

# Pregnant women's knowledge, attitude, and practice toward physical exercise during pregnancy and its associated factors at Dessie town health institutions, Ethiopia



Abdusellam Yimer, MSc; Seada Endris, MSc; Alemtsehay Wossen, MSc; Mengistu Abate, MSc

**BACKGROUND:** Physical exercise consists of planned, repetitive, and intentional movements that reduce the risk of pregnancy-related complications. Worldwide, there is a high rate of physical inactivity during pregnancy, including in Ethiopia, which has detrimental effects on both pregnant women and their developing fetus.

**OBJECTIVE:** This study aimed to assess pregnant women's knowledge, attitude, and practice toward physical exercise during pregnancy and its associated factors among antenatal care attendants at health institutions in Dessie, South Wollo Zone, Amhara Region, Ethiopia, in 2023.

**STUDY DESIGN:** An institutional-based cross-sectional study was conducted among 614 pregnant women receiving antenatal care between January 18, 2023, and February 25, 2023. The study participants were selected using systematic random sampling technique. Data were collected using a pretested, face-to-face interviewer-administered, and semistructured questionnaire. The data were cleaned, coded, and entered into EpiData (version 4.6; [www.epidata.dk](http://www.epidata.dk)) and analyzed using SPSS (version 25; SPSS Inc, Chicago, IL). Bivariate and multivariate binary logistic regression analyses were performed to identify factors associated with knowledge, attitude, and practice toward physical exercise during pregnancy. Variables with a *P* value of  $<.2$  in the bivariate analysis were transferred to the multivariate analysis. Finally, the adjusted odds ratio and 95% confidence interval with a *P* value of  $<.05$  in the multivariate analysis were considered statistically significant.

**RESULTS:** The study found that 56.3% of participants had good knowledge, 51.5% of participants had a favorable attitude, and 32.2% of participants practiced physical exercise during pregnancy. Age, educational level, and heard about physical exercise during pregnancy were positively associated with pregnant women's knowledge and attitude. In addition, age, antenatal care follow-up, no history of abortion, ever done physical exercise before becoming pregnant, and good knowledge were positively associated with pregnant women's practice of physical exercise during pregnancy.

**CONCLUSION:** Our findings indicate that approximately half of the participants had good knowledge and a favorable attitude. However, almost one-third of the participants practiced physical exercise during their pregnancy. It is recommended that antenatal care providers advise pregnant women to strengthen their antenatal care follow-up and offer health education and counseling about the benefits of physical exercise during pregnancy.

**Key words:** attitude, Dessie, Ethiopia, knowledge, physical exercise, practice, pregnant women

## Introduction

Physical activity involves all bodily movements produced by the contraction and relaxation of skeletal muscles. Physical exercise (PEx) is a type of physical activity that consists of

planned, repetitive, and intentional movements that have several health benefits for pregnant women and their fetuses.<sup>1,2</sup>

Comprehensive antenatal care (ANC) is an effective intervention to

prevent maternal morbidity and mortality. This type of care aims to ensure a positive pregnancy and birth experience by identifying risks, managing pregnancy-related complications, and promoting health education.<sup>3,4</sup> PEx is one

From the Department of Midwifery, College of Medicine and Health Sciences, Dire-Dawa University, Dire Dawa, Ethiopia (Yimer); Department of Midwifery, College of Medicine and Health Sciences, Wollo University, Dessie, Ethiopia (Endris, Wossen, and Abate); School of Public Health, Department of Epidemiology and Biostatistics, College of Medicine and Health Sciences, Wollo University, Dessie, Ethiopia (Abate)

Ethical approval and consent were obtained for this study. The ethical clearance letter was granted by the ethical review committee of Wollo University, and oral informed consent was obtained from all participants. Information obtained from each study participant were kept confidential.

The dataset used in this study is available from the corresponding author on reasonable request.

The author report no conflict of interest.

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Corresponding author: Abdusellam Yimer, MSc. [yimerabdusellam@gmail.com](mailto:yimerabdusellam@gmail.com)

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## AJOG Global Reports at a Glance

**Why was this study conducted?**

Physical exercise (PEX) has many health benefits, but little attention has been given to PEX during pregnancy. To the best of the investigator's knowledge, no study has been conducted on pregnant women's knowledge, attitude, and practice toward PEX during pregnancy and its associated factors among antenatal care (ANC) attendants in this study area. A limited number of studies have been conducted on pregnant women's knowledge, attitude, and practice toward PEX during pregnancy and its associated factors. Previous studies have been limited to governmental health institutions. In contrast, governmental and private health institutions were included in this study. Despite the aforementioned gap, labor preparation exercises, such as squatting and pelvic tilts, have not been studied in the past, but these variables are examined in this study.

**Key findings**

Age, educational level, and heard about PEX during pregnancy were positively associated with pregnant women's knowledge and attitude. In addition, age, ANC follow-up, no history of abortion, ever done PEX before becoming pregnant, and good knowledge were positively associated with pregnant women's practice of PEX during pregnancy.

**What does this add to what is known?**

Age (from 25 to 35 years) was determined to affect pregnant women's knowledge, attitude, and practice toward PEX during pregnancy; however, age was not considered a factor affecting the practice of PEX during pregnancy in the previous study. In addition, the number of ANC follow-ups was determined to affect the practice of PEX during pregnancy.

of the health promotion and preventive measures for pregnancy-related complications.<sup>1,2</sup> PEX is reliable, safe, and beneficial during pregnancy for both the pregnant women and fetuses, with no obstetrical or medical contraindications.<sup>2,5,6</sup>

Engaging in PEX during pregnancy enhances physical fitness, reduces gestational weight gain, lowers the risk of gestational diabetes mellitus, decreases cesarean delivery rates, and prevents hypertension, postpartum depression, and instrumental deliveries.<sup>1,2,5,7</sup> The recommended PEX in pregnancy include walking, relaxation/breathing exercises, pelvic floor exercises, back care exercises, ankle and toe exercises, aerobic swimming, and labor preparation exercises, such as squatting and pelvic tilts. The American College of Obstetricians and Gynecologists (ACOG) and the American College of Sports Medicine recommended that light to moderate PEX during pregnancy is generally safe and beneficial for most women. Pregnant women should aim

for at least 150 minutes of moderate-intensity exercise per week, at least 3 days per week, with a minimum of 30 minutes per session.<sup>1,7,8</sup>

The increasing global trend of physical inactivity poses serious health risks, including the increase of noncommunicable diseases, such as hypertensive disorders during pregnancy and gestational diabetes mellitus, contributing to maternal mortality rates.<sup>9,10</sup> The United Nations has set a target within its Sustainable Development Goals in 2015 to reduce the maternal mortality ratio to below 70 per 100,000 live births by 2030.<sup>11</sup> To achieve this, the United Nations Population Fund emphasizes the need for improved health promotion, reproductive healthcare, and preventive services to avoid pregnancy-related complications.<sup>12</sup>

Globally, the magnitude of pregnant women's knowledge of PEX during pregnancy varies across different countries. Evidences from studies conducted in different countries revealed a magnitude of poor knowledge of PEX during

pregnancy: 34.0% in India, 93.0% in Iraq, 81.0% in Zambia, 51.0% in Nigeria, 44.6% in Arba Minch, and 59.5% in Gondar.<sup>13–23</sup>

Globally, the magnitude of pregnant women's attitude toward PEX during pregnancy varies from country to country. Evidences from studies conducted in different countries revealed a magnitude of unfavorable attitude toward PEX during pregnancy: 6.2% in Brazil, 64.5% in Sri Lanka (Colombo), 7% in Zambia, 15.6% in Nigeria, 54.0% in Arba Minch, and 72.1% in Addis Ababa.<sup>14–23</sup>

According to the World Health Organization report in 2015, an estimated 3.2 million global deaths are caused by physical inactivity.<sup>24</sup> Of note, <15% of pregnant women achieved the minimum recommended 150 minutes per week of moderate-intensity PEX during their pregnancy.<sup>2</sup> Researchers worldwide have documented that the magnitude of the practice of PEX during pregnancy in developing countries and in developed countries was low and does not meet ACOG requirements.<sup>14–16,21,25</sup>

A systematic review conducted in Africa found that the magnitude of the practice of PEX during pregnancy was low.<sup>26</sup> The magnitude of the practice of PEX during pregnancy in pregnant Ethiopian women was found to be low, ranging from 20.7% in Mekele to 30.9% in Gondar.<sup>21,23,25</sup> This can be due to several factors, such as lack of information from healthcare providers and lack of awareness about the benefit of PEX during pregnancy,<sup>21,23</sup> no habit of practice of PEX before becoming pregnant,<sup>20,23</sup> history of abortion,<sup>20,25</sup> poor knowledge about PEX,<sup>20,21,23</sup> and unfavorable attitude<sup>20,21</sup> toward PEX during pregnancy.

Planned and repetitive PEX offers several health benefits, including a 35.0% reduction in excessive maternal gestational weight gain, a 55.0% reduction in gestational diabetes mellitus and its complications,<sup>27,28</sup> an 11.2% increase in the likelihood of vaginal delivery, a 66.0% reduction in cesarean delivery rate,<sup>29</sup> a reduced risk of macrosomia, a decreased rate of operative deliveries, a reduced risk of antenatal and postnatal depression, a shortened duration of

labor, a reduction in the rate of delivery complications, and a quick recovery after childbirth.<sup>1,5,29,30</sup> In addition, participating in PEx, such as walking, reduces the risk of hypertensive disorder during pregnancy by 30% to 33%.<sup>27</sup>

Despite these well-documented benefits, little attention has been given to PEx during pregnancy. To the best of the investigator's knowledge, no study has been conducted on pregnant women's knowledge, attitude, and practice toward PEx during pregnancy and its associated factors among ANC attendants in this study area. A limited number of studies have been conducted on pregnant women's knowledge, attitude, and practice toward PEx during pregnancy and its associated factors. Previous research is limited only to governmental health institutions. In contrast, governmental and private health institutions were included in this study. Therefore, this study aimed to fill this gap by assessing pregnant women's knowledge, attitude, and practice toward PEx during pregnancy and its associated factors among ANC attendants at health institutions in Dessie, Amhara Region, Northeast Ethiopia.

## Materials and methods

### Study area, design, and period

This study was conducted at health institutions in Dessie, which is the capital of the South Wollo Zone, Amhara Region, Northeast Ethiopia, which is 401 km away from Addis Ababa. The town of Dessie has 2 governmental hospitals, 8 governmental health centers, 4 private hospitals, and 73 private clinics. Among these, 17 health institutions (10 governmental and 7 private) provide maternal and child health-related services. The number of pregnant women who attended ANC follow-ups at health institutions in Dessie from December 1, 2022, to December 30, 2022, was 1223. An institutional-based cross-sectional study was conducted from January 20, 2023, to March 20, 2023.

**Source population.** The source population included all pregnant women who had attended ANC follow-ups at health institutions in Dessie.

**TABLE 1**

### Sample size calculation for pregnant women's knowledge, attitude, and practice toward PEx during pregnancy at health institutions in Dessie, Northeast Ethiopia, in 2023

No.	Dependent variables	P (%)	D (%)	CI	n	Reference
1	Good knowledge	50.4	5	95	384	<sup>21</sup>
2	Favorable attitude	46	5	95	381	<sup>20</sup>
3	Practice of PEx during pregnancy	30.9	5	95	328	<sup>23</sup>

CI, confidence interval; D, margin of error; P, proportion; PEx, physical exercise.

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**Study population.** The study population included all pregnant women who had attended ANC follow-ups at randomly selected 5 public health institutions and 4 private health institutions in Dessie during the study period.

**Study unit.** The study unit included selected pregnant women who had attended ANC follow-ups at the selected 5 public health institutions and 4 private health institutions during the study period and met inclusion criteria.

**Inclusion criteria.** All pregnant women who had attended ANC follow-ups at the selected 5 public health institutions and 4 private health institutions in Dessie during the study period were included.

**Exclusion criteria.** Pregnant women who had antepartum hemorrhage, orthopedics limitation, and seizure disorder at the time of data collection were excluded.

### Sample size determination

The sample size for the 3 dependent variables (knowledge, attitude, and practice) was calculated using a single population proportion formula (Table 1<sup>20,21,23</sup>), and the sample size for factors associated with pregnant women's knowledge, attitude, and practice toward PEx during pregnancy was calculated using Epi Info software (version 7; Centers for Disease Control and Prevention, Atlanta, GA) (Table 2<sup>20–23</sup>).

For dependent variables, it was calculated based on a single population proportion formula:  $n = (Z_{\alpha/2})^2 \times$

$P \times (1 - P) / d^2$ , where n is the required sample size; Z is the level of significance corresponding to 95% confidence interval (CI) ( $Z_{\alpha/2} = 1.96$ ); P is the proportion of good knowledge (50.4%), favorable attitude (46.0%), and practice (30.9%); and d is the absolute precision or margin of error that can be tolerated (5.0%) ( $d = 0.05$ ).

The study considered the maximum calculated sample size. Therefore, the proportion of pregnant women having good knowledge of PEx during pregnancy taken from a study conducted in Addis Ababa, Ethiopia,<sup>21</sup> was given the maximum sample size of 384. Using a 1.5 design effect and considering a non-response rate of 10% (38), the final sample size becomes 614.

### Sampling techniques and procedures

A stratified sampling technique was used to select study participants. First, the health institutions in Dessie were stratified into 2 groups: governmental and private. Of note, 5 governmental health institutions and 4 private health institutions were selected using a simple random sampling technique.

Second, the total sample size was proportionally allocated for the selected 9 health institutions, depending on the number of pregnant women in each health institution from December 1, 2022, to December 30, 2022. Each study participant was selected using a systematic random sampling technique at every Kth interval from the 9 health institutions.

The sampling interval was approximately 2 for each health institution, and

TABLE 2

**Sample size calculation for factors associated with pregnant women's knowledge, attitude, and practice toward PEx during pregnancy at health institutions in Dessie, Northeast Ethiopia, in 2023**

No.	Associated factors	Po (%)	P1 (%)	AOR	CI	P	r	n	Reference
1	Factors associated with pregnant women's knowledge of PEx during pregnancy								
	College and above educational level	30.1	69.9	3.08	95	80	2	215	21
	Secondary educational level	32.2	67.8	3.95	95	80	2	153	22
	Diploma educational level	18.6	81.2	2.80	95	80	2	377	23
2	Factors associated with pregnant women's attitude toward PEx during pregnancy								
	College and above educational level	30.1	69.9	3.14	95	80	2	209	21
	History of prepregnancy PEx	36.5	63.5	3.04	95	80	2	185	21
	Degree and above educational level	19.8	80.2	3.44	95	80	2	279	23
3	Factors associated with pregnant women's practice of PEx during pregnancy								
	Heard about PEx during pregnancy	41.8	58.2	3.10	95	80	2	161	21
	Diploma educational level	18.6	81.4	2.90	95	80	2	363	23
	Degree and above educational level	19.8	80.2	4.01	95	80	2	240	23

AOR, adjusted odds ratio; CI, confidence interval; P1, proportion of factors in unexposed; PEx, physical exercise; Po, proportion of factors in exposed; r, ratio of unexposed to exposed.

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the study participant was selected every 2 intervals from each health institution until the desired sample size was reached (Figure 1).

### Study variables

**Dependent variables.** The dependent variables of this study were knowledge, attitude, and practice.

**Independent variables.** The independent variables considered in this study were sociodemographic-related characteristics, obstetrical-related characteristics, and awareness of pregnant women toward PEx during pregnancy—related characteristics.

### Operational definitions

**Knowledge of physical exercise during pregnancy.** Knowledge of physical exercise during pregnancy is defined as a pregnant woman's ideas about the health benefits and contraindications of PEx during pregnancy.<sup>14,21–23</sup>

**Good knowledge.** Good knowledge is defined as participants whose responses were greater than or equal to the mean

value (2.4942) of knowledge of PEx during pregnancy questions.<sup>21–23</sup>

**Attitude toward physical exercise during pregnancy.** Attitude toward physical exercise during pregnancy is defined as the opinion of a pregnant woman concerning performing PEx during pregnancy.<sup>21–23</sup>

**Favorable attitude.** Favorable attitude is defined as participants whose responses were greater than or equal to the mean value (3.6439) of attitude toward PEx during pregnancy questions.<sup>21–23</sup>

**Practice physical exercise during pregnancy.** Practice physical exercise during pregnancy is defined as a pregnant woman who participates in or does any type of antenatal PEx in the current pregnancy that is recommended by ACOG.<sup>1</sup>

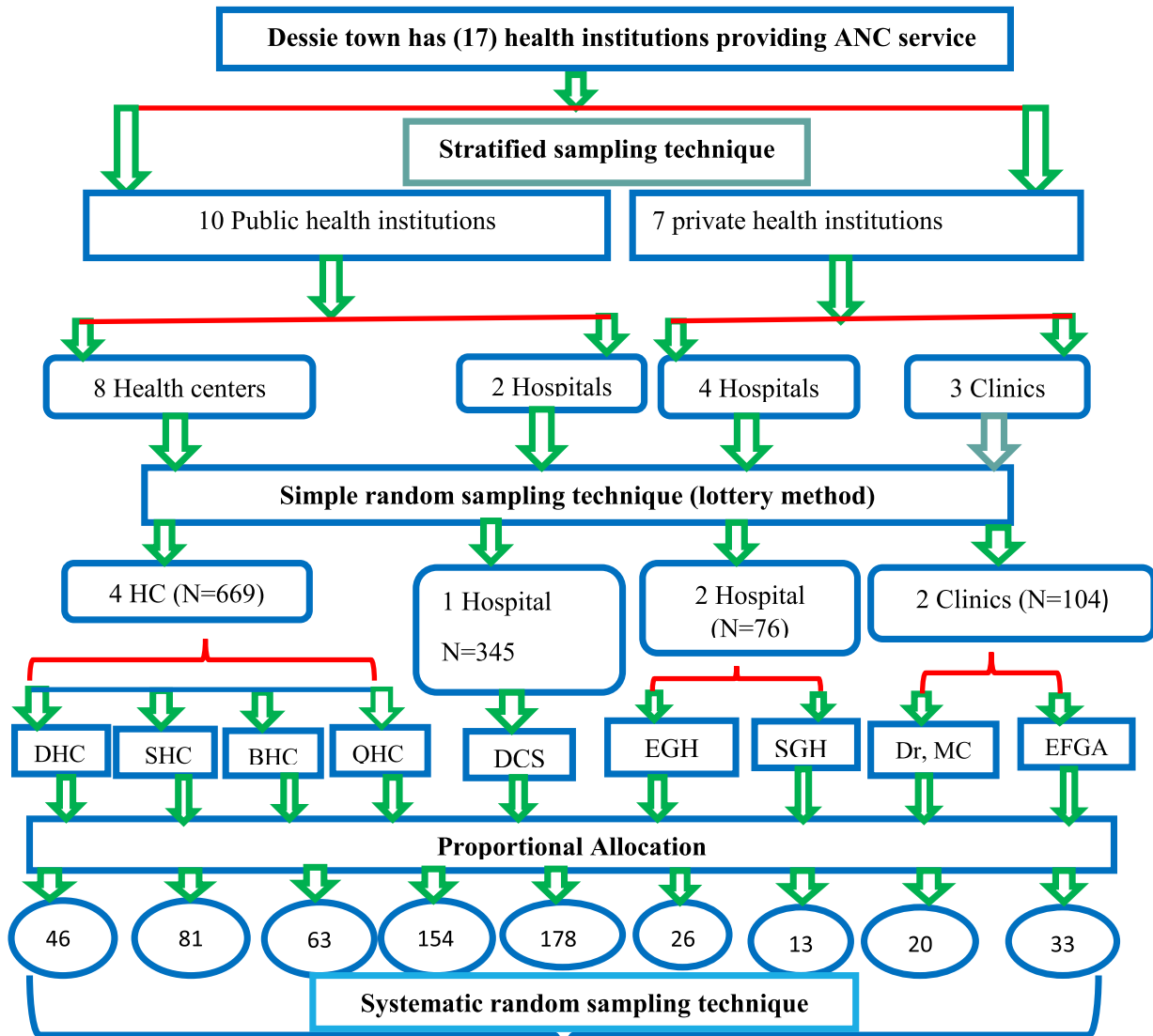
**Practiced.** Practiced is defined as pregnant women who practiced any type of PEx during pregnancy in frequency at least 3 times a week and a duration of  $\geq 30$  minute per session.<sup>1</sup>

### Data collection tools and procedures

Data were collected using a pretested, face-to-face interviewer-administered, and semistructured questionnaire. The tool was adopted and adapted from different literatures reviewed and was based on ACOG recommendations of PEx during pregnancy.<sup>1,20–23</sup> The questionnaire consisted of 6 parts: part 1, sociodemographic characteristics (both open- and close-ended questions); part 2, obstetrical characteristics (open-ended questions); part 3, awareness of pregnant women toward PEx during pregnancy (close-ended questions); part 4, knowledge of PEx during pregnancy (close-ended questions); part 5, attitude toward PEx during pregnancy (close-ended questions); and part 6, practice of PEx during pregnancy (both open- and close-ended questions).

Of note, 9 data collectors (4 midwives with diplomas and 5 midwives with degrees) and 1 public health officer with a master's degree (supervisor) were involved in data collection. Training was provided for 2 days covering study objectives, data collection procedures, participant confidentiality, eligibility criteria, informed consent, and interview techniques. Close monitoring was

**FIGURE 1**  
**Schematic presentation of the sampling procedure**



Key:

DRH=Dessie comprehensive

Specialized hospital

SHC=Segno gebaye health center

BHC=Buambuha health center

QHC=Qurqur health center

EFGA=Family guidance association

DHC=Dessie health center

EGH=Ethio general hospital

W/r SGH= W/r Sihh general hospital

Dr.MC=Dr. Mnase clinic

Final sample size  
= 614

ANC, antenatal care; BHC, Buambuha Health Center; DHC, Dessie Health Center; DRH, Dessie Comprehensive Specialized Hospital; EFGA, Ethiopia Family Guidance Association; EGH, Ethio General Hospital; QHC, Qurqur Health Center; SHC, Segno Gebeya Health Center.

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implemented throughout the data collection process.

### Data quality control

The tool was developed in English, translated into Amharic, and then back-translated to ensure accuracy. Of note, 4 academicians reviewed the tool to determine its content validity, resulting in a content validity index of 0.95 based on their evaluations. Valuable suggestions and recommendations from experts were incorporated into the tool. Data were collected using the Amharic version of the questionnaire for better understanding by data collectors and study participants. A pretest was performed at Kombolcha General Hospital with 5% of the sample size. The tool was assessed for clarity, readability, comprehensiveness, and accuracy. Feedback was incorporated.

The internal consistency/reliability of the item was checked by computing the Cronbach alpha. The values of the Cronbach alpha were 0.83 for knowledge assessment and 0.76 for attitude assessment.

### Data processing and analysis

Data were manually checked for completeness and cleaned. The questionnaire was coded, and data were entered into EpiData (version 4.6.0.0; [www.epi-data.dk](http://www.epi-data.dk)) and then exported to SPSS (version 25; SPSS Inc, Chicago, IL) for analysis. Descriptive statistics (mean, median, standard deviation, and percentage) and inferential statistics (adjusted odds ratio [AOR]) were used to summarize the data. Bivariate logistic regression analysis was performed to identify the associations between each independent variable and pregnant women's knowledge, attitude, and practice toward PEx during pregnancy. Variables with a *P* value of <.2 in bivariate analysis were included in the multivariate logistic regression. In the multivariate logistic regression analysis, statistically significant variables (*P* value of <.05) were reported with AORs and 95% CIs. The Hosmer-Lemeshow goodness-of-fit test was used (*P* value of >.05 considered statistically significant). Multicollinearity was checked using the

variance inflation factor. The results were presented as texts, tables, and graphs.

### Ethical consideration

The Institutional Research Ethical Review Committee at the College of Medicine and Health Science of Wollo University ethically approved the study with a letter reference number (CMHS/749/2023 on January 5, 2023). A formal permission letter was written to the Dessie administration health department from Wollo University. A letter of support was obtained from the Dessie administration health department with a letter reference number (፳፻፳-3/955/2015 on August 5, 2015). Before enrollment, the pregnant women were informed about the objectives of the study, its importance, and the right not to participate in the study. Informed verbal consent was taken from all study participants before data collection

because some of the study participants could not read and write. Anonymity and confidentiality were maintained.

### Results

#### Sociodemographic characteristics of study participants

The response rate of the study was 98.0%. The median age of the participants was 28 years (interquartile range, 25–31). More than half of the participants (58.8%) were in the age category between 25 and 34 years. Of note, 592 participants (98.7%) were married. One-third of the study participants (33.7%) attended primary school. Regarding their occupation, 44.3% of the study participants were housewives (Table 3).

#### Obstetrics characteristics of study participants

Regarding ANC follow-up, nearly half of the participants (44.2%) had attended

**TABLE 3**

**Sociodemographic characteristics of pregnant women among antenatal care attendants at selected health institutions in Dessie, Amhara Region, Northeast Ethiopia, in 2023 (n=600)**

Variables	Category	n	%
Age of women (y)	<25	142	23.7
	25–34	353	58.8
	≥ 35	105	17.5
Religion	Muslim	314	52.3
	Orthodox	267	44.5
	Protestant	6	1.0
	Catholic	13	2.2
Women's educational level	No formal education	99	16.5
	Primary school	202	33.7
	Secondary school	193	32.2
	College and university	106	17.7
Women's occupation	Governmental employed	96	16.0
	Private business	177	29.5
	Housewife	266	44.3
	Nongovernmental	61	10.2
Average monthly income in ETB	<1987 ETB	374	62.3
	≥1987 ETB	226	37.7

ETB, Ethiopian Birr.

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≥3 ANC follow-ups. More than half of the participants (58.0%) were multigravida, and nearly half of the participants (46.2%) were nulliparous. Almost half of the study participants were within 7 to 9 months of pregnancy (Table 4).

### Awareness of pregnant women about physical exercise during pregnancy

Of note, 236 study participants (39.3%) had heard about PEx during pregnancy. Of those who heard about PEx during pregnancy, 100.0%, 13.6%, 10.2%, and 4.2% of the study participants heard about walking, relaxation/breathing, preparing for labor (squatting and pelvic tilts), and pelvic floor muscle exercise, respectively. Most of the study participants (88.2%) did not practice PEx before becoming pregnant (Table 5).

### Source of information of pregnant women about physical exercise during pregnancy

Their source of information about PEx during pregnancy were family and friends, mass media (television and radio), healthcare providers, and social media, accounting for 44.92%, 24.15%, 20.34%, and 10.59%, respectively (Figure 2).

### Pregnant women's knowledge level toward benefits and contraindications of physical exercise during pregnancy

Regarding knowledge assessment questions about the benefits of PEx during pregnancy, 40.7%, 63.5%, 88.8%, 75.3%, and 62.5% of the study participants knew that PEx during pregnancy can reduce the risk of excessive weight gain, can strengthen pelvic floor muscles, can prevent antenatal and postnatal depression, has benefits for general health and development of the baby, and improves the ability to cope with labor and delivery, respectively. Regarding contraindications of PEx during pregnancy, 56.0%, 59.7%, 100.0%, and 54.0% of the study participants knew that chest pain, difficulty in breathing, vaginal bleeding, and decreased fetus movement during pregnancy were contraindicated for

**TABLE 4**

**Obstetrics characteristics of pregnant women among ANC attendants at selected health institutions in Dessie, Amhara Region, Northeast Ethiopia, in 2023 (n=600)**

Variables	Category	n	%
ANC follow-up	Not started	98	16.3
	1–2	237	39.5
	≥3	265	44.2
Gravidity	Primigravida	252	42.0
	Multigravida	348	58.0
Parity	Nulliparous	277	46.2
	Primiparous	197	32.8
	Multiparous	126	21.0
Number of living children they have	No child	276	46.0
	1–2 children	241	40.2
	>2 children	83	13.8
History of abortion	Yes	66	11.0
	No	534	89.0
Gestational age	<4 mo	71	11.8
	4–6 mo	233	38.8
	7–9 mo	296	49.3

ANC, antenatal care.

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**TABLE 5**

**Awareness of pregnant women about PEx during pregnancy among antenatal care attendants at selected health institutions in Dessie, Amhara Region, Northeast Ethiopia, in 2023 (n=600)**

Variables	Category	n	%
Ever heard about PEx during pregnancy (n=600)	Yes	236	39.3
	No	364	60.7
Types of PEx during pregnancy you heard or aware (n=236) <sup>a</sup>	Walking	236	100.0
	Relaxation/breathing	32	13.6
	Pelvic floor exercise	10	4.2
	Back care exercises	1	0.4
	Ankle and toe exercises	1	0.4
	Swimming	5	2.1
	Preparing for labor: squatting and pelvic tilts	24	10.2
Ever done PEx before becoming pregnant (n=600)	Yes	71	11.8
	No	529	88.2

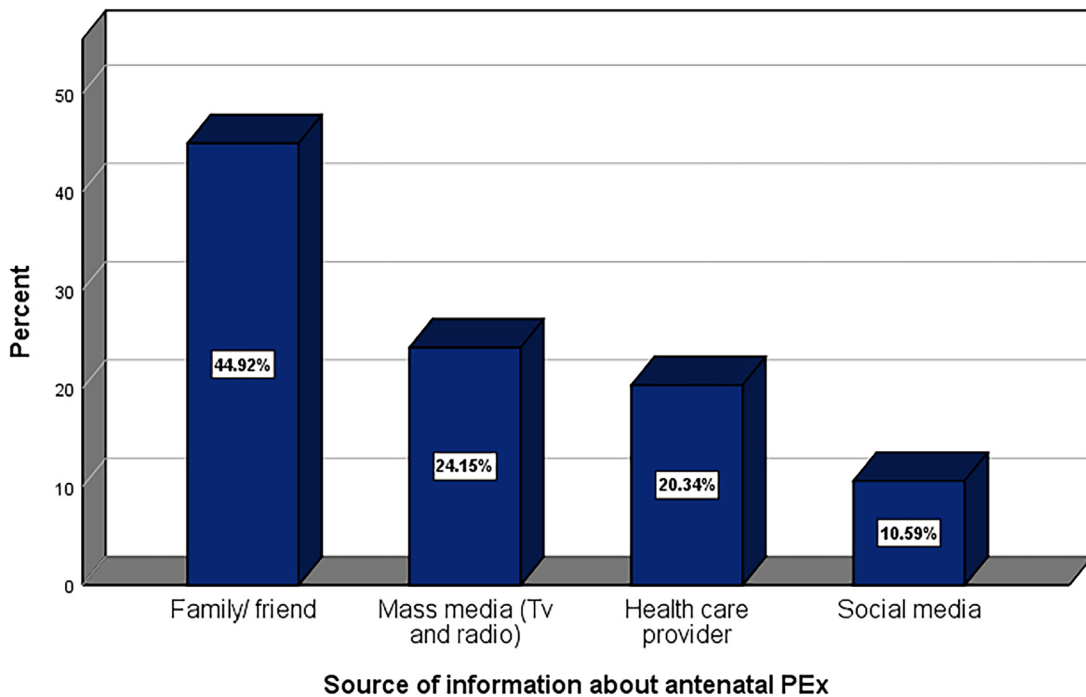
PEx, physical exercise.

<sup>a</sup> Multiple responses.

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**FIGURE 2**

**Source of information of pregnant women about PEx during pregnancy at selected health institutions at Dessie town, Northeast Ethiopia, 2023**



ANC, antenatal care; PEx, physical exercise.

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doing PEx during pregnancy, respectively (Table 6).

Of 600 pregnant women, 338 study participants (56.33%) had overall good knowledge of PEx during pregnancy, whereas the remaining 262 study participants (43.67%) had overall poor knowledge of PEx during pregnancy (Figure 3).

### Pregnant women's attitude level toward physical exercise during pregnancy

Regarding attitude assessment questions toward PEx during pregnancy, approximately 382 study participants (63.7%) agree that PEx during pregnancy is necessary. One-third of the study participants (33.8%) strongly disagreed that PEx during pregnancy poses a risk to the fetus. More than half of the study participants (57.0%) agree that PEx during pregnancy should be performed under the guidance of a healthcare professional. Moreover, 422 study

participants (70.5%) personally like doing PEx (Table 7).

Of 600 pregnant women, approximately 308 study participants (51.33%) had an overall favorable attitude toward PEx during pregnancy, whereas the remaining 292 study participants (48.5%) had an overall unfavorable attitude toward PEx during pregnancy (Figure 4).

### Pregnant women's practice of physical exercise during pregnancy

Regarding the practice of PEx during pregnancy, almost one-third of the study participants (32.2%) practiced PEx in their current pregnancy. Among those who practiced PEx during pregnancy, 193 study participants (100.0%) practiced walking, followed by relaxation/breathing, pelvic floor muscle exercise, and labor preparation exercises (squatting and pelvic tilts), with values of 9.8%, 7.8%, and 6.7%, respectively. Moreover, 43.0%, 36.5%, and 20.7% of the study participants were advised by

themselves, other persons, and health-care providers, respectively. Among those who practiced PEx during pregnancy, 21.8% and 54.9% of the study participants practiced PEx with a frequency of  $\geq 3$  times per week and  $\geq 30$  minutes of duration of PEx during pregnancy per session, respectively (Table 8). The most common reasons why pregnant women did not practice PEx during pregnancy were as follows: health professional did not advise the patient to do exercise (39.9%), lack of time (27.2%), and lack of information (19.2%) (Table 9).

### Factors associated with pregnant women's knowledge, attitude, and practice toward physical exercise during pregnancy

Factors associated with pregnant women's knowledge of physical exercise during pregnancy. Bivariate and multivariate binary logistic regression analyses were performed to assess the



**TABLE 6**  
**Pregnant women's knowledge level toward benefits and contraindications of physical exercise among antenatal care attendants at selected health institutions in Dessie, Amhara Region, Northeast Ethiopia, in 2023 (n=600)**

Variables	Category	n	%
<b>Benefits</b>			
Reduces risk of back pain during pregnancy	I do not now	72	12.0
	No	23	3.8
	Yes	505	84.2
Reduces the risk of gestational diabetes mellitus	I do not now	98	16.3
	No	25	4.2
	Yes	477	79.5
Reduce risk of hypertension	I do not now	125	20.8
	No	25	4.2
	Yes	450	75.0
More rapid postnatal recovery	I do not now	199	33.2
	No	5	0.8
	Yes	396	66.0
<b>Contraindications</b>			
Poorly controlled gestational diabetes mellitus during pregnancy	I do not now	253	42.2
	No	7	1.2
	Yes	340	56.6
Uncontrolled hypertension during pregnancy	I do not now	112	18.7
	No	7	1.2
	Yes	481	80.1
Uterine contractions during pregnancy	I do not now	46	7.7
	No	0	0.0
	Yes	554	92.3

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association between pregnant women's knowledge of PEx during pregnancy and its associated factors. In bivariate logistic regression analysis, 7 independent variables, such as age, level of education, occupational status, income level, history of abortion, ever heard about PEx during pregnancy, and history of PEx before becoming pregnant, were eligible for multivariate binary logistic regression analysis with a cutoff point ( $P < .2$ ). Multivariate binary logistic regression analysis was performed by taking 7 independent variables simultaneously. After testing the logistic assumptions, multivariate logistic regression analysis was performed using

the backward stepwise linear regression variable selection method.

After controlling for cofounders, the odds of having good knowledge of PEx during pregnancy was 1.623 times higher among pregnant women whose ages were between 25 and 34 years than those whose ages were  $< 25$  years (AOR, 1.623; 95% CI, 1.064–2.476).

The odds of having good knowledge of PEx during pregnancy was nearly 2 times higher in pregnant women who had primary education than in those who did not have formal education (AOR, 2.046; 95% CI, 1.208–3.465).

The odds of having good knowledge of PEx during pregnancy was

4.632 times higher in pregnant women who had heard about PEx during pregnancy than in those who had not heard about PEx during pregnancy (AOR, 4.632; 95% CI, 2.995–7.165) (Table 10).

*Factors associated with pregnant women's attitude toward physical exercise during pregnancy.* Bivariate and multivariate binary logistic regression analyses were performed to assess the association between pregnant women's attitude toward PEx during pregnancy and its associated factors. In bivariate logistic regression analysis, 9 independent variables, such as age, marital status, level of education, occupation, income level, ANC follow-up, parity, ever heard about PEx during pregnancy, and history of PEx before becoming pregnant, were eligible for multivariate logistic regression analysis with a cutoff point ( $P < .2$ ). Multivariate logistic regression analysis was performed by taking 9 independent variables simultaneously. After testing the logistic assumptions, multivariate logistic regression analysis was performed using the backward stepwise linear regression variable selection method.

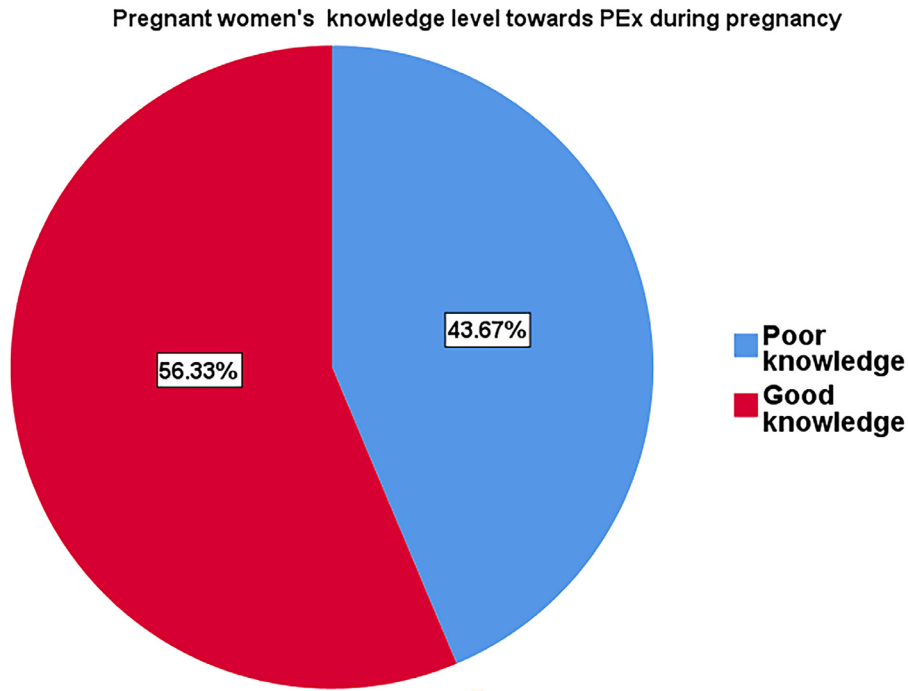
After controlling for cofounders, the likelihood of a favorable attitude toward PEx during pregnancy was 1.844 times higher in pregnant women whose ages were between 25 and 34 years than in those whose ages were  $< 25$  years (AOR, 1.844; 95% CI, 1.172–2.901).

In terms of educational level, pregnant women who had primary school, secondary school, and college and above were nearly 9 (AOR, 8.867; 95% CI, 4.519–17.402), 4 (AOR, 4.274; 95% CI, 2.144–8.520), and 5 (AOR, 4.981; 95% CI, 2.361–10.505) times more likely have a favorable attitude toward PEx during pregnancy than those who did not have formal education, respectively.

Furthermore, pregnant women who had ever heard about PEx during pregnancy were 7.265 (AOR, 7.265; 95% CI, 4.612–11.442) times more likely to have a favorable attitude toward PEx during pregnancy than those who had never heard about PEx during pregnancy (Table 11).

**FIGURE 3**

**Pregnant women’s proportion of good and poor knowledge towards PEx during pregnancy at selected health institutions in Dessie town, Northeast Ethiopia, 2023**



ANC, antenatal care; PEx, physical exercise.

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**TABLE 7**

**Pregnant women’s attitude level toward PEx during pregnancy among antenatal care attendants at selected health institutions in Dessie, Amhara Region, Northeast Ethiopia, in 2023 (n=600)**

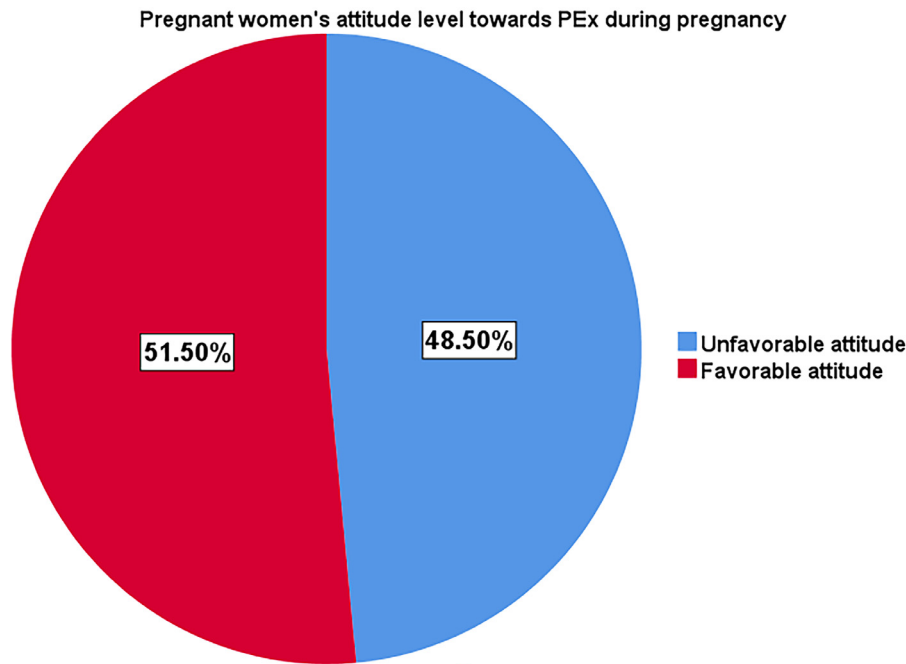
Variables	Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
	n	%	n	%	n	%	n	%	n	%
Do you feel that performing PEx during pregnancy is necessary?	4	0.7	15	2.5	32	5.3	382	63.7	167	27.8
Do you feel that performing PEx during pregnancy has risk to the fetus?	203	33.8	167	27.8	200	33.3	28	4.7	2	0.3
Do you feel that antenatal exercise suits with our culture?	2	0.3	19	3.2	133	22.2	316	52.7	130	21.7
Do you feel that pregnant women should perform PEx under the guidance of a healthcare professional?	7	1.2	26	4.3	62	10.3	342	57	163	27.2
Do you feel that performing antenatal PEx can reduce pregnancy-related complications?	0	0.0	42	7.0	204	34.0	240	43.3	94	15.7
Do you feel that practicing PEx during pregnancy helps in post-delivery recovery?	1	0.2	35	5.8	230	38.3	255	42.5	79	13.3
Do you feel that PEx will help you get back to your shape?	1	0.2	29	4.8	223	37.2	247	41.2	100	16.7
Do you think that regular PEx facilitates normal delivery?	1	0.2	36	6.0	183	30.5	300	50.0	80	13.3

PEx, physical exercise.

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**FIGURE 4**

**Pregnant women's proportion of favorable and unfavorable attitude towards PEx during pregnancy at selected health institutions in Dessie town, Northeast Ethiopia, 2023**



ANC, antenatal care; PEx, physical exercise.

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*Factors associated with pregnant women's practice of physical exercise during pregnancy.* Bivariate and multivariate binary logistic regression analyses were performed to assess the

association between pregnant women's practice of PEx during pregnancy and its associated factors. In bivariate logistic regression analysis, 9 independent variables, such as age, level of education,

occupation, income level, ANC follow-up, history of abortion, ever done PEx before becoming pregnant, knowledge, and attitude, were eligible for multivariate logistic regression analysis with cut-off points ( $P < .2$ ). Multivariate logistic regression analysis was performed by taking 9 independent variables simultaneously. After testing for logistic assumptions, multivariate logistic regression analysis was performed using the backward stepwise linear regression variable selection method.

After controlling for cofounders, pregnant women whose ages were between 25 and 34 years were nearly 7 times more likely to practice PEx during pregnancy than those whose ages were <25 years (AOR, 7.186; 95% CI, 3.853–13.404).

Pregnant women who had attended  $\geq 3$  ANC follow-ups were nearly 2 times more likely to practice PEx during pregnancy than those who did not start ANC follow-up (AOR, 2.082; 95% CI, 1.116–3.884).

**TABLE 8**

**Pregnant women's practice of PEx during pregnancy among antenatal care attendants at selected health institutions in Dessie, Ethiopia, in 2023 (n=600)**

Variables	Category	n	%
Do you practice any type of PEx in your current pregnancy? (n=600)	Yes	193	32.2
	No	407	67.8
Who advised you to do PEx during pregnancy? (n=193)	Healthcare provider	40	20.7
	Self	83	43.0
	Other person	70	36.3
How many times per week do you exercise? (n=193)	<3 times	151	78.2
	$\geq 3$ times	42	21.8
For how many minutes do you exercise per session? (n=193)	<30 min	87	45.1
	$\geq 30$ min	106	54.9

PEx, physical exercise.

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**TABLE 9****Reasons why pregnant women did not practice physical exercise during pregnancy (n=407)**

Reasons (n=407) <sup>a</sup>	n	%
Is afraid that it may be harmful to the fetus	27	6.7
Lack of time	110	27.2
Lack of motivation	39	9.6
I do not have information	78	19.2
Pregnancy discomfort	8	2.0
My health professional did not advise me to do exercises	162	39.9
I am not in good health	4	1.0
Because of cultural reason	0	0.0
Feel tired	25	6.2

<sup>a</sup> Multiple response.Yimer. *Physical exercise during pregnancy. Am J Obstet Gynecol Glob Rep* 2024.

Pregnant women who do not have a history of abortion were 6.518 times more likely to practice PEx during pregnancy than those who have a history of abortion (AOR, 6.518; 95% CI, 2.992–14.220).

Pregnant women who had ever done PEx before becoming pregnant were 3.441 times more likely to practice PEx during pregnancy than those who had

never done PEx before becoming pregnant (AOR, 3.441; 95% CI, 1.763–6.718).

Moreover, pregnant women who had good knowledge of PEx during pregnancy were 13.541 times more likely to practice PEx during pregnancy than those who had poor knowledge (AOR, 13.541; 95% CI, 7.841–23.387) (Table 12).

**Discussion**

The current study aimed to assess pregnant women's knowledge, attitude, and practice toward PEx during pregnancy and identify associated factors among ANC attendants at selected health institutions in Dessie, Amhara Region, Northeast Ethiopia, in 2023.

**Proportion of pregnant women's knowledge of physical exercise during pregnancy**

This study found that 56.33% (95% CI, 52.35%–60.31%) of pregnant women had good knowledge of the benefits and contraindications of PEx during pregnancy. This finding aligns with studies conducted in Nigeria (52.4%)<sup>19</sup>; Bahir Dar, Ethiopia (55.8%)<sup>22</sup>; and Pakistan (53.8%).<sup>31</sup>

However, the current study's findings were lower than those from studies in Brazil (65.6%)<sup>14</sup> and India (66.0%).<sup>13</sup> This discrepancy may be due to differences in educational levels, as many participants in the current study had only primary education and nearly two-thirds had not heard about PEx during pregnancy.

Conversely, the findings were higher than those reported in Addis Ababa, Ethiopia (50.40%)<sup>21</sup>; Gondar, Ethiopia

**TABLE 10****Bivariate and multivariate logistic regression analyses for factors associated with pregnant women's knowledge of PEx during pregnancy among antenatal care attendants at selected health institutions in Dessie, Amhara Region, Northeast Ethiopia, in 2023**

Variables		Knowledge level		COR (95% CI)	AOR (95% CI)
		Poor, n (%)	Good, n (%)		
Age (y)	<25	72 (50.7%)	70 (49.3%)	1	1
	25–34	123 (34.8%)	230 (65.2%)	1.923 (1.295–2.855) <sup>a</sup>	1.623 (1.064–2.476) <sup>a</sup>
	≥35	67 (63.8%)	38 (36.2%)	0.583 (0.348–0.978) <sup>a</sup>	0.560 (0.321–0.977)
Level of education	No formal	60 (60.6%)	39 (39.4%)	1	1
	Primary	95 (47.0%)	107 (53.0%)	1.733 (1.063–2.825) <sup>a</sup>	2.046 (1.208–3.465) <sup>a</sup>
	Secondary	76 (39.4%)	117 (60.6%)	2.368 (1.442–3.889) <sup>a</sup>	1.310 (0.730–2.352)
	College and above	31 (29.2%)	75 (70.8%)	3.722 (2.082–6.655) <sup>a</sup>	1.849 (0.964–3.548)
Ever heard PEx during pregnancy	No	209 (57.4%)	155 (42.6%)	1	1
	Yes	53 (22.5%)	183 (77.3%)	4.656 (3.217–6.738) <sup>a</sup>	4.632 (2.995–7.165) <sup>a</sup>

AOR, adjusted odds ratio; CI, confidence interval; COR, crude odds ratio; PEx, physical exercise.

<sup>a</sup> A P value of <.05 is considered statistically significant.Yimer. *Physical exercise during pregnancy. Am J Obstet Gynecol Glob Rep* 2024.

**TABLE 11**

**Bivariate and multivariate logistic regression analysis for factors associated with pregnant women's attitude toward PEx during pregnancy among antenatal care attendants at selected health institutions in Dessie, Amhara Region, Northeast Ethiopia, in 2023**

Variables		Attitude level		COR (95% CI)	AOR (95% CI)
		Unfavorable, n (%)	Favorable, n (%)		
Age (y)	<25	82 (57.7%)	60 (42.3%)	1	1
	25–34	138 (39.1%)	215 (60.9%)	2.129 (1.433–3.163) <sup>a</sup>	1.844 (1.172–2.901) <sup>a</sup>
	≥35	71 (67.6%)	34 (32.4%)	0.654 (0.386–1.109) <sup>a</sup>	0.559 (0.305–1.023)
Level of education	No formal	83 (83.8%)	16 (16.2%)	1	1
	Primary	95 (47.0%)	107 (53.0%)	5.843 (3.199–10.670) <sup>a</sup>	8.867 (4.519–17.402) <sup>a</sup>
	Secondary	77 (39.9%)	116 (60.1%)	7.815 (4.256–14.351) <sup>a</sup>	4.274 (2.144–8.520) <sup>a</sup>
	College and above	36 (34.0%)	70 (66.0%)	10.087 (5.165–19.698) <sup>a</sup>	4.981 (2.361–10.505) <sup>a</sup>
Ever heard PEx	No	238 (65.4%)	126 (34.6%)	1	1
	Yes	53 (22.5%)	183 (77.5%)	6.552 (4.486–9.483) <sup>a</sup>	7.265 (4.612–11.442) <sup>a</sup>

AOR, adjusted odds ratio; CI, confidence interval; COR, crude odds ratio; PEx, physical exercise.

<sup>a</sup> A P value of <.05 is considered statistically significant.

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(39.50%)<sup>23</sup>; Arba Minch, Ethiopia (46.30%)<sup>20</sup>; Saudi Arabia (50.67%),<sup>15</sup> Sri Lanka (27.33%)<sup>16</sup>; Zambia (19.00%)<sup>18</sup>; and Iraq (7%.00).<sup>17</sup> Possible reasons for these higher results include

sociocultural differences, sample size, study population, and various health institutions surveyed. Increased awareness over time and a higher proportion of study participants with better

educational backgrounds may also contribute to these differences. In addition, urban residents might have more access to information about PEx during pregnancy through various media sources.

**TABLE 12**

**Bivariate and multivariate logistic regression analysis for factors associated with pregnant women's practice of PEx during pregnancy among ANC attendants at selected health institutions in Dessie, Amhara Region, Northeast Ethiopia, in 2023**

Variables		Currently practice PEx		COR (95% CI)	AOR (95% CI)
		No, n (%)	Yes, n (%)		
Age (y)	<25	126 (88.7%)	16 (11.3%)	1	1
	25–34	191 (54.1%)	162 (45.9%)	6.679 (3.813–11.702) <sup>a</sup>	7.186 (3.853–13.404) <sup>a</sup>
	≥35	90 (85.7%)	15 (14.3%)	1.312 (0.617–2.791)	1.695 (0.727–3.953)
ANC follow-up	Not started	71 (72.4%)	27 (27.6%)	1	1
	1–2	167 (70.5%)	70 (29.5%)	1.102 (0.653–1.861)	1.654 (0.877–3.119)
	≥3	169 (63.8%)	96 (36.2%)	1.494 (0.898–2.485) <sup>a</sup>	2.082 (1.116–3.884) <sup>a</sup>
Abortion	Yes	55 (83.3%)	11 (16.7%)	1	1
	No	352 (65.9%)	182 (34.1%)	2.585 (1.321–5.060) <sup>a</sup>	6.518 (2.992–14.220) <sup>a</sup>
PEx before becoming pregnant	No	380 (71.8%)	149 (28.2%)	1	1
	Yes	27 (38.0%)	44 (62.0%)	4.156 (2.483–6.957) <sup>a</sup>	3.441 (1.763–6.718) <sup>a</sup>
Knowledge	Poor	243 (92.7%)	19 (7.3%)	1	1
	Good	164 (48.5%)	174 (51.5%)	13.569 (8.121–22.672) <sup>a</sup>	13.541 (7.841–23.387) <sup>a</sup>

ANC, antenatal care; AOR, adjusted odds ratio; CI, confidence interval; COR, crude odds ratio; PEx, physical exercise.

<sup>a</sup> A P value of <.05 is considered statistically significant.

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### Proportion of pregnant women's attitude toward physical exercise during pregnancy

This study revealed that 51.50% (95% CI, 47.49%–55.51%) of pregnant women had a favorable attitude toward PEx during pregnancy. This finding was in line with studies conducted in Gondar, Ethiopia (55.3%)<sup>23</sup>; Bahir Dar, Ethiopia (53.3%)<sup>22</sup>; and Saudi Arabia (56.1%).<sup>15</sup>

In contrast, the finding of this study was lower than the findings of previous studies conducted in Pakistan (79.0%),<sup>31</sup> Brazil (93.8%),<sup>14</sup> Zambia (93.0%),<sup>18</sup> and Nigeria (84.2%).<sup>19</sup> The possible explanations for the discrepancy might be that most study participants in Brazil and Nigeria had secondary and above educational levels, heard about PEx during pregnancy, and had good knowledge about PEx during pregnancy. In addition, the study noted in these countries that their study participants' attitude level was assessed using a single question. Furthermore, the discrepancy may be that there were a higher proportion of study participants who had attended college and above educational level in Pakistan and Zambia. In addition, most study participants in Zambia were counseled by doctors and midwives about PEx during pregnancy. Therefore, better education of the study participants and counseling by healthcare providers during ANC follow-up were important factors in pregnant women's attitude toward PEx during pregnancy.

The finding of this study was higher than the study conducted in Addis Ababa, Ethiopia (27.9%)<sup>21</sup>; Arba Minch, Ethiopia (46.0%)<sup>20</sup>; and Sri Lanka (35.5%).<sup>16</sup> This higher result may be due to the following reasons. First, it may be due to the influence of pregnant women's knowledge of PEx during pregnancy on pregnant women's attitude toward PEx during pregnancy. Therefore, good knowledge of study participants about PEx during pregnancy can change pregnant women's misconceptions about PEx during pregnancy. Second, because of differences in time lag when the previous researches were conducted, current awareness level

of pregnant women might cause the discrepancy. Third, it might be due to educational background, sociocultural differences, and differences in study populations.

### Proportion of pregnant women's practice of physical exercise during pregnancy

According to the current study, 32.20% of pregnant women practiced PEx (95% CI, 28.42%–35.91%) during their current pregnancy. This finding was in line with previous studies conducted in Gondar, Ethiopia (30.9%),<sup>23</sup> and Brazil (29.0%).<sup>14</sup>

However, the finding of the current study showed a lower rate of pregnant women's practice of PEx during pregnancy than the findings of the previous studies conducted in Turkey (67.1%),<sup>32</sup> Pakistan (46.2%),<sup>31</sup> and Arba Minch, Ethiopia (62.7%).<sup>20</sup> This disparity may be due to the study participants having good knowledge, having a habit of PEx before becoming pregnant,<sup>20,32</sup> and getting advice from healthcare providers to practice PEx during pregnancy.<sup>20,32</sup>

In contrast, the result of the current study concerning pregnant women's practice of PEx during the current pregnancy was higher than the results of studies conducted in Addis Ababa, Ethiopia (22.3%)<sup>21</sup>; Mekele, Ethiopia (20.7%)<sup>25</sup>; India (18.0%)<sup>13</sup>; Saudi Arabia (18.0%)<sup>15</sup>; Sri Lanka (13.6%)<sup>16</sup>; and South Africa (27.7%).<sup>33</sup> This higher result in the current study may be because this study included study participants from both private and governmental health institutions, used a larger sample size than other studies, and included study participants that had good knowledge and a favorable attitude toward PEx during pregnancy.

### Factors affecting pregnant women's knowledge of physical exercise during pregnancy

The study found that pregnant women aged 25 to 35 years had a statistically significant association with pregnant women's good knowledge of PEx during pregnancy. This might be due to having better educational level, good

knowledge, and better understanding of PEx during pregnancy.

Participants who had primary educational level had nearly 2 times higher odds of good knowledge of PEx during pregnancy than those who did not have formal education. This finding was consistent with the findings of studies conducted in South Africa and Zambia.<sup>18,33</sup> This may be due to the fact that information acquisition also increases as pregnant women's level of education increases, enabling pregnant women to read and ask about health information and decide. This shows that education plays an important role in improving pregnant women's knowledge level about the health benefits of PEx during pregnancy.

Participants who had heard about PEx during pregnancy were 4.632 times more likely to have good knowledge of PEx during pregnancy than those who had not heard about PEx during pregnancy. This finding was in line with the results of the studies conducted in Addis Ababa and Bahir Dar.<sup>21,22</sup> This might be explained as the dissemination of information about the health benefits of PEx during pregnancy is an important method for increasing awareness of pregnant women. This means that information will help to improve pregnant women's knowledge about PEx during pregnancy. Therefore, counseling pregnant women during ANC follow-up on the health benefits and contraindications of PEx during pregnancy can enhance their knowledge of PEx during pregnancy.

### Factors affecting pregnant women's attitude toward physical exercise during pregnancy

This study showed that pregnant women aged 25 to 35 years had a statistically significant association with a favorable attitude toward PEx during pregnancy similar to the finding of the study in Gondar.<sup>23</sup> The justifications for this association might be due to having better educational level, good knowledge, and better understanding of PEx during pregnancy.

Participants who had primary, secondary, and college and above

educational levels were nearly 9, 4, and 5 times more likely to have a favorable attitude toward PEx during pregnancy than those who had no formal education, supported by studies conducted in Addis Ababa and Gondar.<sup>21,23</sup> This may be due to the fact that information acquisition also increases as pregnant women's level of education increases, enabling pregnant women to read, ask, and analyze information regarding PEx during pregnancy and decide. In addition, pregnant women who had higher educational level read, watch, and listen to different materials and media regarding PEx during pregnancy and upgrade their attitude and develop good healthcare-seeking behavior. This suggests that educated pregnant women had a favorable attitude toward PEx during pregnancy.

Pregnant women who had heard about PEx during pregnancy had a more favorable attitude toward PEx during pregnancy. It was consistent with the studies conducted in Gondar and Bahir Dar.<sup>22,23</sup> This might be due to health education and counseling about the health benefits of PEx during pregnancy being an important method for increasing awareness of pregnant women. This means that information will help to improve pregnant women's attitude toward PEx during pregnancy. Therefore, counseling pregnant women during ANC follow-up on the benefits of PEx during pregnancy can enhance their attitude toward PEx during pregnancy.

### Factors affecting pregnant women's practice of physical exercise during pregnancy

The results of this study indicated that pregnant women between the ages of 25 and 34 years have 3.85 times higher odds of practicing PEx during their pregnancy than those under the age of 25 years. It aligned with the findings of the Mekele study.<sup>25</sup> This may be the result of the fact that pregnant women in this age group were more actively engaged in various types of PEx and had better knowledge, attitudes, and comprehension of PEx during pregnancy.

Pregnant women who had attended  $\geq 3$  ANC follow-ups had 2.082 times higher odds of practicing PEx during their pregnancy than those who did not start ANC follow-up. This may have to do with the fact that frequent contact with medical facilities for ANC follow-ups gives pregnant women more opportunities to interact with qualified medical professionals and raise their level of awareness regarding PEx during pregnancy. Furthermore, pregnant women may have a different attitude toward practicing PEx during pregnancy and be inspired to at least walk if healthcare providers educate them about it during frequent ANC visits.

Pregnant women without a history of abortion were 6.518 times more likely to practice PEx during pregnancy than those who have a history of abortion. This finding was in line with the finding of study conducted in Arbaminch.<sup>20</sup> This may be because women with no history of abortion are less fearful of potential risks to the fetus and repeat abortions associated with PEx during pregnancy. In contrast, pregnant women with a history of abortion may be more cautious because of concerns about the safety of the fetus and the possibility of repeat abortions during PEx.

Pregnant women who had ever done PEx before becoming pregnant had 3.441 times higher odds of practicing PEx during pregnancy than those who had never done PEx before becoming pregnant. It was consistent with the studies conducted in Arba Minch and Gondar.<sup>20,23</sup> The possible reason for this association might be that pregnant women with an exercise habit before becoming pregnant are more likely to follow their healthcare providers' advice about PEx during pregnancy and those who practiced PEx before becoming pregnant are aware of the health benefits and will continue to exercise during pregnancy.

Pregnant women who had good knowledge had 13.541 times higher odds of practicing PEx during pregnancy than their counterparts. This finding was in line with the findings of the studies conducted in Addis Ababa,

Gondar, and Arba Minch.<sup>20,21,23</sup> Pregnant women with good knowledge were significantly more likely to practice PEx during pregnancy than those with less knowledge, as supported by previous research in various locations. This may be because pregnant women with good knowledge understand the benefits of PEx during pregnancy, are motivated to perform it regularly, and believe it can help prevent pregnancy complications and ultimately reduce maternal morbidity and mortality.

### Strength of the study

This study's strength lies in its focus on pregnant women in both governmental and private health institutions within the study area.

### Limitations of the study

There may be social desirability bias as the study used interview questions to gather data on the practice of PEx assessment. In addition, there is a risk of recall bias as participants were asked to recall past experiences.

### Conclusions

This study revealed that approximately half of pregnant women had good knowledge and a favorable attitude toward PEx during pregnancy. However, almost one-third of pregnant women practiced PEx during their current pregnancy.

Pregnant women in the age category of 25 to 34 years, primary educational level, and heard about PEx during pregnancy were factors positively associated with good knowledge of PEx during pregnancy. In addition, age from 25 to 34 years, educational level (primary, secondary, and college and above), and heard about PEx during pregnancy were factors positively associated with a favorable attitude toward PEx during pregnancy. Age from 25 to 34 years, ANC follow-up ( $\geq 3$ ), no history of abortion, ever done PEx before becoming pregnant, and having good knowledge were factors positively associated with the practice of PEx during pregnancy.

## Recommendation

*For antenatal care providers.* ANC providers should advise pregnant women to strengthen ANC follow-up, giving special attention to pregnant women with a history of abortion and encouraging women to practice PEx before becoming pregnant.

ANC providers should provide health education and counseling regarding the benefits and contraindications of PEx during pregnancy for pregnant women during ANC follow-up to improve their knowledge, attitude, and practice toward PEx during pregnancy.

*For the Ministry of Health.* The Minister of Health should create adequate awareness regarding PEx during pregnancy and its health benefits through the use of various media sources, such as television, radio, and social media.

The country's Ministry of Health should develop better strategies to provide appropriate information about PEx during pregnancy by including it in the health education system.

*For future researchers.* Future researchers should incorporate objective methods for assessing the practice of PEx during pregnancy, such as the use of a pedometer.

## Glossary

ACOG, American College of Obstetricians and Gynecologists

ANC, Antenatal care

AOR, Adjusted odds ratio

CI, Confidence interval

PEx, Physical exercise

## ORCID authorship contribution statement

**Abdusellam Yimer:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Seada Endris:** Writing – review & editing, Writing – original draft, Validation, Software, Investigation, Formal analysis,

Conceptualization. **Alemtsehay Wossen:** Writing – review & editing, Writing – original draft, Visualization, Software, Project administration, Methodology, Funding acquisition, Formal analysis, Data curation. **Mengistu Abate:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Investigation, Formal analysis, Data curation. ■

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