
Term pregnancy	735 (65.8)	208 (65.2)	527 (66.0)	1.13 [0.81-1.57]	0.80 [0.52-1.25]
Post term pregnancy	62 (5.6)	27 (8.5)	35 (4.4)	2.20 [1.23-3.93]	1.65 [0.85-3.20]
Others ^l	89 (8.0)	24 (7.5)	65 (8.1)	1.05 [0.61-1.83]	0.72 [0.38-1.36]
Patient type					

Gynaecology ward	125 (11.2)	22 (6.9)	103 (12.9)	1	1
Maternity ward	992 (88.8)	297 (93.1)	695 (87.1)	2.00 [1.24-3.23]	2.80 [1.43-5.48]
Chronic illness ^m					
No	1061 (95.0)	294 (92.2)	767 (96.1)	1	1
Yes	56 (5.0)	25 (7.8)	31 (3.9)	2.10 [1.22-3.62]	1.83 [1.04-3.24]
Conventional medicine use ⁿ					
No	817 (73.1)	209 (65.5)	608 (76.2)	1	1
Yes	300 (26.9)	110 (34.5)	190 (23.8)	1.68 [1.27-2.23]	1.83 [1.36-2.46]
Chew Khat (<i>Catha edulis</i>) ^o					
No	1052 (94.2)	289 (90.6)	763 (95.6)	1	1
Yes	65 (5.8)	30 (9.4)	35 (4.4)	2.26 [1.36- 3.75]	2.53 [1.46-4.39]
Alcohol consumption					
No	1071 (95.9)	297 (93.1)	774 (97.0)	1	1
Yes	46 (4.1)	22 (6.9)	24 (3.0)	2.39 [1.32-4.33]	2.43 [1.28-4.62]
Past adverse pregnancy outcome					
No/not applicable	994 (89.0)	275 (86.2)	719 (90.1)	1	-
Yes	123 (11.0)	44 (13.8)	79 (9.9)	1.51 [1.00-2.28]	

535

536

537

538

539

540

541

542

543

544

545

546

547

548

549

550

551

^aNumbers may not add up to 1117 due to missing values, ^bCI, confidence interval, OR, odds ratio; Significant findings are in bold ($P < 0.05$); ^cAdjusted for age, marital status, educational level, ethnic group, access to health facility, gestational age, patient type, chronic illness, conventional medicine use, chew *khat*, alcohol consumption; ^dMedian age 25 years, interquartile range 22–30 years; ^eOthers includes single 41(3.7%), divorced 4(0.4%), widowed 1(0.1%); ^fProtestant/Others includes Protestant 74(6.6), Catholic 2(0.2%), Waqqefeta 1(0.1%), missing 4(0.4); ^gRead & write: no formal education but can read and write due to literacy campaigns, traditional religious institution and informal peer learning, Primary school: Grade 1–8, Secondary school: Grade 9–12; Post-secondary school: Technical and vocational school, college or university; ^hOthers includes daily labourers 24(2.1), students 22(2.0), private institution workers 18(1.6), other sectors 10(0.9%); ⁱOthers includes Gurage 41(3.7), Silte 30(2.7), Kaffa 16(1.4), Tigre 3(0.3), Wolayita 3(0.3), mixed ethnic backgrounds 7(0.6); ^jAccess to health facility means access to either primary, secondary or tertiary levels of healthcare; it mainly represents access to health posts; ^kGravidity includes the current pregnancy; ^lWomen are in the first, second or third trimester of pregnancy but exact week of pregnancy is not known; ^mIncludes hypertension, diabetes mellitus, asthma, cardiac diseases, chronic gastritis/peptic ulcer, HIV, chronic renal failure, chronic liver disease, etc.; ⁿRefers to self-medication with conventional medicine before hospitalization; ^o*Khat (Catha edulis)* plant leaves are chewed by people for their stimulant action

552 **Table 2.** Pregnancy disorders treated with medicinal plants at JUMC, Ethiopia, n=319

Variables	Number (%) ^a	Most common medicinal plants (number of users)
Induction and “reduction” of labour ^b	192 (60.2)	<i>Linum usitatissimum</i> (Flaxseed) (179) <i>Trigonella foenum-graecum</i> (Fenugreek) (6) <i>Carica papaya</i> (Papaya) (4)
Common cold/flu	65 (20.4)	<i>Zingiber officinale</i> (Ginger) (23) <i>Allium sativum</i> (Garlic) (13) <i>Eucalyptus globulus</i> (<i>Nech-bahir zaf</i>) (12)
Preparation for labour	50 (15.7)	<i>Linum usitatissimum</i> (Flaxseed) (22) <i>Carica papaya</i> (Papaya) (17) <i>Trigonella foenum-graecum</i> (Fenugreek) (11)
Abdominal cramps/ache	30 (9.4)	<i>Nigella sativa</i> (Black seed) (10) <i>Allium sativum</i> (Garlic) (5) <i>Carica papaya</i> (Papaya) (4)
Headache/Migraine	27 (8.5)	<i>Nigella sativa</i> (Black seed) (10) <i>Ocimum lamiifolium</i> (<i>Damakessie</i>) (8) <i>Allium sativum</i> (Garlic) (3)
Heartburn/reflux problems	27 (8.5)	<i>Linum usitatissimum</i> (Flaxseed) (16) <i>Carica papaya</i> (Papaya) (5)
<i>Mitch</i> ^c	24 (7.5)	<i>Ocimum lamiifolium</i> (<i>Damakessie</i>) (18)
Gastritis/burning sensation	22 (6.9)	<i>Linum usitatissimum</i> (Flaxseed) (19)
Constipation/obstipation	17 (5.3)	<i>Linum usitatissimum</i> (Flaxseed) (16)
General wellbeing	15 (4.7)	<i>Allium sativum</i> (Garlic) (5) <i>Ruta chalepensis</i> (Fringed rue) (3)
Nausea	11 (3.4)	<i>Zingiber officinale</i> (Ginger) (4) <i>Ruta chalepensis</i> (Fringed rue) (4)
Helminths	6 (1.9)	<i>Carica papaya</i> (Papaya) (2) <i>Hagenia abyssinica</i> (<i>Kosso</i>) (2)
Leg/foot Swelling	5 (1.6)	<i>Linum usitatissimum</i> (Flaxseed) (1) <i>Cinnamomum verum</i> (Cinnamon) (1) <i>Croton macrostachyus</i> (<i>Bisena</i>) (1) <i>Veronia amygdalina</i> (<i>Grawa</i>) (1) B'auu (1)
Prevent bad smell	5 (1.6)	<i>Ocimum lamiifolium</i> (<i>Damakessie</i>) (5)
Strong craving	5 (1.6)	<i>Linum usitatissimum</i> (Flaxseed) (1) <i>Carica papaya</i> (Papaya) (1) <i>Nigella sativa</i> (Black seed) (1) <i>Ruta chalepensis</i> (Fringed rue) (1) <i>Zingiber officinale</i> (Ginger) (1)
Emergency illnesses	4 (1.3)	<i>Ocimum lamiifolium</i> (<i>Damakessie</i>) (3)
Postpartum bathing	4 (1.3)	<i>Eucalyptus globulus</i> (<i>Nech-bahir zaf</i>) (3)
Vomiting	3 (0.9)	<i>Zingiber officinale</i> (Ginger) (2)
<i>Yemahitsen mitch</i> ^c (‘gynaecologic mitch’)	3 (0.9)	<i>Croton macrostachyus</i> (<i>Bisena</i>) (1) <i>Ocimum lamiifolium</i> (<i>Damakessie</i>) (1) <i>Pycnostachys abyssinica</i> (<i>Yeroo</i>) (1)
Depression	3 (0.9)	<i>Echinops kebericho</i> (<i>Kebericho</i>) (1) <i>Ruta chalepensis</i> (Fringed rue) (1) <i>Cinnamomum verum</i> (Cinnamon) (1)
Wellbeing and nourishing the foetus	3 (0.9)	<i>Linum usitatissimum</i> (Flaxseed) (2) <i>Trigonella foenum-graecum</i> (Fenugreek) (1)
Cough	2 (0.6)	<i>Nigella sativa</i> (Black seed) (1) <i>Saccharum officinarum</i> (Sugar crystals) (1)
<i>Birdd</i> ^d	2 (0.6)	<i>Allium sativum</i> (Garlic) (1) <i>Nigella sativa</i> (Black seed) (1)
Diarrhoea	2 (0.6)	<i>Ocimum lamiifolium</i> (<i>Damakessie</i>) (1) <i>Taverniera abyssinica</i> (<i>Dingetegn</i>) (1)
Joint pain (<i>kurtimatt</i>)	2 (0.6)	<i>Allium sativum</i> (Garlic) (1)

Variables	Number (%) ^a	Most common medicinal plants (number of users)
		<i>Nigella sativa</i> (Black seed) (1)
Sleeping problems	2 (0.6)	<i>Artemisia abyssinica</i> (<i>Chikugn</i>) (2)
Mental wellbeing	2 (0.6)	<i>Ruta chalepensis</i> (Fringed rue) (2)
Evil eye	2 (0.6)	<i>Artemisia afra</i> (<i>Ariti</i>) (1) <i>Veronia amygdalina</i> (<i>Grawa</i>) (1)
Others ^e	15 (4.7)	<i>Linum usitatissimum</i> (Flaxseed) (3) <i>Allium sativum</i> (Garlic) (3) <i>Ocimum lamiifolium</i> (<i>Damakessie</i>) (3)

^aTotal percentage may exceed 100% due to multiple responses

^b**Reduction of labour:** Includes reduced intensity and shortened duration of labour.

^c**Mitch:** A febrile illness believed to develop when strong sunlight strikes a part of the body that is sweating or unclean.

^d**Bird:** An illness typified by a feeling of chills, arthralgia, myalgia, generalized body weakness, pain (particularly chest pain) and coughing. In general, it is characterized by pneumonia/flu-like symptoms.

^eOthers includes make labour simple, stomach rambling, quicken labour, prevent '*megagna*', fever, facilitation of digestion, tonsillitis, pregnancy associated body/physical illnesses, skin rashes ('*Shifta*'), abdominal distension/bloating, throat congestion ('*Guroroyen siyafinegn*'), malaria, appetizer, upper extremity fatigability, for any illness, each with a frequency of one.

563 **Table 3.** Overview of the most frequently used medicinal plants during pregnancy according to
 564 number of users and the most common indications at JUMC, Ethiopia

Medicinal plant (English name) (local name) Preparation method	Number of users (n = 319), n (28.6%)	Most common indications (No. of citations)
<i>Linum usitatissimum</i> L. (Flaxseed or Linseed) (<i>Telba</i>) Flax seeds are roasted, pounded, thoroughly mixed with water and consumed in soup form.	246 (77.1)	Induction or “reduction” of labour (179) ^a Prepare for labour (22) Heartburn/reflux problems (19) Constipation/obstipation (16) Gastritis/burning sensation (14) Abdominal cramps or ache (2)
<i>Ocimum lamiifolium</i> L. (No common English name) (<i>Damakessie</i>) Adding minced fresh leaves or steeping in leaves in tea, coffee, milk or decoction or maceration of minced root are drunk, or fresh leaves are put in nostrils and sniffed	40 (12.5)	Mitch (19) ^b Common cold/flu (10) Headaches/Migraine (8) Prevent bad smell (5) Emergency cases/illnesses (3) Nausea (2)
<i>Carica papaya</i> L. (Papaya) (<i>Papaya</i>) Ripened fresh fruit is eaten or its juice is extracted and then drunk	35 (11.0)	Prepare for labour (17) Heartburn/reflux problems (5) Induce labour (4) Abdominal cramps or ache (4) Gastritis/burning sensation (3) Helminths (2)
<i>Zingiber officinale</i> Roscoe. (Ginger) (<i>Zingibil</i>) Drinking aqueous decoction or maceration, or drinking minced root with water or tea	29 (9.1)	Common cold/flu (23) Nausea (4) Vomiting (2) Abdominal cramps (2)
<i>Allium sativum</i> L. (Garlic) (<i>Nech shinkrut</i>) Drinking minced cloves with tea, coffee, milk or eating raw cloves with Ethiopian bread, ‘ <i>Injera</i> ’	28 (8.8)	Common cold/flu (13) General wellbeing (5) Abdominal cramps (5) Headaches/Migraine (3) <i>Bird</i> (2) ^c
<i>Trigonella foenum-graecum</i> L. (Fenugreek) (<i>Abish</i>) Drink aqueous maceration of seeds or consume roasted and powdered seeds in soup form	24 (7.5)	Prepare for labour (11) Induce labour (6) Gastritis/burning sensation (4)
<i>Nigella sativa</i> L (Black seed) (<i>Tikur Azmud</i>) Drinking few drops of the seed oil with tea, coffee, milk or sniffing the oil drops	21 (6.4)	Headaches/Migraine (10) Abdominal cramps or ache (7) Common cold/flu (6)
<i>Ruta chalepensis</i> L. (Fringed rue) (<i>Tenadam</i>) Adding minced fresh leaves or steeping in leaves in tea, coffee, or milk and then drunk or fresh leaves squeezed, and then drunk	15 (4.7)	Nausea (4) General wellbeing (3) Headaches/Migraine (2) Mental wellbeing (2) Abdominal cramps (2)
<i>Eucalyptus globulus</i> Labill. (“Eucalyptus”) (<i>Nech-bahir zaf</i>) Leaves are boiled in water, patient fumigated and the vapour is inhaled	13 (4.1)	Common cold/flu (12) Postpartum bathing (3) Mitch (2)

565 ^a“Reduction of labour”: Includes reduced intensity and shortened duration of labour; ^b“Mitch”: A febrile illness believed to
 566 develop when strong sunlight strikes a part of the body that is sweating or unclean; ^c“Bird”: An illness typified by a feeling
 567 of chills, arthralgia, myalgia, generalized body weakness, pain (particularly chest pain) and coughing. In general, it is
 568 characterized by pneumonia/flu-like symptoms

569 **Table 4.** Pregnant women's self-reported safety concerns and experiences with medicinal plants at
 570 JUMC, Ethiopia, n=319

Medicinal plants (MPs), reported reasons for contraindication (No. of citations)	MPs, reported precautions (No. of citations)	MPs, reported Side effects (No. of citations)	MPs, reported adverse drug reactions (No. of citations)
Flaxseed: Cause uterine contractions, miscarriage or premature labour (2), Dries up breastmilk (1)	Flaxseed ^a : Aloe vera is bitter and makes flaxseed preparation unpalatable (1), the woman should stay away from sunlight while /after taking flaxseed preparation (1)	Flaxseed: Nausea (4), Postpartum shivering (1), Diarrhoea (1), Vomiting (1), Loss of appetite (1),	Flaxseed: Severe postpartum shivering (1), Loss of consciousness (1), Uterine rupture (1), Still birth (1)
<i>Kosso</i> ^b : Causes uterine stimulation (4)	<i>Kosso</i> : <i>Kosso</i> protects the mother from outside person's 'tila' as it may kill her (1), After taking <i>Kosso</i> , the woman should stay at home for 2 days protected from outside person's 'tila' (1) ^c	<i>Kosso</i> : Diarrhoea (2)	<i>Kosso</i> : Severe diarrhoea (2)
<i>Dingetegna</i> : harmful during pregnancy, reason unknown (1) ^d	<i>Dingetegna</i> ^e : the woman who took <i>dingetegna</i> should stay at home, outsiders should not be allowed to get in for fear of their 'tila' (1)	<i>Dingetegna</i> : Diarrhoea (2), Vomiting (1)	<i>Dingetegna</i> : Severe diarrhoea (2)
<i>Damakessie</i> : Causes uterine stimulation (1)	<i>Damakessie</i> ^f : After applying MPs stay at home, going outside is forbidden (1) ^g	<i>Damakessie</i> : Loss of appetite (1), Bitter (after) taste (1), Sneezing (1)	Chikugn ^h : Anencephaly: giving birth to a headless neonate (1)
<i>Tej Sar</i> ⁱ : Causes uterine stimulation (1), harmful during pregnancy, reason unknown (1) ^d	Cinnamon ^j : inflammatory to the stomach, thus eat food before taking cinnamon (1)	Cinnamon: Heart burn (1)	Cinnamon: Severe heart burn (1)
Ensilal ^k : Causes uterine stimulation (1), harmful during pregnancy, reason unknown (1) ^d	Garlic: larger dose of garlic is irritant, thus eat food before taking it (1)	Garlic: Discomfort to foetus (1), Gastric irritation (1), Loss of appetite (1)	Garlic: Harm to the foetus (1), Bad mouth smell (1), Severe heart burn (1)
Grawa ^l : Causes uterine stimulation (2) harmful during pregnancy, reason unknown (1) ^d	Ginger: stomach irritant, thus eat food before taking ginger (1), beware since ginger decreases appetite (1) and induces fever (1)	Ginger: Gastric irritation (2), Heart burn (2), Discomfort to foetus (1)	Ginger: Harm to foetus (1), Severe heart burn (1)
Black seed: Generally not good for the woman and the foetus, thus better not to take it during pregnancy (1)	Yeroo ^m : After applying MPs stay at home, going outside is forbidden (1) ^g	Black seed: Gastric irritation (3), Loss of appetite (1)	-----
Bisana ⁿ : causes uterine stimulation (2), harmful to the foetus (1), generally not good for the foetus (1), its smell deteriorates health of pregnant women (1)	Bisana ^o : After applying MPs stay at home, going outside is forbidden (1) ^g	"Eucalyptus" ^p : Decrease in appetite (1)	-----
Kebericho: Generally not good for the foetus(1)	Kebericho ^q : Kebericho interacts with <i>damakessie</i> and worsen the <i>Mitch</i> ^r disease (1)	Sugar ^s : Eye irritation (1)	-----
<i>Etse Fares</i> ^t : Harmful to the foetus (1), Causes uterine stimulation (3), Generally not good for pregnant woman and the foetus (1)	Fringed rue: Kebericho should not be taken with rue because it will worsen the nausea (1), beware since it induces fever (1), There is a plant interacting with rue, but forgot its name (1)	Fringed rue: Loss of appetite (1)	-----
'Baruda' plant ^u : Causes uterine stimulation (1)	-----	-----	-----

Endod ^v : Causes uterine stimulation (1)	-----	-----	-----
Metere ^w : Harmful to the foetus (1)	-----	-----	-----
Feto ^x : Causes uterine stimulation (1)	-----	-----	-----

571 ^aAfter consuming Flaxseed (*L. usitatissimum*) preparation the woman should stay at home, exposure to sunlight results in
572 *Mitch* disease, ^b*H. abyssinica*, ^c'Tila', loosely translated means the shade of a person that is believed to have pernicious effect,
573 ^dThe plant is harmful during pregnancy, but the woman does not know the reason for contraindication, ^e*T. abyssinica*, ^gStay at
574 home after applying the ^f Damakessie (*O. lamiifolium*) / ^mYeroo (*P. abyssinica*) / ^oBisana (*C. macrostachyus*) mixture
575 formulation, going outside is forbidden; Otherwise there is relapse of the disease; ^h*A. abyssinica*, ⁱ*Cymbopogon citratus* (DC.)
576 Stapf, ^j*C. verum*, ^k*F. vulgare*, ^l*V. amygdalina*, ⁿ*C. macrostachyus*, ^p*E. globulus*, ^q*E. kebericho*, ^r*Mitch*: A febrile illness believed
577 to develop when strong sunlight strikes a part of the body that is sweating or unclean; ^s*Saccharum officinarum* L., ^t*Datura*
578 *stramonium* L., ^uinserting the root in to the vagina and/or drink its juice, ^v*Phytolacca dodecandra* L'Hér., ^w*Glinus lotoides* L.,
579 ^x*L. sativum*, ^{b, x}(particularly use of *Kosso* with *Feto* causes severe uterine stimulation).

580

581 References

- 582 1. Hailemeskel B, Fullas F, Habte A, Al-Matari R, Brewer D. A review of natural
583 remedies commonly used by Ethiopian immigrants in the USA. *Curr Res Integr Med*.
584 2017; 2: 31-36.
- 585 2. Jamshidi-Kia F, Lorigooini Z, Amini-Khoei H: Medicinal plants: Past history and
586 future perspective. *J Herbmед Pharmacol*. 2018; 7:1-7.
- 587 3. Mazzari ALDA, Prieto JM: Herbal medicines in Brazil: pharmacokinetic profile and
588 potential herb-drug interactions. *Front Pharmacol*. 2014; 5: 162.
- 589 4. Ahmed SM, Nordeng H, Sundby J, Aragaw YA, de Boer HJ: The use of medicinal
590 plants by pregnant women in Africa: A systematic review. *J Ethnopharmacol*. 2018;
591 224:297-313.
- 592 5. Shewamene Z, Dune T, Smith CA: The use of traditional medicine in maternity care
593 among African women in Africa and the diaspora: a systematic review. *BMC*
594 *Complement Altern Med*. 2017; 17: 382.
- 595 6. United States Central Intelligence Agency (CIA). The World Fact Book, Africa:
596 Ethiopia. [https://www.cia.gov/the-world-factbook/countries/ethiopia/#people-and-](https://www.cia.gov/the-world-factbook/countries/ethiopia/#people-and-society)
597 [society](https://www.cia.gov/the-world-factbook/countries/ethiopia/#people-and-society). (2018). Accessed 13 Feb 2019.

- 1
2
3 598 7. Ficquet E. Interfaith Relations between Christianity and Islam in Ethiopia
4
5 599 [https://www.sciencespo.fr/ceci/fr/oir/interfaith-relations-between-christianity-and-](https://www.sciencespo.fr/ceci/fr/oir/interfaith-relations-between-christianity-and-islam-ethiopia)
6
7 [islam-ethiopia](https://www.sciencespo.fr/ceci/fr/oir/interfaith-relations-between-christianity-and-islam-ethiopia). (2019). Accessed 20 Feb 2021.
8 600
9
10 601 8. Ethiopian Public Health Institute (EPHI). Traditional and Modern Medicine Research
11
12 602 <http://www.ephi.gov.et/index.php/research/traditional-modern-medicine>. (2019).
13
14 603 Accessed 25 Feb 2019.
15
16 604 9. Laelago T, Yohannes T, Lemango F: Prevalence of herbal medicine use and
17
18 605 associated factors among pregnant women attending antenatal care at public health
19
20 606 facilities in Hossana town, southern Ethiopia: facility based cross sectional study.
21
22 607 Arch Public Health. 2016; 74 : 7.
23
24 608 10. United Nations Children's Fund (UNICEF). Maternal and Newborn Health Disparities
25
26 609 country profiles. [https://data.unicef.org/resources/maternal-newborn-health-](https://data.unicef.org/resources/maternal-newborn-health-disparities-country-profiles/)
27
28 610 [disparities-country-profiles/](https://data.unicef.org/resources/maternal-newborn-health-disparities-country-profiles/) (2018). Accessed 05 Sept 2019.
29
30 611 11. Ahmed SM, Sundby J, Aragaw YA, Abebe F. Self-Medication and Safety Profile of
31
32 612 Medicines Used among Pregnant Women in a Tertiary Teaching Hospital in Jimma,
33
34 613 Ethiopia: A Cross-Sectional Study. Int J Environ Res Public Health. 2020; 17: 3993.
35
36 614 12. Bayisa B, Tatiparthi R, Mulisa E: Use of herbal medicine among pregnant women on
37
38 615 antenatal care at Nekemte Hospital, Western Ethiopia. Jundishapur J Nat Pharm Prod.
39
40 616 2014; 9: e17368.
41
42 617 13. Jambo A, Mengistu G, Sisay M, Amare F, Edessa D: Self-Medication and
43
44 618 Contributing Factors Among Pregnant Women Attending Antenatal Care at Public
45
46 619 Hospitals of Harar Town, Ethiopia. Front Pharmacol. 2018; 9: 1063.
47
48 620 14. Mekuria AB, Erku DA, Gebresillassie BM, Birru EM, Tizazu B, Ahmedin A:
49
50 621 Prevalence and associated factors of herbal medicine use among pregnant women on
51
52
53
54
55
56
57
58
59
60

- 1
2
3 622 antenatal care follow-up at University of Gondar referral and teaching hospital,
4
5 623 Ethiopia: a cross-sectional study. *BMC Complement Altern Med.* 2017; 17: 86.
6
7
8 624 15. Nega SS, Bekele HM, Meles GG, Nordeng H: Medicinal Plants and Concomitant Use
9
10 625 with Pharmaceutical Drugs Among Pregnant Women. *J Altern Complement Med.*
11
12 626 2019; 25: 427-434.
13
14 627 16. Hall HG, Griffiths DL, McKenna LG: The use of complementary and alternative
15
16 628 medicine by pregnant women: A literature review. *Midwifery.* 2011; 27: 817-824.
17
18 629 17. Westfall RE: Herbal healing in pregnancy: women's experiences. *J Herb*
19
20 630 *Pharmacother.* 2003, 3: 17-39.
21
22 631 18. Kennedy DA, Lupattelli A, Koren G, Nordeng H: Herbal medicine use in pregnancy:
23
24 632 results of a multinational study. *BMC Complement Altern Med.* 2013; 13: 355.
25
26 633 19. Ahmed M, Hwang JH, Choi S, Han D: Safety classification of herbal medicines used
27
28 634 among pregnant women in Asian countries: a systematic review. *BMC Complement*
29
30 635 *Altern Med.* 2017; 17: 489.
31
32 636 20. Ahmed M, Hwang JH, Hasan MA, Han D: Herbal medicine use by pregnant women
33
34 637 in Bangladesh: a cross-sectional study. *BMC Complement Altern Med.* 2018; 18: 333.
35
36 638 21. Kennedy DA, Lupattelli A, Koren G, Nordeng H: Safety classification of herbal
37
38 639 medicines used in pregnancy in a multinational study. *BMC Complement Altern Med.*
39
40 640 2016; 16: 102.
41
42 641 22. Godlove M: Prevalence of herbal medicine use and associated factors among pregnant
43
44 642 women attending antenatal clinic at Mbeya Referral Hospital in 2010 (M.Sc. Thesis)
45
46 643 <http://hdl.handle.net/123456789/41>. Muhimbili University of Health and Allied
47
48 644 Sciences, Dar es salaam, Tanzania. (2011). Accessed 03 Oct 2018.
49
50
51
52
53
54
55
56
57
58
59
60

- 1
2
3 645 23. Segni H, Ayana D, Jarso H: Prevalence of Hyperemesis Gravidarum and Associated
4
5 646 Factors Among Pregnant Women at Jimma University Medical Center, South West
6
7 647 Ethiopia: A Cross-Sectional Study. *EC Gynaecol.* 2016; 3: 376-387.
- 8
9
10 648 24. Jimma University Specialized hospital. [http://www.ju.edu.et/jimma-university-](http://www.ju.edu.et/jimma-university-specialized-hospital-jush)
11
12 649 [specialized-hospital-jush](http://www.ju.edu.et/jimma-university-specialized-hospital-jush) (2017). Accessed 13 Sept 2018.
- 13
14
15 650 25. Kish L: *Survey Sampling*. New York, NY, USA: John Wiley & Sons, Inc.; 1965.
- 16
17 651 26. Mureyi DD, Monera TG, Maponga CC: Prevalence and patterns of prenatal use of
18
19 652 traditional medicine among women at selected harare clinics: a cross-sectional study.
20
21 653 *BMC Complement Altern Med.* 2012; 12: 164.
- 22
23
24 654 27. Mkize GT: *An Assessment of Use of Traditional Medicine in Pregnancy &*
25
26 655 *Associated Factors Among Black South African Women Delivering in Bertha Gxowa*
27
28 656 *Hospital (M.Sc. Thesis)*. University of the Witwatersrand, Johannesburg, South
29
30 657 Africa. <http://wiredspace.wits.ac.za/handle/10539/17340?show=full> (2015). Accessed
31
32 658 25 Apr, 2019.
- 33
34
35 659 28. Gall A, Shenkute Z. *Ethiopian Traditional and Herbal Medications and Their*
36
37 660 *Interactions with Conventional Drugs*.
38
39 661 <https://ethnomed.org/clinical/pharmacy/ethiopian-herb-drug-interactions>. Accessed 17
40
41 662 Oct 2018.
- 42
43
44 663 29. Gedif T, Hahn H-J: *The use of medicinal plants in self-care in rural central Ethiopia*. *J*
45
46 664 *Ethnopharmacol.* 2003; 87:155-161.
- 47
48
49 665 30. Mills E, Dugwoa J-J, Perri D, Koren G: *Herbal medicines in pregnancy and lactation:*
50
51 666 *An evidence-based approach*. London ; New York: Taylor & Francis; 2006.
- 52
53
54 667 31. Mills S, Bone K: *The Essential Guide to Herbal Safety*. St. Louis, Mo: Elsevier
55
56 668 Churchill Livingstone; 2005.
- 57
58
59
60

- 1
2
3 669 32. Gardner Z, McGuffin M: American Herbal Products Association. American herbal
4
5 670 products association's botanical safety handbook, 2nd edn. Boca Raton, FL: CRC
6
7 671 Press; 2013.
- 8
9
10 672 33. Zamawe C, King C, Jennings HM, Mandiwa C, Fottrell E: Effectiveness and safety of
11
12 673 herbal medicines for induction of labour: a systematic review and meta-analysis. BMJ
13
14 674 Open. 2018; 8: e022499.
- 15
16
17 675 34. Gokhale S, Sahu A: Pharmacological properties of flaxseed, *Linum usitatissimum*
18
19 676 Linn., as a potential medicinal plant: An overview. World J Pharm Sci. 2016; 4: 207-
20
21 677 215.
- 22
23
24 678 35. Hodes RM, Teferedegne B: Traditional beliefs and disease practices of Ethiopian
25
26 679 Jews. Isr J Med Sci. 1996; 32: 561-7.
- 27
28
29 680 36. Hodes R: Cross-cultural medicine and diverse health beliefs. Ethiopians abroad. West
30
31 681 J Med. 1997; 166: 29-36.
- 32
33 682 37. Kifle H, Woldu AM, Asres K, Mazumder A, Bucar F: Composition, antimicrobial and
34
35 683 free-radical scavenging properties of the essential oil of Damakese (*Ocimum*
36
37 684 *lamiifolium*): A popular home remedy in Ethiopia. Int J Essen Oil Ther. 2007; 1: 110 -
38
39 685 116.
- 40
41
42 686 38. Debella A, Makonnen E, Abebe D, Teka F, Kidanemariam AT: Pain management in
43
44 687 mice using the aqueous and ethanol extracts of four medicinal plants. East Afr Med J.
45
46 688 2003; 80: 435-439.
- 47
48
49 689 39. Kefe A, Giday M, Mamo H, Erko B: Antimalarial properties of crude extracts of
50
51 690 seeds of *Brucea antidysenterica* and leaves of *Ocimum lamiifolium*. BMC
52
53 691 Complement Altern Med. 2016; 16:118.
54
55
56
57
58
59
60

- 1
2
3 692 40. Oderinde O, Noronha C, Oremosu A, Kusemiju T, Okanlawon OA: Abortifacient
4
5 693 properties of aqueous extract of *Carica papaya* (Linn) seeds on female Sprague-
6
7 694 Dawley rats. Niger Postgrad Med J. 2002; 9: 95-8.
- 8
9
10 695 41. El Hajj M, Holst L: Herbal Medicine Use During Pregnancy: A Review of the
11
12 696 Literature With a Special Focus on Sub-Saharan Africa. Front Pharmacol. 2020;
13
14 697 11:866.
- 15
16
17
18 698

For peer review only

Consent form and Interviewer administered questionnaire

Medicinal plants used among pregnant women admitted in Jimma University Medical Center maternity and gynaecology wards in Jimma city, Ethiopia

Consent form

Background and purpose

This is an invitation for you to participate in a research conducted with the objective of assessing medicinal plants and pharmaceutical medicines used among pregnant women admitted in Jimma University Medical Center (JUMC) maternity and gynecology wards in Jimma city, Ethiopia. Although medicinal plants play a significant role in traditional medicine during pregnancy, childbirth and postpartum care, little is known about the extent and types of medicinal plants used during pregnancy in Ethiopia. The aim of this study is therefore to investigate and describe medicinal plants and pharmaceutical medicines used during pregnancy, the reasons for use and the utilization pattern among inpatient pregnant and lactating women. As the study is directly related to women seeking care in the maternity and gynaecology ward of this hospital, you are one of the candidates who can participate in the study. Thus, you are kindly requested to participate in the present research and provide the information required from you.

What does the study involve?

Concerning the study process, first we will ask you questions about your background including questions about your age, religion, residence place, occupation, family size, ethnic group, marital status, educational level, access to modern health facility and walking distance to the facility. Next, we will ask you about maternal diseases, pregnancy-related illness and treatments, use of medicinal plants, information about women's safety concerns and experiences with use of medicinal plants in pregnancy. We will further collect data about your chronic diseases and medication history, self-medication with conventional medicines, and social drug use during pregnancy.

Potential advantages and disadvantages

1
2
3 The results obtained from this study are useful in order to develop better strategies to
4 appropriately use medicinal plants, minimize medicinal plant use related problems and reduce
5 maternal morbidity and mortality. There is not any disadvantage in participating in this study,
6
7 except the time that it takes to answer the study questions.
8
9

10 11 **What will happen to your personal information?** 12

13 The data registered about you will only be used in accordance with the purpose of the study as
14 described above. All the data will be processed without name, personal identification number
15 or other directly recognisable type of information. A code number links you to your data and
16 only the authorized study staff will have access to this list. There will be no way of linking
17 your individual responses to the final result of the study findings. For documentation and
18 follow-up purposes, the data will be kept until 14.01.2024. The data will be stored as de-
19 identified data, i.e. a file with key identifiable information stored separately from the file
20 containing other data. The data will be anonymized within 6 months after this date. It will not
21 be possible to identify you in the results of the study when these are published.
22
23
24
25
26
27
28
29

30 **Voluntary participation** 31

32 Participation in this study is voluntary. You can withdraw your consent to participate in the
33 study at any time and without stating any particular reason. This will not have any
34 consequences for your further treatment. If you wish to participate, please sign the declaration
35 of consent at the bottom of this page. In case if you are not able to give written consent (i.e.
36 due to literacy and /or cultural reasons), your oral consent will be sought and documented as
37 equal to a written consent. There are no consequences for women who decide not to participate
38 in this study. The patient's decision to participate or not will have no impact on the treatment(s)
39 that she receives.
40
41
42
43
44
45
46
47

48 **Right to access and material storage** 49

50 If you agree to participate in the study, you are entitled to have access to the information
51 registered about you. You are further entitled to correct any mistakes in the information we
52 have registered. If you withdraw from the study, no further information or material will be
53 collected about you. Data that have already been collected will not be deleted.
54
55
56
57

58 **Information about the outcome of the study** 59 60

1
2
3 You, as a participant in this study, are entitled to receive information about the
4 outcome/result of the study.
5
6
7

8 **Funding**

9
10 Mr. Seid Mussa is a PhD student in the University of Oslo. He is a recipient of scholarship
11 from the Norwegian Loan Fund (Lånekassen).
12

13 If you have questions concerning the study, you may contact the research team:
14

15 **Mr. Seid Mussa Ahmed**

16 Telephone: +251911820125 (Mobile phone), +251471111979 (Office phone)

17 Email: seid.mussa@ju.edu.et / seidma@studmed.uio.no

18 School of Pharmacy, Faculty of health sciences, Jimma Institute of Health,
19 Jimma University, Jimma, Ethiopia;
20
21
22
23
24

25 **Dr. Yesuf Ahmed Aragaw**

26 Telephone: +251911004736 (Mobile phone), +251 471110867 (Office phone)

27 Email: yesuf.aragaw@ju.edu.et / yesufahmed47@yahoo.com

28 Department of Obstetrics and Gynaecology, Faculty of Medical Sciences,
29 Jimma Institute of Health, Jimma University, Jimma, Ethiopia;
30
31
32
33
34
35
36

37 **Consent for participation in the study**

38
39
40 I consent to participate in the study. _____

41 (Signed by the study participant, date)
42
43
44

45 Third party consent when this is warranted, either in addition to or in place of the
46 participant's consent. _____

47 (Signed by a close relative/partner/friend, date)
48
49
50
51

52 I confirm that I have given information about the study. _____

53 (Signed by the data collector, date)
54
55
56
57
58
59
60

Questionnaire

Instructions for enumerators:

- Many questions allow multiple answers. Unless specifically instructed in the question, do not prompt and simply encircle the answers that the woman mentions
- For open ended questions please write down the pregnant woman's response legibly

Part I. Socio-demographics characteristics of respondents

1.1. Study ID code _____

1.2. What is your age? _____

1.3. What is your place of residence?

- A. Urban
- B. Rural

1.4. What is your educational level?

- A. Illiterate
- B. Read and write but no formal education
- C. Primary 1st cycle (1-4)
- D. Primary 2nd cycle (5-8)
- E. Secondary school (9-12)
- F. Post-secondary school
- G. Others, specify _____

1.5. What is your marital status?

- A. Married
- B. Single
- C. Divorced
- D. Widowed

1.6. What is your ethnic group?

- A. Oromo
- B. Amhara
- C. Gurage
- D. Dawuro
- E. Silte
- F. Yem

- 1
2
3 G. Tigre
4
5 H. Others, specify _____
6

7 **1.7. What is your religion?**

- 8 A. Islam
9
10 B. Orthodox Christian
11
12 C. Protestant Christian
13
14 D. Catholic Christian
15
16 E. Others, specify _____

17 **1.8. What is your occupation?**

- 18 A. Farmer
19
20 B. House wife
21
22 C. Trader/Merchant
23
24 D. Government employee
25
26 E. Private employee
27
28 F. Daily labourer
29
30 G. Others, specify _____

31 **1.9. How many family members do you have (including yourself)? _____**

32 **1.10. Do you have access to any modern health facility (especially in 5 to 10 km walking**
33 **distance from your residence)? (If no skip to Q 2.1)**

- 34
35
36 A. Yes
37
38 B. No

39 **1.11. How many minutes walking distance is it to your nearest health facility? _____**

40
41
42 **Part II. Pregnancy-related questions**

43 **2.1. Are you pregnant? (If no skip to Q 2.3)**

- 44
45
46 A. Yes
47
48 B. No

49 **2.2. In which week of pregnancy (gestation age) are you? _____**

50 **2.3. How many days have passed since delivery? _____**

51 **2.4. How many children do you have from before the current pregnancy? _____**

52 **2.5. How many times have you been pregnant (i.e. Gravida)? _____**

53 **2.6. The number of times your pregnancies reaching viable gestational**
54 **age (including live births and stillbirths, i.e. parity) _____**

55 **2.7. History of any adverse pregnancy outcome? (If no skip to Q 3.1)**
56
57
58
59
60

1
2
3 A. Yes

4
5 B. No

6
7 **2.8. What type (s) of adverse pregnancy outcome?**

8 A. Down syndrome

9
10 B. Cleft lip/ palate

11 C. Neural tube defect

12 D. Cardiac defect

13
14 E. More than one/ mixed [please explain] _____

15
16 F. Others, specify _____

17
18
19 **2.9. Have you used iron sulphate during pregnancy? (If no skip to Q 3.1)**

20 A. Yes

21
22 B. No

23
24 **2.10. When did you use?**

25 A. First trimester (first three months of pregnancy)

26 B. Throughout the entire pregnancy

27 C. Before and during pregnancy

28
29 D. Others, specify _____

30
31
32
33
34 **Part III. Chronic disease and medication**

35
36 **3.1. Do you have chronic disease? (If no skip to Q 4.1)**

37 A. Yes

38
39 B. No

40
41 **3.2. What is the chronic disease? _____**

42 A. Hypertension

43 B. Diabetes mellitus

44 C. Asthma

45 D. Cardiac diseases

46 E. Liver disease

47 F. Chronic renal failure

48 G. Gastritis/peptic ulcer

49 H. HIV/AIDS

50 I. Others, specify _____

51
52
53
54
55
56
57
58 **3.3. Do you take drugs for the management of chronic illness? (If no skip to Q 3.5)**

59 A. Yes

1
2
3 B. No
4

5 3.4. What type of drugs are you taking [names of drugs]? _____
6

7 3.5. Are you currently attending chronic disease follow-up clinic?
8

9 A. Yes

10 B. No
11
12

13 **Part IV. Self-medication with conventional medicines**

14 4.1. Have you ever practiced self-medication (to treat self-diagnosed disorders or
15 symptoms) with conventional medicines during pregnancy? (If no skip to Q 5.1)
16

17 A. Yes

18 B. No
19

20 4.2. Which drugs did you use for self-medication?
21

22 A. NSAIDs (write drug name (s)) _____
23

24 B. Dermatologicals (write drug name (s)) _____
25

26 C. Antimicrobials (write drug name (s)) _____
27

28 D. Others, Specify _____
29

30 4.4. Had you received any advice /counselling on self-medications drugs? (If no skip to
31 Q 5.1)
32

33 A. Yes

34 B. No
35

36 4.5. For which of the following points you had received advice?
37

38 A. Tolerable side effects of drugs

39 B. Adverse drug reactions which requires prescribers visit

40 C. Management of missed dose

41 D. How to take the medication

42 E. Others specify _____
43
44
45
46
47
48
49

50 **Part V. Social drug use during pregnancy**

51 5.1. Do you smoke cigarette? (If no skip to Q 5.2.)
52

53 A. Yes

54 B. No
55

56 5.2. How many cigarettes do you smoke per day? _____
57

58 5.3. For how many years have you smoked? _____
59

60 5.4. Do you drink alcohol? (If no skip to Q 5.3.)

1
2
3 A. Yes

4
5 B. No

6
7 5.5. Which type of alcohol do you drink? _____

8 A. Tella (Local beer)

9
10 B. Katikala ('Ethiopian vodka')

11 C. Beer

12 D. Wine

13
14 E. Others, specify _____

15
16
17 5.6. What millilitre per day do you drink? _____

18
19 5.7. For how many years have you drunk? _____

20
21 5.8. Do you chew *Khat*? (If no skip to Q 6.1.)

22 A. Yes

23
24 B. No

25
26 5.9. What is the average weight in “zurba” that you chew daily? _____

27
28 5.10. For how many years have you chewed? _____

29
30 5.11. Any other social drug you used? _____

31
32
33 **Part VI. General questions about medicinal plants used during pregnancy**

34
35 6.1. Have you used any medicinal plants to manage your current pregnancy illness?

36 (If yes skip to Q. 6.4; if no skip to Q. 6.2 and Q. 6.3, and after that thank
37 the woman and stop the interview)

38 A. Yes

39
40 B. No

41
42
43 6.2. Why didn't you use medicinal plants in pregnancy?

44 A. Fear of complications to the baby

45 B. Religious belief

46 C. Not aware of their use in pregnancy

47 D. Counseled by the health worker

48 E. Others, specify _____

49
50
51 6.3. Outcomes of previous pregnancy for non-users of medicinal plants?

52 A. Alive

53 B. Neonatal death

54 C. Stillbirth

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

D. Abortion

E. Others, specify _____

For peer review only

Instructions for enumerators:

- Please interview the woman and fill the following table carefully for those women who claimed that they have used medicinal plants during pregnancy
- Please write the appropriate response accordingly or letters of the corresponding variable option or the variable option itself under each medicinal plant the woman mentions in the “Information about medicinal plants used by the woman” column on the right side of this page)
- If the woman mentions more types of medicinal plants, please use additional questionnaire and record the same code number to the additional questionnaire

Ser. no.	Questions on medicinal plants and medicinal plant utilization NB: Multiple responses are possible throughout this part	Name of the medicinal plant used & Information about its utilization		
		1.	2.	3.
6.4.	<p>Could you tell me any medicinal plant that you have used in your pregnancy, for the management of your pregnancy illnesses or for the benefit of the foetus or for any other related purpose?</p> <p>NB: <i>Please read the following medicinal plants for the interviewee and write down any Name of the plant(s) (local name and the language used) from the below list or other medicinal plants that she mentions</i></p> <ul style="list-style-type: none"> • Damakessie • Zingibil • Nech shinkrut • Abish • Tikur Azmud • Tena-Adam • Nech-bahr zaf • Dingetegna • Chikugn • Bisena/Misana • Kebericho • Kosso • Grawa • Ariti • Feto • Papaya • Ensilal • Dimbelal • Telba • Qarafa • Yeroo • Astenagr /Atse-faris • Areg Riesa • Senafitch • Besobila 			

Ser. no.	Questions on medicinal plants and medicinal plant utilization NB: Multiple responses are possible throughout this part	Name of the medicinal plant used & Information about its utilization		
		1.	2.	3.
6.5.	<p>For which type of pregnancy illness, do you use the medicinal plant?</p> <p>NB: <i>please read the following pregnancy related illnesses to the woman and write down any from the below list or other ailments that she mentions</i></p> <ul style="list-style-type: none"> • Pain (in back, neck or shoulder) • Headaches/Migraine • Heartburn/reflux problems • Gastritis/burning sensation • Urinary tract infection • Nausea • Vomiting • Induction of labour • Joint pain • Common cold/flu • Constipation/obstipation • Gestational hypertension (Preeclampsia) • Gestational diabetes • Abdominal cramps/ache • Postpartum bathing • Insomnia/Sleeping problems • Expel retained placenta • Prepare for labour • Leg/foot swelling • Wellbeing and nourishing foetus • General wellbeing • Mental wellbeing • Emergency illnesses • Depression 			
6.6.	In which trimester of pregnancy do you use it?			
	A. First trimester			
	B. Second trimester			
	C. Third trimester			
	D. Throughout pregnancy			
	E. Others, specify _____			
6.7.	For how many episodes do you take it during your pregnancy?			
	A. Once			

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46

Ser. no.	Questions on medicinal plants and medicinal plant utilization NB: Multiple responses are possible throughout this part	Name of the medicinal plant used & Information about its utilization		
		1.	2.	3.
	B. Twice			
	C. Trice			
	D. Every time when I feel sick			
	E. Others, specify _____			
6.8.	What part of the plant do you use?			
	A. Flower			
	B. Fruit			
	C. Seed			
	D. Leaf			
	E. Root			
	F. Stem			
	G. Bark: which one? i) Root bark ii) Stem bark iii) Both types of barks			
	H. Others, specify _____			
6.9.	What is the Mode of use?			
	A. Dried			
	B. Fresh			
	C. Both Fresh and Dried			
6.10.	What preparation methods do you use for each medicinal plant (please ask the woman and write down details of preparation procedures for each medicinal plant)			
	A. Maceration			
	B. Decoction			

Ser. no.	Questions on medicinal plants and medicinal plant utilization NB: Multiple responses are possible throughout this part	Name of the medicinal plant used & Information about its utilization		
		1.	2.	3.
	C. Infusion (tea form)			
	D. Squeezing			
	E. Powdering			
	F. Others, specify_____			
6.11.	6.11.1. Is there any medicinal plant or other additive mixed with this Medicinal plant during preparation? (If no skip to Q 6.12) A. Yes B. No			
	6.11.2. If Yes, please mention it with the importance of its incorporation _____			
6.12.	What is the route of administration, with a brief explanation if possible?			
	A. Oral			
	B. Topical			
	C. Nasal			
	D. Inhalation			
	E. Others, specify_____			
6.13.	What is the measure of medicinal plant preparation? (please write details)___			
6.14.	What is the dosage? (please write details)_____			
6.15.	What is the frequency of administration per day? (please write details)___			
6.16.	What is the duration of treatment? (please write details)_____			
6.17.	What is the solvent you used for the preparation?			
	A. Water			
	B. Oil			
	C. Coffee			
	D. Tea			

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46

Ser. no.	Questions on medicinal plants and medicinal plant utilization NB: Multiple responses are possible throughout this part	Name of the medicinal plant used & Information about its utilization		
		1.	2.	3.
	E. Milk			
	F. Soup			
	G. Others, specify_____			
6.18.	6.18.1. Is there any contraindications or any dietary restriction imposed during medicinal plants use? (If no skip to Q 6.19) A. Yes B. No			
	6.18.2. If yes, please tell me details_____			
6.19.	6.19.1. Do you have any information about precautions to be taken during medicinal plants use? (If no skip to Q 6.20) A. Yes B. No			
	6.19.2. If yes, please tell me details_____			
6.20.	6.20.1. Have you encountered/experienced any side effects during treatment? (If no skip to Q 6.21) A. Yes B. No			
	6.20.2. If yes, please tell me details_____			
6.21.	6.19.1. Have you encountered/experienced any adverse effects during treatment? (If no skip to Q 6.22) A. Yes B. No			
	6.21.2. If yes, please tell me details_____			

Ser. no.	Questions on medicinal plants and medicinal plant utilization NB: Multiple responses are possible throughout this part	Name of the medicinal plant used & Information about its utilization		
		1.	2.	3.
6.22.	6.22.1. Is there any antidotes to the adverse (unwanted) effects of the medicinal plant? (If no skip to Q 6.23) A. Yes B. No			
	6.22.2. If yes, please tell me details _____			
6.23.	6.23.1. Have you used any conventional medicine with the medicinal plants together or one after the other or at any time during pregnancy for pregnancy related illness prevention or treatment? (If no skip to Q 6.24) A. Yes B. No			
	6.23.2. Could you please tell me the name of the conventional medicine you used with the medicinal plants?			
	6.23.3. Why you used the conventional medicine and medicinal plants together?			
6.24.	6.24.1. Is there any interactions (medicinal plants-conventional medicine and/ or medicinal plants - medicinal plants interaction) you experienced/expected during treatment. (If no skip to Q 6.25) A. Yes B. No			
	6.24.2. If yes, please tell me details _____			
6.25.	6.25.1. Have you ever used medicinal plant for foetal advantage purpose? (If no skip to Q 6.26) A. Yes B. No			
	6.25.2. If yes, which medicinal plant? _____			

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46

Ser. no.	Questions on medicinal plants and medicinal plant utilization NB: Multiple responses are possible throughout this part	Name of the medicinal plant used & Information about its utilization		
		1.	2.	3.
	6.23.3. If yes, What is the proposed advantage of the medicinal plant for the foetus?___			
6.26.	7.26.1. Is there any medicinal plants contraindicated during pregnancy? (If no skip to Q 6.27) A. Yes B. No			
	6.26.2. If yes, why? please tell me details_____			
6.27.	6.27.1. Is there any medicinal plants contraindicated during lactation? (If no skip to Q 6.28) A. Yes B. No			
	6.27.2. If yes, please tell me the medicinal plant name _____			
	6.27.3. Why is it contraindicated during lactation?			
6.28.	Anything you want to tell us before we conclude the interview?_____			

1
2
3 **Part VII. Sources of information and medicinal plants used during pregnancy**
4

5 **7.1. What is your source of medicinal plants?** _____
6

- 7 A. Market places
8 B. Traditional healers (herbalist)
9 C. Garden
10 D. Shop
11 E. Neighbor
12 F. Others, specify _____
13
14

15 **7.2. Who helps you in the collection of the medicinal plants?**

- 16 A. Family members (mother, father, husband, grandmother, etc.)
17 B. Neighbours
18 C. Friends
19 D. My-self
20 E. Others, specify _____
21
22

23 **7.3. Who recommended you to use medicinal plants during pregnancy?**

- 24 A. Family members (mother, father, husband, grandmother, etc.)
25 B. Neighbours
26 C. Friends
27 D. My-self
28 E. Others, specify _____
29
30

31 **7.4. If anyone recommended you, did you get any information how to use medicinal
32 plants?**

- 33 A. Yes
34 B. No
35 C. Others, specify _____
36

37 **7.5. Were you satisfied with medicinal plant treatment outcomes? (If yes, finish!)**

- 38 A. Yes
39 B. No
40

41 **7.6. Why you were not satisfied?**

- 42 A. Got abortion
43 B. Uterine hyper-stimulation
44 C. Fetal distress
45 D. Stillbirth
46 E. Uterine rupture
47 F. Any other reason, specify _____
48
49

50 **7.7. Will you use medicinal plants in your future pregnancy?**

- 51 A. Yes
52 B. No
53
54

55 **I thank you for your time and cooperation!**
56

57
58 **Data collector: Name _____ Signature _____ date _____**
59
60

Additional table 2: Data extraction form for patient medical record review

Basic admission details and patient characteristics:

- Study Id ; Admission ward: Maternity/labour ; Gynaecology
- Age ; Weight ; Height
- Admission date Discharge date Duration of hospitalization
- Gestational age (in weeks)
- Gravidity: ; Parity
- Type of patient: Antenatal Postnatal
- Type of delivery: Vaginal delivery Cesarean delivery
- Breast feeding :Yes No
- Known drug allergies: Yes No ; Type of drug allergy

Details of admission (including vital signs):

Pregnancy outcomes and other obstetrics data (live birth, stillbirth, twin birth, postpartum haemorrhage, congenital abnormalities/birth defects, hypertension/eclampsia/HELLP, diabetes, placental abruption, etc.):

Any other maternal and perinatal outcomes:

Relevant laboratory results and investigations (Renal function test, Liver function test, Complete Blood Count (CBC), Echocardiography, Lipid Profile, Cardiac function, Electrolyte test, Glycaemic level, etc.):

Data collector: Name _____ **Signature** _____

Supplementary table 3: Definitions of safety categories of medicinal plants used during pregnancy at JUMC, Ethiopia

Classification	Description
Safe to use in pregnancy	Available human evidence suggests the medicinal plant can be safely used in pregnancy
Use with Caution	Available human evidence for the medicinal plant is limited so it should not be used without consulting a qualified health care practitioner
Potentially harmful to use in pregnancy	Available evidence has shown adverse impacts on pregnancy or fetus following the use of the medicinal plant
Information unavailable	No reference was found regarding use of the medicinal plant in pregnancy

Source [adapted from]: Kennedy DA, Lupattelli A, Koren G, Nordeng H. Safety classification of herbal medicines used in pregnancy in a multinational study. *BMC Complement Altern Med.* 2016; 16: 102.

Supplementary table 4: Overview of medicinal plants used during pregnancy according to safety classification and number of users at JUMC, Ethiopia

Type of medicinal plant used	Safety class*	Number of users (N=319)	Percentage [#]
<i>Linum usitatissimum</i> L. (Telba)	Caution	246	77.1
<i>Ocimum lamiifolium</i> L. (Damakessie)	Unavailable	40	12.5
<i>Carica papaya</i> L. (Papaya)	Caution	35	11.0
<i>Zingiber officinale</i> Roscoe. (Zingibil)	Safe	29	9.1
<i>Allium sativum</i> L. (Nech shinkrut)	Safe	28	8.8
<i>Trigonella foenum-graecum</i> L. (Abish)	Harmful	24	7.5
<i>Nigella sativa</i> L. (Tikur Azmud)	Unavailable	21	6.4
<i>Ruta chalepensis</i> L. (Tenadam)	Harmful	15	4.7
<i>Eucalyptus globulus</i> Labill. (Nech-bier zaf)	Safe	13	4.1
<i>Cinnamomum verum</i> J.Presl (Qarafa)	Harmful	4	1.3
<i>Taverniera abyssinica</i> A. Rich. (Dingetegna)	Unavailable	3	0.9
<i>Artemisia abyssinica</i> Sch.Bip. ex A.Rich. (Chikugn)	Harmful	3	0.9
<i>Croton macrostachyus</i> Hochst. (Bisena/Misana)	Harmful	3	0.9
<i>Echinops kebericho</i> Mesfin (Kebericho)	Harmful	3	0.9
<i>Hagenia abyssinica</i> (Bruce ex Steud.) J.F.Gmel. (Kosso)	Harmful	2	0.6
<i>Vernonia amygdalina</i> Del. (Grawa)	Unavailable	2	0.6
<i>Saccharum officinarum</i> L. (Sugar cane)	Safe	2	0.6
<i>Brassica nigra</i> (L.) K.Koch (Senafitch)	Unavailable	1	0.3
<i>Zehneria scabra</i> Sond. (Areg Riesa)	Unavailable	1	0.3
<i>Artemisia afra</i> Jacq. ex Willd. (Ariti)	Harmful	1	0.3
<i>Lepidium sativum</i> L. (feto)	Unavailable	1	0.3
<i>Guizotia abyssinica</i> (L.f.) Cass. (Nug)	Unavailable	1	0.3
<i>Vicia faba</i> L. (faba Beans)	Unavailable	1	0.3
<i>Ananas comosus</i> (L.) Merr. (Annanas)	Caution	1	0.3
<i>Phoenix dactylifera</i> L. (Temir)	Safe	1	0.3
<i>Pycnostachys abyssinica</i> Fresen. (Yeroo)	Unavailable	1	0.3
Bahuu/B'auu (Oromiffa language name)	Unavailable	1	0.3

***Safe:** safe to use in pregnancy; **Caution:** requires cautious to use in pregnancy; **Unavailable;** information on safety to use in pregnancy was not available in the current literature;

Harmful: potentially harmful to use in pregnancy [Contraindicated]; [#]Total percentage may exceed 100% due to multiple responses

Supplementary table 4: Overview of the utilization pattern of the most frequently used medicinal plants during pregnancy at JUMC, Ethiopia

Utilization properties (No. of citations) *

Scientific name, English name, Number of users, (n = 319)	Part of plant	Plant condition	Solvent	Excipients and reason for addition**	Routes of administration	Dose and measure of formulation	Frequency***	Duration of treatment***	Number of occasions of use in pregnancy****
<i>L. usitatissimum</i> (Flaxseed) (N=246)	Seed (244)	Dried (234) Fresh or dried (10) Fresh (2)	Water (192) Soup (53)	Sugar (86), sweetener Salt (6), flavourant Butter (2), flavourant Yogurt (1), flavourant Sugar or Salt (1), sweetener/flavourant/	Oral (245) Topical (1)	1 WGJC (176) 1 CC (38) ANSA (7) 2 WGJC (7) 1 TSP (4)	Once (151) Twice (60) Every time (20) Trice (9) 1 to 2 times (3)	During labour (92) Every time (40) Two months (39) Three months (19) Two days (17)	Once (138) Twice (44) Many times (38) Trice (19)
<i>O. lamifolium</i> (No common English name) (N=40)	Leaf (39)	Fresh (30) Fresh or dried (8)	Water (27) NSD (8)	-	Oral (18) Nasal/Inhalation (13)	ANSA (13) 1 CC (11) 1 to 2 CC (4)	Once (19) Every time (16)	Every time (22) One day (8)	Many times (17) Once (16)
<i>C. papaya</i> (Papaya) (N=35)	Fruit (32) Stem or Root Bark (2)	Fresh (32) Fresh or dried (2)	Water (6) NSD (29)	Sugar (8), sweetener Annans (1), for better effect	Oral (35)	1 WGJC (22) ANSA (9)	Once (24) Twice (5) Every time (3)	During labour (17) Two months (6) Every time (5)	Once (22) Many times (8)
<i>Z. officinale</i> (Ginger) (N=29)	Root or tuber (27)	Fresh or dried (14) Dried (9) Fresh (6)	Water (17) Tea (6)	Garlic (1), for better effect	Oral (27) Nasal/Inhalation (2)	1 CC (11) ANSA (7) 1 WGJC (4)	Once (11) Every time (9) Twice (5)	Every time (19) One day (5)	Many times (21) Once (4)
<i>A. sativum</i> (Garlic) (N=28)	Root or tuber (28)	Fresh or dried (16) Dried (7) Fresh (5)	Water (14) NSD (7)	Honey (2), sweetener Ginger (1), for better effect	Oral (27)	ANSA (9) 1 CC (5) 1 head of garlic (3)	Every time (11) Once (9) Twice (5)	Every time (18) One day (3)	Many times (22)
<i>T. foenum-graecum</i> (Fenugreek) (N=24)	Seed (21)	Dried (22)	Water (19) Soup (5)	Sugar (2), sweetener	Oral (23)	1 WGJC (16) 1 CC (5) ANSA (2)	Once (13) Twice (8) Every time (3)	During labour (14) 3 months (4) Every time (3)	Once (19) Many times (4)
<i>N. sativa</i> (Black seed) (N=21)	Oil (11) Seed (9)	Oil (11) Dried (7)	Water (7) NSD (8)	Cheese (1), flavourant	Oral (16)	ANSA (4) 1 TSP (3)	Every time (10) Once (6)	Every time (17) One day (3)	Many times (13)
<i>R. chalepensis</i> (Fringed rue) (N=15)	Leaf (15)	Fresh (12) Fresh or dried (3)	Water (11) Coffee (4)	Garlic (1), for better effect	Oral (15)	1 WGJC (6) 1 CC (4) ANSA (4)	Once (9) Every time (5)	Every time (10) Two days (2)	Many times (9) Once (4)
<i>E. globulus</i> ("Eucalyptus"/blue gum) (N=13)	Leaf (12)	Fresh (12)	Water (11)	<i>O. lamifolium</i> and <i>Leucas martinicensis</i> (Jacq.) R.Br. (1), for better effect <i>O. lamifolium</i> (1), for better effect	Nasal/Inhalation (10)	ANSA (12)	Every time (9) Once (4)	Every time (7) One day (5)	Many times (9) Once (3)

Abbreviations: WGJC: water glass/water jug cup (≈250mL), 1WGJC: One water glass/water jug cup, CC: Coffee cup, ANSA: take as 'needed in safe amount' using any appropriate measuring device for the appropriate duration the woman believes, SSp: Soup Spoon, NSD: No solvent needed, TSP: Teaspoon full. *Numbers may not add up due to missing values. **For better effect: Added to produce either synergistic or additive effect. ***Every time: a duration or frequency of treatment whereby the pregnant woman takes the MP for many frequencies per day that she believes is appropriate for a period of time until she feels cured. ****use for a given duration is taken as one occasion, for example use of the medicinal plant for a week, one month, two months, three months or more duration is taken as one occasion. On the other hand, if a woman uses for 2 weeks in the first month of pregnancy, and in the 2nd, 3rd, 4th and 5th months of pregnancy, each for one-week duration then the number of occasions will be five.

Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the STROBE cross sectional reporting guidelines, and cite them as:

von Elm E, Altman DG, Egger M, Pocock SJ, Gotsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies.

		Page
	Reporting Item	Number
Title and abstract		
Title	#1a Indicate the study's design with a commonly used term in the title or the abstract	1

1	Abstract	#1b	Provide in the abstract an informative and balanced summary	2
2				
3			of what was done and what was found	
4				
5				
6	Introduction			
7				
8				
9				
10	Background /	#2	Explain the scientific background and rationale for the	4,5
11	rationale		investigation being reported	
12				
13				
14				
15	Objectives	#3	State specific objectives, including any prespecified	5,6
16			hypotheses	
17				
18				
19				
20	Methods			
21				
22				
23	Study design	#4	Present key elements of study design early in the paper	6, 7
24				
25				
26	Setting	#5	Describe the setting, locations, and relevant dates, including	6-8
27			periods of recruitment, exposure, follow-up, and data	
28			collection	
29				
30				
31				
32				
33				
34	Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of	6, 7
35			selection of participants.	
36				
37				
38				
39				
40		#7	Clearly define all outcomes, exposures, predictors, potential	8-11
41			confounders, and effect modifiers. Give diagnostic criteria, if	
42			applicable	
43				
44				
45				
46				
47	Data sources /	#8	For each variable of interest give sources of data and details	8-10
48	measurement		of methods of assessment (measurement). Describe	
49			comparability of assessment methods if there is more than	
50			one group. Give information separately for exposed and	
51			unexposed groups if applicable.	
52				
53				
54				
55				
56				
57				
58				
59				
60				

1	Bias	#9	Describe any efforts to address potential sources of bias	7,8, 11
2				
3				
4	Study size	#10	Explain how the study size was arrived at	7
5				
6				
7	Quantitative	#11	Explain how quantitative variables were handled in the	10, 11
8	variables		analyses. If applicable, describe which groupings were	
9			chosen, and why	
10				
11				
12				
13				
14				
15	Statistical	#12a	Describe all statistical methods, including those used to	10, 11
16	methods		control for confounding	
17				
18				
19				
20	Statistical	#12b	Describe any methods used to examine subgroups and	10, 11
21	methods		interactions	
22				
23				
24				
25				
26	Statistical	#12c	Explain how missing data were addressed	n/a
27	methods			
28				
29				
30				
31	Statistical	#12d	If applicable, describe analytical methods taking account of	10, 11
32	methods		sampling strategy	
33				
34				
35				
36	Statistical	#12e	Describe any sensitivity analyses	n/a
37	methods			
38				
39				
40				
41				
42	Results			
43				
44				
45	Participants	#13a	Report numbers of individuals at each stage of study—eg	12
46			numbers potentially eligible, examined for eligibility,	
47			confirmed eligible, included in the study, completing follow-	
48			up, and analysed. Give information separately for for	
49			exposed and unexposed groups if applicable.	
50				
51				
52				
53				
54				
55				
56				
57	Participants	#13b	Give reasons for non-participation at each stage	12
58				
59				
60				

1	Participants	#13c	Consider use of a flow diagram	n/a
2				
3				
4	Descriptive data	#14a	Give characteristics of study participants (eg demographic,	n/a
5			clinical, social) and information on exposures and potential	
6			confounders. Give information separately for exposed and	
7			unexposed groups if applicable.	
8				
9				
10				
11				
12				
13				
14	Descriptive data	#14b	Indicate number of participants with missing data for each	12
15			variable of interest	
16				
17				
18				
19	Outcome data	#15	Report numbers of outcome events or summary measures.	23,24
20			Give information separately for exposed and unexposed	
21			groups if applicable.	
22				
23				
24				
25				
26				
27	Main results	#16a	Give unadjusted estimates and, if applicable, confounder-	23,24
28			adjusted estimates and their precision (eg, 95% confidence	
29			interval). Make clear which confounders were adjusted for	
30			and why they were included	
31				
32				
33				
34				
35				
36				
37	Main results	#16b	Report category boundaries when continuous variables were	23,24
38			categorized	
39				
40				
41				
42	Main results	#16c	If relevant, consider translating estimates of relative risk into	n/a
43			absolute risk for a meaningful time period	
44				
45				
46				
47				
48	Other analyses	#17	Report other analyses done—e.g., analyses of subgroups	n/a
49			and interactions, and sensitivity analyses	
50				
51				
52				
53	Discussion			
54				
55				
56	Key results	#18	Summarise key results with reference to study objectives	16
57				
58				
59				
60				

1	Limitations	#19	Discuss limitations of the study, taking into account sources	19,20
2			of potential bias or imprecision. Discuss both direction and	
3			magnitude of any potential bias.	
4				
5				
6				
7				
8				
9	Interpretation	#20	Give a cautious overall interpretation considering objectives,	16-19
10			limitations, multiplicity of analyses, results from similar	
11			studies, and other relevant evidence.	
12				
13				
14				
15				
16	Generalisability	#21	Discuss the generalisability (external validity) of the study	19, 20
17			results.	
18				
19				
20				
21				
22	Other Information			
23				
24				
25	Funding	#22	Give the source of funding and the role of the funders for the	21
26			present study and, if applicable, for the original study on	
27			which the present article is based	
28				
29				
30				
31				
32				

33 The STROBE checklist is distributed under the terms of the Creative Commons Attribution License
34 CC-BY. This checklist was completed on 31. October 2020 using <https://www.goodreports.org/>, a tool
35 made by the [EQUATOR Network](#) in collaboration with [Penelope.ai](#)
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60