Knowledge, Attitude and Associated Factors of Obstetric Ultrasonography Among Pregnant Women in KSA: A Cross-Sectional Study

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HOW TO CITE:

Abdullah Sulaiman Alshehri, Mohammed Suleman Ahmed Alshehri, Arwa Ahmed Mohammed Asiri, Razan Abdullah Ali Alwadae (2026). Knowledge, Attitude and Associated Factors of Obstetric Ultrasonography Among Pregnant Women in KSA: A Cross-Sectional Study. International Journal of Special Education, 41(9s), 1233-1251

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ABSTRACT:

Background: Ultrasound examination is an essential part of antenatal care in both high-risk and normal pregnancies. Although it provides reassurance to pregnant women and helps in fetal assessment, in many settings its use is still misunderstood by pregnant women. Aim: The study aimed to assess the knowledge, attitudes, and associated factors of obstetric ultrasonography among pregnant women in the Aseer region in southwestern Saudi Arabia.

Methods: A descriptive cross-sectional study was conducted at Aseer maternity and Children's Hospital Maternity clinics at health centers affiliated with the Aseer Health Cluster in Abha, Saudi Arabia. A total of 304 pregnant women attending antenatal clinics were selected using convenience sampling. Data were collected using a predesigned, self-administered questionnaire covering socio-demographic details, knowledge of ultrasound, attitude toward its use, sources of information, and barriers faced by pregnant women. Data were analyzed using descriptive and inferential statistics.

Results: The majority of pregnant women demonstrated excellent knowledge level of obstetric ultrasonography (80.9%), while 16.4% had moderate and 2.6% had poor knowledge; however, 39.5% exhibited negative attitudes despite 60.5% showing positive attitudes. Knowledge level among pregnant women was significantly associated with prior ultrasound exposure ($\chi^2 = 6.6$, $p = 0.03$) and clear information from healthcare providers ($\chi^2 = 29.6$, $p < 0.001$). Attitudes were significantly influenced by perceived barriers to ultrasound utilization ($\chi^2 = 17.0$, $p = 0.049$). Moreover, a highly significant association was observed between knowledge and attitude ($\chi^2 = 15.6$, $p < 0.001$).

Conclusion: Despite a high level of knowledge, a considerable proportion of pregnant women exhibited negative attitudes, indicating a gap between knowledge and perception toward

obstetric ultrasonography. Knowledge was significantly influenced by prior ultrasound exposure and clear provider communication, while attitudes were mainly affected by perceived barriers, highlighting the need for improved health education through healthcare providers and media with considerations to the barriers faced by pregnant women related to ultrasound during the follow up period of pregnancy.

Keywords: Knowledge, Attitude, Associated Factors, Obstetric Ultrasonography, Pregnant Women, KSA, Cross-Sectional Study.

Background

An obstetric ultrasound scan (USS) is a non-invasive diagnostic imaging procedure that mainly uses sound waves of frequency greater than 20 kilohertz (20 KHz) to scan a pregnant mother's abdominal and pelvic cavity and provides parents with a real-time image of the fetus. Unlike X-rays, gamma rays, and many others, USS uses safe non-ionizing energy (Recker, Gembruch, & Strizek, 2024). Obstetric ultrasonography has become an essential component of advanced antenatal care, playing a critical role in monitoring fetal development, detecting congenital anomalies, estimating gestational age, and guiding clinical decision-making throughout pregnancy. It is widely regarded as a safe and effective diagnostic tool that significantly contributes to improving maternal and neonatal outcomes (Granese et al., 2023). Over the past decades, the use of ultrasound has expanded globally, making it one of the most routinely utilized imaging modalities in pregnancy care (Chelikam et al., 2023).

Moreover, pregnant women's knowledge regarding obstetric ultrasonography refers to their understanding of its purpose, benefits, safety, timing, and limitations as a diagnostic tool during pregnancy and is considered a key component of maternal health literacy influencing their decisions and anxiety levels throughout the pregnancy period. Besides, attitude reflects pregnant women's beliefs, perceptions, and feelings toward ultrasound use—whether they view it as beneficial, safe, necessary, or associated with misconceptions—which can directly influence their acceptance and compliance with recommended scans (Molla, Mengistu, & Wudneh, 2022).

Furthermore, multiple associated factors influence pregnant women's knowledge and attitudes toward obstetric ultrasound —notably education level, residence (urban vs. rural), parity, and prior pregnancy experience—significantly influence pregnant women's knowledge and attitudes toward obstetric ultrasound (Haile & Gurmu, 2024).The previous studies have shown that while many women recognize ultrasound as an important and reassuring scan tool, misconceptions—such as its association with fetal sex determination or concerns about safety and potential harm—still persist in some cultures, particularly among less-educated, younger, or first-time mothers (Kim et al., 2018; Favaretto, M., Rost, 2025), which can negatively affect utilization patterns and decision-making during pregnancy.

In the context of the Kingdom of Saudi Arabia (KSA), recent research indicated that most pregnant women demonstrate a generally high level of knowledge and positive perceptions toward antenatal ultrasound. Nonetheless, variations in knowledge were significantly associated with the participants' socio-demographic factors such as education, occupation, and income (Abduljabbar et al., 2020).

Additionally, healthcare-related factors, especially access to information and counseling from healthcare providers, further enhance women's awareness and perceptions towards the obstetric ultrasound, while lack of information contributes to misconceptions and negative attitudes (Chinene & Mudadi, 2023). Moreover, contextual and structural barriers—such as long waiting times, limited access to services, and concerns about privacy or side effects—can

negatively influence attitudes of pregnant women towards ultrasound and reduce utilization of ultrasound services (Alam et al., 2025). Also, the regional factors, including residence (urban versus rural), have also been shown to affect the pregnant women's knowledge levels regarding ultrasound, as women in rural areas demonstrat significantly lower awareness due to reduced access to health information and services (Mengistie et al., 2023).

Other influencing factors contribute to the ignorance of the value of obstetric ultrasonography knowledge and attitudes among pregnant women, such as society, culture, the way of life, and the level of literacy as presented in the previous study (Alghamdi et al., 2024). Accordingly, in a recent qualitative study of the midwives' experiences, the doctors who request ultrasonography, unfortunately do not give enough information to these patients, which negatively affects the pregnant women's perceptions and awareness of obstetric ultrasound (Tefera et al., 2024). Given these considerations, assessing the knowledge, attitudes, and associated factors related to obstetric ultrasonography among pregnant women in KSA remains highly relevant to address existing gaps and support evidence-based interventions tailored to the Saudi population for future studies.

2. Research Aim and Objectives

2.1 Primary Aim

To assess the knowledge, attitudes, and associated factors of obstetric ultrasonography among pregnant women in the Aseer region in southwestern Saudi Arabia.

2.2 Specific Objectives

- To assess the personal and medical conditions among pregnant women under obstetric ultrasonography.
- To assess the levels of knowledge of obstetric ultrasonography among pregnant women in the Aseer region in southwestern Saudi Arabia.
- To assess the attitudes of pregnant women toward obstetric ultrasonography in Saudi Arabia.
- To assess the associated factors affect pregnant women' knowledge and attitudes toward obstetric ultrasonography in the Aseer region in southwestern Saudi Arabia.
- To assess the correlations between the levels of knowledge and attitude of pregnant women, and their personal and medical conditions in the Aseer region in southwestern Saudi Arabia.

3. Research Questions

- What are the levels of knowledge of obstetric ultrasonography among pregnant women in Saudi Arabia?
- What is the attitudes of pregnant women toward obstetric ultrasonography in Saudi Arabia?
- What are the associated factors to pregnant women' knowledge and attitudes toward obstetric ultrasonography in Saudi Arabia?
- What are the correlations between the levels of knowledge and attitudes of pregnant women, and their personal and medical conditions in Saudi Arabia?

4. Significance of the Study

This study will add to the existing knowledge in maternal health by providing context-specific information about the knowledge, attitudes, and associated factors of obstetric ultrasonography among pregnant women in KSA. There is a dearth of Saudi research examining women's knowledge of its role, benefits, risks, and limitations and attitudes towards its use. Through measurement of these aspects, the study will:

1. Determine Knowledge Gaps - Assess the extent of knowledge about the clinical utilisation of ultrasound for monitoring fetal growth, identifying fetal anomalies, and diagnosing pregnancy complications.

2. Assess Attitudinal Patterns - Identify cultural, religious, and individual beliefs such as acceptance and fear of ultrasound.

3. Examine influencing factors - assess the relationship between socio-demographic and obstetric factors (age, education, parity, region, income, and prior pregnancy) and knowledge and attitudes to inform targeted strategies.

4. Provide Evidence for Practice and Policy - Offer evidence for health policymakers in KSA to enhance antenatal education, establish protocols for patient counseling, and ensure access to ultrasound services. Moreover, this research is anticipated to contribute to evidence-based maternal health care in KSA by ensuring that when ultrasound is used, it is with informed consent, appropriate expectation setting, and culturally relevant communication, leading to improved maternal and fetal health outcomes.

5. Similar Studies and Research Gaps

While there is an increasing number of studies addressing the knowledge, attitudes, and perceptions of obstetric ultrasound in pregnant women, there are still some important limitations that warrant further research, especially in Saudi Arabia. There is a lack of depth in measuring knowledge. While many recent studies show that pregnant women have moderate or even good levels of knowledge, earlier studies, however, have shown a gap in specific knowledge - for example, about the diagnostic purposes of ultrasound in detecting congenital anomalies (Chinene & Mudadi, 2023) - suggesting that the present literature assesses overall awareness rather than specific, relevant clinical knowledge, suggesting that more extensive assessment instruments are needed. The second significant gap is the conflicting literature on the factors associated with knowledge. Likewise, the Ethiopian study by Haile & Gurmu (2024) found education and prior exposure to ultrasound were significant predictors of good knowledge, while other demographical factors had mixed associations. Furthermore, there is a noticeable gap in region-specific studies in Saudi Arabia, particularly large-scale or national studies. While there are recent Saudi studies on knowledge and perceptions, these are limited to small-scale or regional studies and often to specific health facilities (Alghamdi et al., 2024). Another key gap is the lack of research on the association between knowledge, attitude, and practice (KAP).

While a few studies confirm a positive association between knowledge and attitude, fewer studies relate this association with practice or even the use of ultrasound services, with limited emphasis on the interplay among pregnant women in real-life situations (Li et al., 2025). Another critical gap is the lack of in-depth exploration of barriers to ultrasound use such as long wait times, cost, and lack of access; these are often cited superficially without complementary qualitative exploration of women's perspectives and perceptions (Haile & Gurmu, 2024). Furthermore, there is a lack of assessment of healthcare provider communication and educational programs. Although research consistently recognizes the importance of health care providers' information, no Saudi studies have evaluated the impact of different communication styles of health care providers on pregnant women's knowledge and attitude towards obstetric ultrasound.

6. Research Problem

Despite obstetric ultrasound scan's widespread use, pregnant women's understanding of obstetric ultrasonography varies considerably across different populations. Knowledge gaps may exist regarding its purpose, safety, and limitations, which can influence women's perceptions and acceptance of the procedure. The awareness of obstetric ultrasonography scanning during pregnancy in a different region in Saudi Arabia still, until now, hasn't reached the actual level of understanding, particularly in the Aseer region in southwestern Saudi Arabia. Moreover, the mildest knowledge influences the pregnant women's and fetus's health even on the fetal mortality rate. When pregnant women don't realize the importance of obstetric ultrasonography scanning, they may not do it. Additionally, the ignorance of the appropriate time for scanning leads to delaying it; therefore, the early detection of the fetal

abnormality will not happen, and the treatment becomes difficult or impossible and often forces us to abortion.

7. Operational Definitions of Key Terms

1. Knowledge of obstetric ultrasonography:

The level of awareness and understanding that pregnant women have regarding the purpose, benefits, safety, timing, and uses of obstetric ultrasound in antenatal care. It was typically measured using the knowledge, attitude, and associated factors of pregnant women's structured questionnaire (18 items) developed by the researcher.

2. Attitude toward obstetric ultrasonography:

The feelings, beliefs, perceptions, and willingness of pregnant women toward the use of obstetric ultrasound during pregnancy, including their acceptance and perceived importance of the procedure. It is commonly classified as a negative or positive attitude based on total attitude scores. . It was typically measured using the knowledge, attitude, and associated factors of pregnant women's structured questionnaire (12 items) developed by the researcher.

3. Associated factors:

Socio-demographic, obstetric, and healthcare-related characteristics that may influence pregnant women's knowledge and attitudes toward obstetric ultrasonography, such as age, education level, parity, gravidity, antenatal care visits, previous exposure to ultrasound information, and barriers faced by pregnant women (19 items) developed by the researcher.

8. Conceptual Framework of the Study

The conceptual framework for this study is based on the assumption that pregnant women's knowledge and attitudes toward obstetric ultrasonography are influenced by a set of interrelated socio-demographic, obstetric, and healthcare-related factors**,** and that knowledge of pregnant women in turn affects their attitudes towards the obstetric ultrasound. The independent variables (associated factors) include:

- Socio-demographic factors: age, education level, occupation, income, and residence
- Obstetric factors: trimester of pregnancy, gravidity, parity, gestational age, number of ANC visits, and history of abnormal or congenital birth
- Healthcare-related factors: exposure to ultrasound for non-pregnancy reasons, number of previous ultrasound examinations, information resources, and whether the healthcare provider provided information about the scan
- Perceived barriers: cost, accessibility, cultural beliefs, and service-related limitations. While the Knowledge and attitude of pregnant women regarding obstetric ultrasonography are the dependent variables. In addition, the framework proposes a direct relationship between knowledge and attitude, where increased knowledge leads to more positive attitudes toward obstetric ultrasound use.

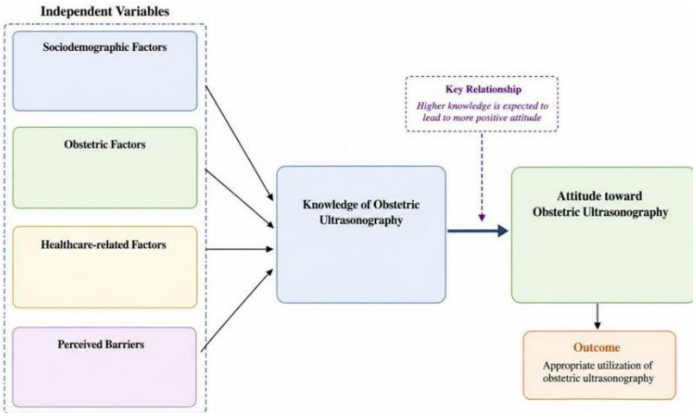

Fig. 1: The conceptual model of the study (proposed by the researcher)

9. Subjects and Methods

9.1 Study Design

A descriptive cross-sectional design was utilized, involving collecting data from a defined population at a single point in time in order to assess and describe existing levels of knowledge, attitudes, or practices without manipulating any variables.

9.2 Study Settings

The research was carried out in Aseer Maternity and Children's Hospital maternity clinics at health centers affiliated with the Aseer Health Cluster in Abha, the capital of the Aseer Region in southwestern Saudi Arabia.

9.3 Study Population

A 304 pregnant women attending Aseer Maternity and Children's Hospital maternity clinics were recruited, including women across various gestational ages, gravidity, and socioeconomic backgrounds who fit the inclusion and exclusion criteria.

6.3.1 Inclusion Criteria

- ✓ Pregnant women (age ≥ 18 years) admitted to the pre-mentioned study setting.
- ✓ Pregnant women visited the study setting in regular visits at the time of follow-up.
- ✓ Confirmed obstetric ultrasound scan from any site for the first time or many times.

9.3.2 Exclusion Criteria

- ✓ Incomplete medical records of women or unidentified history and medical data.
- ✓ Women with attention or memory or psychiatric and mental disorders.
- ✓ Women missed follow-up or were transferred to other hospitals.
- ✓ **9.4 Sampling and Sample Size Calculation**Convenient non-probability sample of all pregnant women with confirmed inclusion criteria in the study setting in Saudi Arabia from Start October 2025 to End March 2026. The total number of target participants expected to visit the study setting in the study period is 800 pregnant women, according to the rate of antenatal clinical flow in the last 6 months in the study setting. In a total population size of about **800** pregnant women, the sample size calculation by the Yamane (1967) formula at a 95% confidence level determines the final required sample size of pregnant women should be at least 267, and add 10% for incomplete responses or withdrawal to be about 304 pregnant women.

Where:

- n= sample size
- N = total population (800)
- e= margin of error (commonly 0.05 for 95% confidence).

9.6 Data Collection Tool: The study used the knowledge, attitude, and associated factors of pregnant women questionnaire developed by the researcher based on the review of related literature. It consisted of 3 parts and 49 items. "Personal & medical data" (6 items), "knowledge" (18 items, yes or no questions), "attitude" (12 items, 5-point scale), "associated factors of obstetric ultrasonography" (13 items) (Krishnamoorthy & Kasinathan, 2016; Suarayasa et al., 2025). The chronbach's alpha score for the current study sample was (0.82).

$$n = N / (1 + N(e)^2)$$

Example:

$$N = 800,\ e = 0.05$$

$$n = 800 / (1 + 800(0.05)^2)$$

$$n = 800 / (1 + 800 \times 0.0025)$$

$$n = 800 / 3 \sim 267$$

9.5 Data Collection and Data Management

The researcher sent a link with the online questionnaire to potential pregnant women who

visited the Aseer Maternity and Children's Hospital maternity clinics at health centers affiliated with the Aseer Health Cluster in Abha, Saudi Arabia. The data was collected by using Google Forms, with 20 min. required by each participant to answer the tool. Collected data was organized in an Excel file for further processing. Data was entered into a password-protected, secure database. Each woman was assigned a unique identifier to ensure confidentiality. Data quality is regularly checked for accuracy and completeness.

9.8 Statistical Analysis

Data were analyzed using a statistical software package such as SPSS version 27. The descriptive statistics were used to summarize the demographic and obstetric characteristics of the participants. Categorical variables (e.g., education level, parity, and trimester) were presented as frequencies and percentages. The association between knowledge, attitude, and socio-demographic/obstetric factors was tested using the Chi-square (χ^2) test for categorical variables. Moreover, the relationship between knowledge and attitude was also assessed using chi-square analysis to determine the statistical significance. A p-value ≤ 0.05 was considered statistically significant at a 95% confidence interval.

9.10 Ethical Considerations

All pregnant women were provided with information about the study, procedures, and their rights, and they were fully aware that their involvement is voluntary and they can withdraw at any time without any impact on their health care. Written informed consent was obtained at the beginning of the questionnaire, and completing the questionnaire indicated agreement to participate. Identification personal data such as (e.g., name, ID number, and phone number) was not collected. All collected information was stored in a password-protected encrypted folder on the investigator's personal computer, which is secured with two-factor authentication. Access to the data was restricted exclusively to the principal investigator to protect the confidentiality and privacy of study participants.

In addition, confidentiality and privacy of data were ensured by maintaining the personal and medical information collected in an anonymized manner that is secure and accessed only by authorized individuals who are involved in conducting the research. It was ensured that participation in the study did not put the patients in any form of harm, whether physically or psychologically, due to discussion on the participants' knowledge, attitudes, and barriers they faced with utilizing UUS. IRB approval was obtained before conducting the study as per the Institutional Review Board of Aseer Health Cluster Research Ethics Committee, which approved the study proposal before starting data collection. A waiver of consent has been requested from the study setting managers.

10. Results and Data Analysis

Table (1) presents the demographic characteristics of the participating pregnant women. The findings show that the majority of participants were Saudi nationals (95.4%). Regarding regional distribution, participants were drawn from all regions, with the highest representation from the central region (42.1%), followed by the western region (19.1%). The eastern and southern regions made up 13.2% each, while the northern region made up 12.5%. This indicates a relatively good geographical representation. According to age, most women were aged 26-35 years (58.5%), which is the period considered to be the prime reproductive years. This was followed by women aged 18–25 years (24.7%) and 36–45 years (16.7%). Moreover, almost half of the participants had a bachelor's degree (49.3%) and a large proportion had postgraduate degrees (38.5%), suggesting a high level of education among this group. In terms of employment, most of the participants were working women (60.2%), while 35.5% were housekeepers, suggesting high participation in the labour market. Lastly, in terms of income, most women had a monthly income greater than 10,000 SR (38.2%), followed by between 5,000 and 10,000 SR (32.6%).

Table (1): Demographic data of participating pregnant women (n=304)

Demographic data	No.	%
Nationality		
Non-Saudi	14	4.6
Saudi	290	95.4
Region		
Center	128	42.1
East	40	13.2
North	38	12.5
South	40	13.2
West	58	19.1
Age		
>55	0	0
18- 25	75	24.7
26- 35	178	58.5
36- 45	51	16.7
46- 55	0	0
Education		
Graduate	150	49.3
Illiterate	2	.7
Postgraduate	117	38.5
School education	35	11.5
Occupation		
Housekeeper	108	35.5
Students	13	4.3
Working	183	60.2
Income		
> 10000 SR	116	38.2
Between 5000 to 10,000 SR	99	32.6
Less than 5000 SR	89	29.3

only a few (2.6%) reported poor knowledge, which implies that most of the women were knowledgeable about the obstetric ultrasound, possibly due to effective communication of

The knowledge and attitudes of the pregnant women are shown in table (2). The results show that most of the participants' levels of knowledge were good (80.9%), 16.4% were moderate, and

Taken together, the findings show that knowledge and attitude are not necessarily in agreement, implying that if the pregnant women are well-informed, it may not necessarily translate to their positive attitudes, and suggests that efforts need to be made to not only improve knowledge of pregnant women, but also consider the elements of belief, perception and behaviour in order to bring a more positive attitude among pregnant women.

information or previous exposure to the education. The patterns of attitudes, however, were mixed. While more than half of the women (60.5%) showed a positive attitude among pregnant women towards the obstetric ultrasound, a significant number (39.5%) continued to exhibit negative attitudes, suggesting that although the high level of knowledge suggests that women were well-informed, it does not necessarily translate to positive attitudes among all pregnant women.

Table (2): Level of knowledge and attitudes of participating pregnant women (n=304)

Level of Knowledge	**No.**	**%**
Bad	8	2.6
Moderate	50	16.4
good	246	80.9
Level of attitude		
Negative	120	39.5
Positive	184	60.5

for the pregnant women were family and friends (37.8%) and obstetricians (29.6%), while fewer sourced information from the internet and media.

Moreover, most (69.4%) reported their healthcare providers explained the scans to them. Regarding the perceived cost of obstetric ultrasound, most women thought that ultrasound was of moderate cost (64.8%) but 28.3% thought it was expensive. The barriers included waiting time (40.8%), distance (17.1%) and cultural reasons (16.8%). Overall, the table indicates that knowledge and attitudes may be influenced by healthcare access, prior experiences, information sources, and systemic barriers such as waiting time and distance.

Table (3) presents the factors associated with knowledge and attitudes toward obstetric ultrasonography among pregnant women. The findings demonstrate that most participants were in the third trimester (44.4%) and (32.2%) were in later pregnancy (37-40 weeks). The majority (78.3%) were primigravida and (71.7%) had visited at least four sessions of antenatal care (ANC), suggesting good health care attendance. Many participants (63.8%) had undergone ultrasound examination before for a non-pregnancy-related reason and almost half (45.4%) had an abortion history. Similarly, most women had more than one ultrasound scan, with 41.8% having five or more. In terms of sources of information, the primary sources of information

Table (3): The associated factors affecting knowledge and attitudes of pregnant women towards obstetric ultrasonography (n=304)

The associated factors affecting knowledge and attitudes	**No.**	**%**
Trimester		
First	86	28.3
Second	83	27.3
Third	135	44.4
Gestational age		

< 28 week	92	30.3
28- 31 week	48	15.8
32- 36 week	65	21.4
37- 40 week	98	32.2
Gravidity		
Primigravida	238	78.3
Multigravi	54	17.8
Multigravida	8	2.6
Primigravida	4	1.3
Parity		
Grand multiparty	124	40.8
Multiparty	143	47.0
Null parity	37	12.2
Number of ANC visits		
Four and above	218	71.7
One	26	8.6
Three	37	12.2
Two	23	7.6
History of abnormal/congenital anomaly birth		
No	242	79.6
Yes	62	20.4
Exposure to us for reason other than pregnancy		
No	110	36.2
Yes	194	63.8
History of abortion		
No	166	54.6
Yes	138	45.4
Number of obstetric ultrasounds		
>5	127	41.8
1-2	52	17.1
3-5	125	41.1
Information resources		
Family and friends	115	37.8
Internet	39	12.8
Media (press, TV, radio).	12	3.9
Obstetrician	90	29.6
The doctor who performs the scan gave you information about the baby		
No, I wasn't given details	32	10.5
Yes, but it was not clear for me	61	20.1
Yes, clear for me	211	69.4
The views of USS cost		
Average	197	64.8
Cheap	21	6.9
Costly	86	28.3
Barriers towards participants' utilizations of obstetric ultrasound		
Being attended by students	7	2.3
Cultural beliefs	51	16.8

High cost	25	8.2
Long distance	52	17.1
Long waiting time	124	40.8
No privacy	12	3.9
Rough handling by health worker	4	1.3
Side effect of UUS	9	3.0

perceived barriers to utilization. However, two factors showed statistically significant correlations with knowledge level are the exposure to ultrasound for reasons other than pregnancy ($\chi^2 = 6.6$, $p = 0.03$), suggesting that women with prior exposure to ultrasound had higher knowledge levels. Secondly, the receiving clear information from the doctor performing the scan ($\chi^2 = 29.6$, $p = 0.00$), indicating that clarity of communication from healthcare providers plays a crucial role in improving women's knowledge.

The table (4) demonstrates the correlation between selected associated factors **of** pregnant women towards obstetric ultrasonography and their knowledge level of pregnant women regarding obstetric ultrasonography. Overall, most variables did not show a statistically significant relationship with knowledge level, including trimester, gestational age, gravidity, parity, number of ANC visits, history of congenital anomalies, history of abortion, number of ultrasound scans, information resources, perceived cost of ultrasound, and

Table (4): The correlation between associated factors of pregnant women towards obstetric ultrasonography and their knowledge level

The associated factors	**Knowledge level**			X2	p
	Bad	**Moderate**	**High**		
Trimester				5.3	0.23
First	4	18	64		
Second	2	15	66		
third	2	17	116		
Gestational age				1.1	0.99
< 28 week	1	7	40		
28- 31 week	2	10	53		
32- 36 week	2	16	80		
37- 40 week	3	17	72		
Gravidity				4.3	0.62
Primigravida	5	41	192		
Multigravi	3	8	43		
Multigravida	0	0	8		
Primigravida	0	1	3		
Parity				4.3	0.36
grand multiparty	2	27	114		

Multiparty	2	3	32		
Null parity	4	20	100		
Number of ANC visits				4.5	0.6
Four and above	5	34	179		
One	2	6	18		
Three	1	6	30		
Two	0	4	19		
History of abnormal/congenital anomaly birth				0.2	0.8
No	6	39	197		
yes	2	11	49		
Exposure to US for reason other than pregnancy				6.6	0.03*
No	6	14	90		
yes	2	36	156		
History of abortion				0.52	0.77
No	5	29	132		
yes	3	21	114		
Number of obstetric ultrasonography				1.1	0.9
1-2	2	8	42		
3-5	4	21	100		
>5	2	21	104		
Information resources				11.5	0.31
Family and Friends	2	21	92		
Internet	1	6	32		
Media (press, TV, radio).	0	1	11		
Obstetrician	3	9	78		
The doctor who performs the scan gave you information about the baby				29.6	0.00*
No, I wasn't given details	2	12	18		
Yes, but it was not clear for me	4	16	41		
Yes, clear for me	2	22	187		
The views of USS cost				7.9	0.09
Average	2	29	166		
Cheap	1	3	17		
Costly	5	18	63		

Barriers towards participants utilizations of obstetric ultrasound				31.2	0.052
Being attended by students	0	0	7		
Cultural beliefs	0	9	42		
High cost	1	4	20		
Long distance	1	12	39		
Long waiting time	3	15	106		
No privacy	0	1	9		
Rough handling by health worker	0	0	4		
Side effect of US	0	5	4		

resources, clarity of information provided by the doctor, and perceived cost of ultrasound. However, barriers to the utilization of obstetric ultrasound showed a statistically significant association with attitude levels of pregnant women (χ^2 = 17.0, p = 0.049), indicating that perceived barriers—such as long waiting times, cultural beliefs, and distance—play an important role in shaping pregnant women's attitudes. Specifically, the presence of such barriers is likely to contribute to more negative attitudes of pregnant women toward the obstetric ultrasound.

The table (5) illustrates the relationship between associated factors of pregnant women towards obstetric ultrasonography and their attitude levels of pregnant women toward obstetric ultrasonography. Overall, the findings indicate that most of the studied variables did not show statistically significant relationships with attitude level of pregnant women, including trimester, gestational age, gravidity, parity, number of ANC visits, history of congenital anomalies, prior exposure to ultrasound, history of abortion, number of ultrasound scans, information

Table (5): The relationship between associated factors of pregnant women towards obstetric ultrasonography and their attitude level

The associated factors	**Attitude level**		X2	p
	Negative	**Positive**		
Trimester			1.1	0.5
First	38	48		
Second	31	52		
third	51	84		
Gestational age			3.5	0.46
< 28 week	21	27		
28- 31 week	20	45		
32- 36 week	42	56		
37- 40 week	37	55		
Gravidity			5.3	0.14
Primigravida	98	140		

Multigravi	21	33		
Multigravida	1	7		
Primigravida	0	4		
Parity			3.4	0.17
grand multiparty	53	90		
Multiparty	11	26		
Null parity	56	68		
Number of ANC visits			0.71	0.86
Four and above	89	129		
One	9	17		
Three	13	24		
Two	9	14		
History of abnormal/congenital anomaly birth			1.1	0.3
No	92	150		
yes	28	34		
Exposure to US for reason other than pregnancy			0.12	0.72
No	42	68		
yes	78	116		
History of abortion			0.01	0.9
No	65	101		
yes	55	83		
Number of obstetric ultrasonography			4.2	0.12
1-2	25	27		
3-5	53	72		
>5	42	85		
Information resources			8.1	0.16
Family and Friends	39	76		
Internet	14	25		
Media (press, TV, radio).	4	8		
Obstetrician	36	54		
The doctor who performs the scan gave you information about the baby			1.4	0.6
No, I wasn't given details	16	16		
Yes, but it was not clear for me	24	37		

Yes, clear for me	80	131		
The views of USS cost			0.28	0.86
Average	76	121		
Cheap	8	13		
Costly	36	50		
Barriers towards of participants' utilizations of obstetric ultrasound			17.0	0.049*
Being attended by students	4	3		
Cultural beliefs	21	30		
High cost	8	17		
Long distance	15	37		
Long waiting time	56	68		
No privacy	1	9		
Rough handling by health worker	0	4		
Side effect of US	6	3		

However, barriers to the utilization of obstetric ultrasound showed a statistically significant relationship with attitude ($\chi^2 = 17.0$, $p = 0.049$), indicating that perceived obstacles may negatively influence women's attitudes toward ultrasound use. Furthermore, a highly significant association was observed between knowledge and attitude ($\chi^2 = 15.6$, $p < 0.001$), suggesting that better-informed women tend to have more positive attitudes toward obstetric ultrasound.

As regards table (6) presents the association between the study variables, demonstrating that the exposure to ultrasound for reasons other than pregnancy was significantly associated with higher knowledge levels ($\chi^2 = 6.6$, $p = 0.03$). Additionally, receiving information from the doctor performing the scan showed a highly significant relationship with knowledge ($\chi^2 = 29.6$, $p < 0.001$), highlighting the critical role of healthcare providers in patient education.

Table (6): The correlation between Knowledge and attitude of pregnant women towards the obstetric ultrasound and the associated factors

The associated factors	Knowledge of women		Attitude of women	
	X2	p	X2	p
Trimester	5.3	0.23	1.1	0.5
Gestational age	1.1	0.99	3.5	0.46
Gravidity	4.3	0.62	5.3	0.14
Parity	4.3	0.36	3.4	0.17
Number of ANC visits	4.5	0.6	0.71	0.86
History of abnormal/congenital anomaly birth	0.2	0.8	1.1	0.3
Exposure to US for reason other than pregnancy	6.6	0.03*	0.12	0.72

History of abortion	0.52	0.77	0.01	0.9
Number of obstetric ultrasonography	1.1	0.9	4.2	0.12
Information resources	11.5	0.31	8.1	0.16
The doctor who performs the scan gave you information about the baby	29.6	0.00*	1.4	0.6
The views of USS cost	7.9	0.09	0.28	0.86
Barriers towards utilizations of pregnant women to the use of obstetric ultrasound	31.2	0.052	17.0	0.049*
Knowledge of pregnant women	-	-	15.6	0.00*

In terms of factors that are associated with pregnant women's attitude and knowledge towards the obstetric ultrasound, there is supporting evidence that the frequency of experience with the obstetric ultrasound among pregnant women improves their knowledge (Molla, Mengistu, & Wudneh, 2022). Also, the quality of information provided by health professionals was a strong predictor of pregnant women's knowledge level about the obstetric ultrasound. This is in line with emerging evidence that highlights the importance of effective communication between pregnant women and health professionals in promoting their knowledge and participation (Gashaw et al., 2025).

Conversely, attitudes were significantly affected by the perceived barriers to using the ultrasound. Factors such as long waiting times, distance to healthcare facilities, and cultural beliefs were significantly associated with negative attitudes. This is in agreement with recent studies highlighting that healthcare system inefficiencies and accessibility issues can negatively affect pregnant women's perceptions and healthcare utilization (Alqahtani et al., 2022). In general, the study highlights that although knowledge is high among pregnant women in KSA, to improve attitudes both interpersonal (e.g., communication) and structural health service factors must be considered. These results are in line with recent international evidence suggesting the need for patient-centered models of care which incorporate education, communication,

11. Discussion

This study aimed to assess the knowledge, attitude, and associated factors related to obstetric ultrasonography among pregnant women in KSA. The findings revealed that the majority of participants had good knowledge about obstetric ultrasonography, which was aligned with recent studies conducted in Saudi Arabia, which reported higher awareness levels among pregnant women regarding the ultrasound due to improved access to antenatal care services and widespread health information dissemination (Alhazmi et al., 2025; Alshalahi et al., 2025). Also, the high educational level observed in the participating pregnant women may have also contributed to better understanding and awareness, as education is consistently identified as a key determinant of health literacy (WHO, 2025).

With regard to the pregnant women's attitude and knowledge towards the obstetric ultrasound, the study revealed that while more than half of the women had positive attitudes, there was still a significant number of women with negative attitudes. This is in line with earlier studies that suggest the knowledge of pregnant women does not always translate to positive attitudes and practices of pregnant women towards the obstetric ultrasound (Maniragena et al., 2021). Furthermore, this may be explained by the cultural beliefs, fear for the fetal health, and misconceptions about the safety of the ultrasound procedure, especially in the Middle East (Qudsieh et al., 2026).

data were collected at one point in time. Second, the use of self-reported data could influence the results because of recall bias or under- or over reporting. Certain factors, like attitudes and perceptions, are subjective and may not adequately reflect the uniqueness of participants' perspectives. Finally, while we investigated several associated factors, there might be other unmeasured factors, such as health-care provider or institutional policy factors that might affect knowledge and attitudes. Lastly, the study was conducted in particular health care facilities, which may not be representative of all regions and health care facilities in the Kingdom of Saudi Arabia.

13. Recommendations and further studies

According to the study results, it is suggested to improve health education initiatives to correct misunderstanding and improve the attitudes of pregnant women towards obstetric ultrasonography. Similarly, improving communication skills of health care professionals is also crucial to provide women with clear, comprehensible and positive information during the ultrasound examination. Moreover, it is also recommended to address system-related barriers, such as waiting times, lack of accessibility and privacy, which were found to affect the pregnant' attitudes. Also, adopting multiple channels of information dissemination, such as information technology and community education, to better share knowledge. For future research, additional studies should focus on the impact of educational and counselling interventions aimed at improving the pregnant' attitudes towards the obstetric ultrasound. Qualitative research to better understand the reasons for negative attitudes despite the high knowledge is also recommended. Also, studies on health system factors and provider practices would help us to address service delivery.

14. Conclusion

Overall, the results of this study revealed that pregnant women had high knowledge about obstetric ultrasonography, but this was not reflected in their attitudes as many remained with negative attitudes about obstetric and accessibility to achieve better maternal outcomes (Labrusse et al., 2022).

Moreover, the findings of the present study revealed a strong significant association between knowledge and attitude, where pregnant women who are more informed about the purpose, safety and benefits of obstetric ultrasound tend to develop positive attitudes, acceptance and willingness to use the service, which is in line with the typical knowledge-attitude relationship described in health behavior theories, where increased knowledge and awareness address misconceptions (e.g., concern about harm, frequent use) and facilitate trust in medical interventions. This finding also implies that attitude formed from informational sources, such as information from health care practitioners. So, increased knowledge is likely to trigger change, such as improved adherence to the recommended antenatal ultrasound.

The finding of the current study is well supported by a multi-centered, cross-sectional study that reported knowledge about obstetric ultrasound had a significant association with women's attitude; women who were knowledgeable were nearly four times more likely to hold a positive attitude (Molla, Mengistu, & Wudneh, 2022). Likewise, Li (2025) found a positive association between knowledge and attitude of pregnant women, suggesting that as knowledge increases, women's attitude about ultrasound screening is much improved. Similarly, a study conducted in Ethiopia stressed that women's knowledge and attitudes shape their reactions and uptake of ultrasound services, and that women's willingness to comply with antenatal care programs is influenced by their level of knowledge (Haile & Gurmu, 2024). Similarly, previous studies also showed that the acceptance of ultrasound is related to women's knowledge and attitude, and lack of knowledge leads to misconceptions and negative attitude.

12. Limitations of the study

There are some limitations to this study. First, due to the cross-sectional nature of the study, causality between knowledge, attitudes, and associated factors could not be inferred, as

valuable contributions. Special thanks are extended to **the** administrative bodies that facilitated data collection and supported the completion of this research.

Data availability:

The data supporting the findings of this study are available from the corresponding author upon reasonable request. Access to the data is subject to ethical approval and data protection regulations.

Declarations:

Ethical approval for the study was obtained from the Institutional Review Board of Aseer Health Cluster Research Ethics Committee with Ref. No. (IRB-80-2025) prior to data collection. Participation in the study was entirely voluntary, and informed consent was obtained from all participants prior to data collection for agreement of participation. Ethical principles regarding confidentiality, anonymity, and the right to withdraw at any time were strictly observed.

Conflict of interest: the authors declare no competing interests.

Fund: no fund

ultrasonography. This suggests a gap between knowledge and attitude and that knowledge is not a sufficient predictor of positive attitudes towards obstetric ultrasonography. In addition, the findings also concluded that the prior experience to ultrasound, and the clarity of the information given by health professionals for pregnant women was more important in affecting knowledge. However, pregnant women's attitudes were greatly influenced by the systemic and access barriers, including waiting time, distance and cultural factors. Also, the results showed improving pregnant women's knowledge is a key step to improving positive attitudes towards obstetric ultrasound due to the highly significant correlation between knowledge and attitude of pregnant women towards the ultrasound. In summary, this study highlights the need for improving educational programs, communication between health-care providers and pregnant women, and also the need to address the systemic barriers in the health-care system. These are key to closing the knowledge-attitude gap and improve pregnant women's attitude towards obstetric ultrasonography.

Acknowledgements:

The author acknowledges all pregnant women who participated in this study for their time and

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