

# Assessment of Oral Health Status and Pregnancy Outcomes Among Women in Saudi Arabia

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**Purpose:** Pregnant women witness many changes in the body as well as in the oral cavity with many factors influencing these changes. This study evaluated the relationship between oral health status, perceptions, and pregnancy outcomes.

**Methods:** A cross sectional study design was implemented to recruit a convenience sample of women attending Obstetrics and gynecology department in public hospitals in East and capital city of Saudi Arabia. To collect data, a validated self-administered questionnaire in English and Arabic was used. The questionnaire covered background information, perceived oral health status, and dental visits.

**Results:** About 64.4% of the 481 women recruited had dental problems, 49.7% reported deterioration in their oral health during pregnancy, and 17.5% reported adverse pregnancy outcomes. Only 40.7% of pregnant women rated their oral health as good, and only 22% visited a dentist during their pregnancy. Dentists were the most common source of oral health information (44.1%), followed by social media (38.9%). Dental problems during pregnancy were significantly associated with adverse outcomes ( $P=0.007$ ). Oral health perceptions of pregnant women, not visiting the dentist during pregnancy, and gingival problems were also significantly associated with adverse pregnancy outcomes ( $P=0.001$ ). Those with fair to poor oral health were twice as likely to experience adverse pregnancy outcome. Those who intended to visit the dentist during their pregnancy but did not do so, as well as those who did not visit the dentist at all were 12 and 9 times more likely to experience adverse pregnancy outcomes respectively.

**Conclusion:** Dental complaints during pregnancy, oral health perceptions, and a lack of dental visits were all linked to increased likelihood of adverse pregnancy outcomes. There is a need for interprofessional collaboration to dispel myths and encourage oral health care and regular dental visits during pregnancy.

**Keywords:** oral health, pregnant women, adverse pregnancy outcomes, preterm, low birth weight

## Introduction

Pregnancy-induced changes in the woman's endocrine and immune systems increase her susceptibility to a variety of infections, including those of the oral cavity.<sup>1</sup> The reduction in pH, which in turn leads to a decrease in salivary buffering capacity may explain the shift in the microbial composition.<sup>2</sup> These combined with changes in dietary and oral hygiene habits, contribute to bacterial growth and raise the risk of dental caries during pregnancy.<sup>3,4</sup> Pregnant women are usually at greater risk of developing gingival inflammation and periodontal diseases due to hormonal changes.<sup>1,5</sup> Altered host inflammatory response, increased vascular permeability and the shift in supra and sub microbiota are some proposed factors that explain periodontal changes during pregnancy.<sup>2,6</sup>

Adverse pregnancy outcome has been linked to periodontal diseases; the compromised immunity, inflammatory mediators and toxic products were some of the reasons that explained the link between periodontal disease and adverse pregnancy outcomes.<sup>2,6</sup> The most common adverse pregnancy outcomes include preterm delivery, low birth weight and pre-eclampsia. Children born with preterm low birth weight (which is a combination of preterm delivery and low birth

weight) are at greater risk of newborn death and lifelong disabilities.<sup>7</sup> Pre-eclampsia is a multisystem progressive disorder characterized by hypertension and proteinuria leading to postpartum risks to women and also to the offspring who may be exposed to preterm low birth weight and increased disease risk in their postnatal lives.<sup>8</sup>

Correct knowledge and perception were identified as key predictors to the adoption of good oral health practices as well as maintaining regular dental visits among pregnant women.<sup>9</sup> However, studies conducted among pregnant women have always reported lack of proper oral health knowledge as well as wrong perceptions about the importance of oral health and its effects on their pregnancy and their offsprings oral and general health.<sup>9–11</sup> It was also reported that pregnant women lack the knowledge about the importance of regular dental visits and tend to avoid dental care even if they suffer from dental problems<sup>11</sup> mainly due to lack of knowledge and misconceptions that dental care/treatment will harm the fetus.<sup>12</sup>

In Saudi Arabia there is a continuum increase in the prevalence of adverse pregnancy outcomes<sup>13</sup> as well as high prevalence of periodontal diseases.<sup>14</sup> Dental care for pregnant women is recommended and appropriate, either as a preventive measure for oral diseases and their potential consequences or as a means of treating existing problems and is completely safe when followed by certain precautions.<sup>15–17</sup> Avoidance of dental care during pregnancy was linked to personal, psychosocial, financial, behavioral, and perceptions about general and oral health needs.<sup>18,19</sup> Self-assessment or self-perception of health is the individual ability to evaluate or to assess disease risks as well as severity, and it has been used as a subjective predictive indicator of long-term morbidity and mortality.<sup>20</sup> Although many studies investigated oral health knowledge, attitudes and practices among pregnant women in Saudi Arabia as well as in other Arab countries, nevertheless these studies were either from a single site or did not investigate women's perceptions and its link to adverse pregnancy outcomes. As such evaluating the oral changes that occur during pregnancy is critical for early detection and intervention to prevent adverse pregnancy outcomes and promoting oral health of the newly born. This study investigated oral health changes, perceptions, and pregnancy outcomes among women in Saudi Arabia.

## Materials and Methods

### Study Design and Setting

This cross-sectional survey-based study was carried in the Eastern province and Riyadh (the capital city of Saudi Arabia) over a period of one month from November to December 2022 (for both the recruitment period and data collection period).

### Study Participants

The study enlisted female participants (pregnant or not) from the eastern province and the Riyadh region. The survey targeted female patients that were or were not pregnant. Participants were included if they agreed to participate and answered all of the survey questions. Female dentists were barred from participating in the study.

### Sample Size and Sampling Technique

The research team members visited selected healthcare facilities during the study period, and recruited women attending Obstetrics and gynecology department using convenience sampling. The sample size was calculated using an online calculator with a 95% confidence level, and 5% accuracy resulting in a minimum and a population of 16,000 and considering pregnant women's population attending pre-natal facilities for 2 months to be as such: 500 pregnant women/week leading to a total of 16,000 women ( $500 \times 4$  (weeks)  $\times$  2 (months)  $\times$  4 (sites: Dammam, Khobar, Dhahran and Riyadh). The computed sample size was 375 pregnant women, which was increased to 400 to compensate for any missing data.

### Data Collection Tool

The data was collected in reception areas or lounges while participants were waiting for their turn in the Obstetrics and gynecology department. The research team shared the link with the participants and just requested them to notify the team when they complete it.

Participants responded to the questionnaire using their own mobile phones. The participant could not respond to the questionnaire more than once using the same device. A closed-ended, self-administered questionnaire was used. The questionnaire was developed on Google forms and a QR code was generated to be scanned and shared online and was administered in both English and Arabic languages. Before beginning the study, the questionnaire was pilot tested on 30 pregnant women (who were not part of the actual study) and Cronbach's  $\alpha$  coefficient was calculated (0.85). We also requested feedback from the piloted participants regarding the clarity and simplicity of the questions. No questions required modifications or deletion. The questionnaire included the following sections:

## Demographics

This section consisted of nine questions and included 1) age with possible response of younger than 25 years old, between 25 and 40 years, or older than 40 years. 2) nationality and participants can choose either Saudi or not Saudi. The categorization of age was purposely selected by the authors to include a range from >25 to < than 40 years as the childbearing age with an average of 26.6 years as per the Statista GCC report of 2017. 3) marital status with two options either married or not married. 4) educational level with three options no formal education, school education or university degree and above. 5) occupation and participants can choose either being a housewife, employed or employed in the health sector. For occupation, the categorization was purposely selected as housewife i.e unemployed Vs employed however we added a third category as employed in health sector as those working in health sector would have better knowledge and practices as such controlling this confounder. 6) family income per month categorized into less than 5000 Saudi Riyal (SR), between 5000 and 20,000 SR, more than 20,000SR or not sure. The income categorization was based on Statista Research Department data of 2021. 7) history of pregnancy answered as yes, no, currently pregnant. 8) participants were asked if they suffer from any of the following medical conditions hypertension, diabetes, obesity, high cholesterol, or others or none if they do not suffer from any medical condition. 9) participants were also asked if they are currently taking any medications and can respond with yes or no.

## Oral Problems and Changes in Oral Health

Participants were asked if they had suffered from any oral problems or changes in their oral health during the last year answered as yes, no, or I do not recall. Participants who are currently pregnant, were asked if they had any dental complaints in the last year with possible answers of dental decay, tooth pain, gingivitis, gum bleeding, or no complaint. Participants were also asked to report what kind of oral changes during pregnancy have they encountered and they can choose one or more of the following options tooth pain, gum bleeding, bad oral odor, swelling in the oral cavity, gingival swelling, no changes. Responses for oral changes which was based on the common dental/oral problems during pregnancy that are thought to be linked to adverse pregnancy outcomes.

## Perceptions of Oral Health

Participants were asked about how they perceive their oral health status with possible answers of good, fair, poor, or not sure.

## Dental Visits and Sources of Health Information

Participants were asked about their patterns of dental visits before and during pregnancy (answered as yes, no, I planned to but did not go, yes, due to dental problem/complaint). They were also asked if they had been advised against dental care by a nurse or health-care professional (no, I did not receive, yes, from a nurse, yes, from an obstetrician, I was not pregnant before). Regarding dental visits, the selection of responses was based on previous reports that pregnant women either avoid dental visits (no) or visit the dentist (yes) or hesitant due to misconceptions about dental treatment (planned but did not go) or visit the dentist due to emergency (Yes, due to dental problem/complaint). We also asked if any of the participants have a close family member who is a dentist answered with yes or no.

## Oral Health Knowledge

Participants were asked if they think that pregnancy increases the possibility of gingival inflammation and they can answer with yes, no, or I do not know. They were asked about the possible cause of oral changes during pregnancy, and they can answer hormonal changes, improper teeth brushing, poor oral hygiene, malnutrition, medications, or do not know. Participants were asked if they are aware about the treatment of gingival inflammation during pregnancy and they can choose surgical removal of swollen gum, no treatment needed, professional scaling, extract the affected tooth, medications, or do not know. We also asked the participants if they are aware about the consequences of gingival inflammation and they can choose one or more from the following options overgrowth of gum tissue, spontaneous gum bleeding, inflammation of supporting tooth structure, tooth sensitivity, tooth decay, affects oral health of the newborn, abscess, tooth mobility, loss of teeth, cause preterm labor and/or deliveries with low birth weight, do not know, no effect.

## Adverse Pregnancy Outcomes

Participants were asked to report if they suffered from any complications during or after birth with possible answers of: no, I did not have any; no, I was not pregnant before; yes, low birth weight; yes, I did, had a preterm birth; yes, I had septicemia.

## Ethical Considerations

The study protocol was developed in accordance with the principles of ethics of Helsinki declaration and was reviewed and approved by Deanship of Scientific Research at Imam Abdulrahman bin Faisal University (IRB-2022—02-085). A written introduction explaining the study objectives, the survey details and the time required to complete it was provided to all participants. Participants were assured of the confidentiality and anonymity of their responses, as well as the freedom to quit the survey at any time by choosing not to submit or exit button with no risks at all to the participants. Reading the survey introduction and agreeing to participate was considered as a consent to participate in the study.

## Statistical Analysis

The dependent variable was adverse pregnancy outcomes. Two models were implemented. In the first model, we investigated oral health factors (oral health changes during pregnancy, dental complaints during pregnancy, and dental visits) as the independent variables and adverse pregnancy outcomes as a dependent variable. In the second model, we investigated perceptions of oral health as independent variable and adverse pregnancy outcomes as a dependent variable. Descriptive statistics were used to calculate the frequency and percentage of demographic characteristics. The association between factors and oral health knowledge and habits was examined using the Chi-Square Test. Additionally, multiple logistic regression was conducted, with adverse pregnancy outcomes as the dependent variable and oral health factors (such as changes during pregnancy, dental complaints, and dental visits) as the independent variables. Data were downloaded as Excel sheet, coded, and analysis was performed using the Statistical Package for the Social Sciences (SPSS version 22, IBM USA), with statistical significance defined as a p-value below 0.05.

## Results

A total of 481 women participated in the survey, with [Table 1](#) presenting their demographic details. The largest age group was between 25 and 45 years old, comprising 53% of respondents. Almost all participants (95.6%) were Saudi nationals, 83% were married, 76.7% had higher education, and 46.4% identified as housewives. The majority (74.8%) had a history of pregnancy.

Among the participants, 17.5% reported complications during or after birth, 64.4% faced dental issues in the past year, and 46.2% rated their oral health as fair. [Figure 1](#) illustrates that over 250 women noticed oral health deterioration during pregnancy, but only 22.5% visited the dentist during pregnancy. The majority (74.4%) did not receive oral health education during pregnancy, with dentists being the primary source of oral health information followed by media ([Figure 2](#)).

**Table I** Background Information of the Study Participants (N=481)

<b>Study Variables</b>	<b>N (%)</b>
<b>Age</b>	
Younger than 25 years old	82 (17)
Between 25 and 45 years	255 (53)
Older than 40 years	144 (29.9)
<b>Nationality</b>	
Saudi	460 (95.6)
Non-Saudi	21 (4.4)
<b>Marital Status</b>	
Married	399 (83)
Not married	82 (17)
<b>Educational level</b>	
School education	110 (22.9)
University and above	369 (76.7)
No formal education	2 (0.4)
<b>Occupation</b>	
Housewife	223 (46.4)
Employed	214 (44.5)
Employed in health sector	44 (9.1)
<b>Family income/month</b>	
Less than 5000SR	131 (27.2)
Between 5000 and 20,000SR	223 (46.4)
More than 20,000SR	38 (18.5)
I am not sure	89 (18.5)
<b>History of pregnancy</b>	
Yes	360 (74.8)
No	88 (18.3)
Currently pregnant	33 (6.9)
<b>Had you faced any dental problem/complaint during the last year?</b>	
Yes	310 (64.4)
No	130 (27)
I do not recall	41 (8.5)
<b>Have you suffered from any complications during/after birth?</b>	
No, I did not have any	308 (64)
No, I was not pregnant before	89 (18.5)
Yes, low birth weight	27 (5.6)
Yes I did, had a preterm birth.	47 (9.8)
Yes, I had septicemia	10 (2.1)
<b>How do you rate your current oral health status?</b>	
Good	196 (40.7)
Fair	222 (46.2)
Poor	36 (7.5)
I am not sure	27 (5.6)

(Continued)

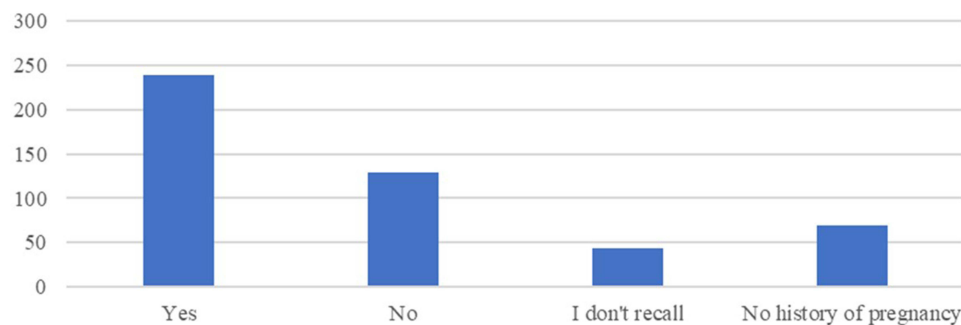
**Table 1** (Continued).

Study Variables	N (%)
<b>Have you visited the dentist for check during pregnancy?</b>	
Yes	108 (22.5)
No	214 (44.5)
I planned to but did not go	33 (6.9)
Yes, due to dental problem/complaint	126 (26.2)
<b>Have you received oral health education from an obstetrician or nurse during pregnancy?</b>	
No, I did not receive.	358 (74.4)
Yes, from a nurse	31 (6.4)
Yes, from an obstetrician	15 (3.1)
I was not pregnant before	77 (16)

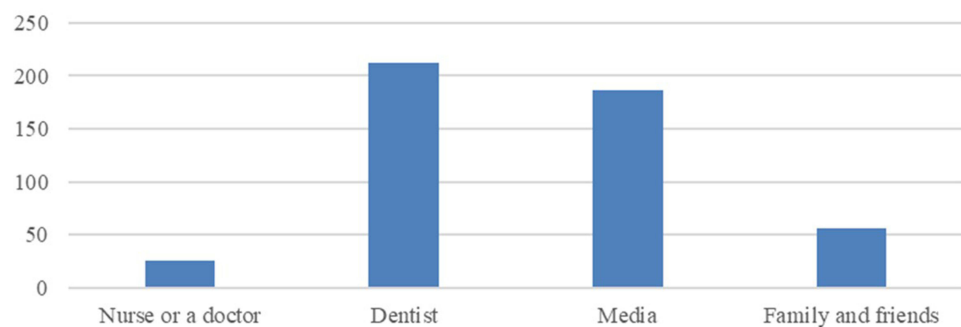
Table 2 outlines factors associated with adverse pregnancy outcomes. Experiencing dental problems in the past year, perceiving poor oral health, noticing oral health deterioration during pregnancy, and lacking dental visits or oral health education during pregnancy were all linked to adverse outcomes ( $p < 0.05$ ). Gingival bleeding, dental pain, or halitosis were also significantly associated with adverse outcomes ( $p < 0.05$ ). Those rating their oral health as fair or poor were twice as likely to experience adverse outcomes.

Table 3 delves into the association between perception/knowledge of oral health and adverse pregnancy outcomes. Believing that pregnancy exacerbates gingival inflammation ( $p = 0.002$ ) or increases the risk of tooth loss was significantly linked to adverse outcomes ( $p = 0.04$ ).

Poor oral health was associated with a 2.562-fold increase in adverse pregnancy outcomes ( $p = 0.02$ ) (Table 4). While obtaining oral health information from family and friends seemed to increase the likelihood of adverse outcomes by 3.27



**Figure 1** Number of women who noticed deterioration in their oral health during pregnancy.



**Figure 2** Source of oral health information among study participants.

**Table 2** Factors Associated with Adverse Pregnancy Outcomes

Oral Health Factors		Had You Faced Any Complications During/After Birth?					**P-value
		No	No, I was Not Pregnant	Yes, Low Birth Weight	Yes, I Did, Had a Preterm birth	Yes, I Had Septicemia	
Had you faced any dental problem during the last year?	Yes	195(63)	195(63)	47(15)	24(8)	34(11)	<b>0.007*</b>
	No	86(28)	86(66)	33(25)	3(2)	8(6)	
	I do not recall	27(9)	27(66)	9(22)	0(0)	5(12)	
How do you rate your current oral health status?	Good	114(37)	114(58)	50(26)	7(4)	24(12)	<b>&lt;0.001*</b>
	Fair	162(52)	162(73)	28(13)	13(6)	15(7)	
	Poor	20(6)	20(56)	4(11)	3(8)	4(11)	
	I am not sure	12(4)	12(44)	7(26)	4(15)	4(15)	
Deterioration of oral health during pregnancy	Yes	175(56)	175(73)	7(3)	19(8)	29(12)	<b>&lt;0.001*</b>
	No	95(31)	95(74)	15(12)	5(4)	13(10)	
	I do not recall	35(11)	35(81)	0(0)	3(7)	5(12)	
	No history of pregnancy	3(1)	3(4)	67(96)	0(0)	0(0)	
Have you visited the dentist during pregnancy?	Yes	77(25)	77(71)	5(5)	10(9)	10(9)	<b>&lt;0.001*</b>
	No	169(55)	169(79)	7(3)	8(4)	28(13)	
	Planned but did not go	21(7)	21(64)	3(9)	6(18)	3(9)	
	Yes, due to dental problem/ complaint	41(13)	41(33)	74(59)	3(2)	6(5)	
Source of oral health information	Nurse/ doctor	16(5)	16(62)	8(31)	1(4)	0(0)	0.076
	Dentist	128(41)	128(60)	48(23)	8(4)	22(10)	
	Media	132(43)	132(71)	21(11)	13(7)	19(10)	
	Family/ friends	32(10)	32(57)	12(21)	5(9)	6(11)	
Have you suffered from gum bleeding during pregnancy?	Yes	65(21)	65(64)	4(4)	12(12)	14(14)	<b>&lt;0.001*</b>
	No	243(78)	243(64)	85(22)	15(4)	33(9)	
Have you suffered from dental pain during pregnancy?	Yes	163(53)	163(75)	3(1)	17(8)	25(12)	<b>&lt;0.001*</b>
	No	145(47)	145(55)	86(33)	10(4)	22(8)	
Have you suffered from halitosis during pregnancy?	Yes	34(11)	34(64)	3(6)	5(9)	11(21)	<b>0.004*</b>
	No	274(88)	274(64)	86(20)	22(5)	36(8)	
Have you suffered from gingival swelling during pregnancy?	Yes	11(4)	11(61)	0(0)	3(17)	3(17)	<b>0.049</b>
	No	297(96)	297(64)	89(19)	24(5)	44(10)	
Have you received oral health education during pregnancy?	No, I did not	267(86)	267(75)	17(5)	22(6)	43(12)	<b>&lt;0.001*</b>
	Yes, from a nurse	22(7)	22(71)	3(10)	4(13)	2(6)	
	Yes, from an obstetrician	12(4)	12(80)	0(0)	1(7)	1(7)	
	I was not pregnant before	7(2)	7(9)	69(90)	0(0)	1(1)	

**Notes:** \*significance (less than 0.05). \*\*Chi-square test.

**Table 3** Oral Health Knowledge and Its Association with Adverse Pregnancy Outcomes

Factors		Had You Faced Any Complications During/After Birth?					**P-value
		No	No, I was not pregnant	Yes, low birth weight	Yes, I did, had a preterm birth	Yes, I had septicemia	
Do you think pregnancy increases the possibility of gingival inflammation?	Yes	155(65)	28(12)	18(8)	27(11)	9(4)	<b>0.002*</b>
	No	50(68)	18(24)	3(4)	3(4)	0(0)	
	I do not know	103(61)	43(25)	6(4)	17(10)	1(1)	
Do you think pregnancy increases the possibility of tooth decay?	Yes	138(66)	33(16)	15(7)	18(9)	5(2)	0.508
	No	70(61)	28(24)	4(3)	10(9)	3(3)	
	I do not know	100(64)	28(18)	8(5)	19(12)	2(1)	
Do you think pregnancy increases the possibility of tooth loss?	Yes	160(65)	37(15)	15(6)	26(10)	10(4)	<b>0.040*</b>
	No	68(69)	21(21)	4(4)	6(6)	0(0)	
	I do not know	80(60)	31(23)	8(6)	15(11)	0(0)	
Hormonal changes are the cause of poor oral health during pregnancy.	Yes	165(64)	45(17)	13(5)	28(11)	8(3)	0.390
	No	143(64)	44(20)	14(6)	19(9)	2(1)	
Improper brushing is the cause of poor oral health during pregnancy.	Yes	59(59)	21(21)	7(7)	11(11)	2(2)	0.817
	No	249(65)	68(18)	20(5)	36(9)	8(2)	
Poor oral hygiene is the cause of dental problems during pregnancy.	Yes	38(52)	20(27)	5(7)	9(12)	1(1)	0.157
	No	270(66)	69(17)	22(5)	38(9)	9(2)	
Malnutrition is the cause of dental problems during pregnancy.	Yes	147(65)	33(15)	16(7)	25(11)	6(3)	0.158
	No	161(63)	56(22)	11(4)	22(9)	4(2)	
Medications are the cause of dental problems during pregnancy.	Yes	42(54)	16(21)	8(10)	11(14)	1(1)	0.118
	No	266(66)	73(18)	19(5)	36(9)	9(2)	

Notes: \* significance (less than 0.05). \*\*Chi square test.

**Table 4** Multiple Logistics Regression

	OR	95% C.I. for OR		** p-values	
		Lower	Upper		
How do you rate your current oral health?	Good	Ref			
	Fair	863	0.507	1.470	0.588
	Poor	2.562	1.163	5.645	<b>0.020*</b>
	I am not sure	2.158	870	5.354	0.097
Where do you get oral health information?	Nurse or a doctor	Ref			
	Dentist	2.455	0.555	10.852	0.236
	Media	2.667	0.601	11.827	0.197
	Family and friends	3.273	0.676	15.848	0.141

(Continued)



Table 4 (Continued).

		OR	95% C.I. for OR		** p-values
			Lower	Upper	
Have you visited the dentist for checkup during pregnancy?	Yes	Ref			
	No	681	0.388	1.196	0.181
	Yes, I planned to but did not go	1.183	0.489	2.863	0.710
	Yes, due to dental problem/ complaint	0.302	0.141	645	<b>0.002*</b>

Notes: \*Statistically significant at 0.05. \*\*Regression Analysis.

times, this association was not statistically significant ( $p > 0.05$ ). Planning to visit the dentist during pregnancy but not doing so increased the likelihood of adverse outcomes by 1.82 times. Conversely, those who did not visit the dentist at all were less likely to experience adverse outcomes, a statistically significant finding ( $p = 0.002$ ).

## Discussion

This study investigated oral health status, perceptions, and adverse pregnancy outcomes among a sample of women in two Saudi cities. Although almost half of the women witnessed deterioration in their oral health and less than half perceived their oral health as good, yet less than a quarter visited the dentist during pregnancy. Dental complaints, lower perception of oral health and lack of dental visits during pregnancy were all associated with increased likelihood of adverse pregnancy outcomes.

Complications during pregnancy and childbirth are among the leading causes of disease and death among women in reproductive age worldwide.<sup>21</sup> In the current study, less than a quarter (17.5%) reported adverse pregnancy outcomes, a recent study in Qassim also reported a similar prevalence of 17.9%<sup>22</sup> which was significantly associated with higher prevalence and severity of periodontal diseases in both studies. The evidence for such an association is increasing with the prevalence reported worldwide to be between 15% and 100%.<sup>23–25</sup> A recent study has linked adverse pregnancy outcomes to increased risk of ischemic heart disease.<sup>26</sup> Premature infant health issues can have an impact on both their general and oral health. Due to enamel defects and poor dietary and oral hygiene habits, these children may be at greater risk of developing dental caries as well.<sup>27</sup> Adverse pregnancy outcomes are the most important indicators used to evaluate the efficiency of maternal and child health programs; they are also a measure of the quality of maternal and child health care services such as antenatal care, intrapartum care, and medical care. As a result, collaborative efforts are required to raise awareness about the risk factors and consequences of adverse pregnancy outcomes, as well as to identify potential risk factors through prenatal dental checkups.

According to the current study, more than half of the participants possessed adequate knowledge about the oral health changes they might experience during pregnancy. These findings are at odds with those of other studies.<sup>28–31</sup> On the other hand, our results are in line with those of a prior study that was carried out in Saudi Arabia.<sup>32</sup> Women educational level may be one of the factors that contribute to increased level of overall oral health knowledge. In the current sample, almost seventy-five percent of the women had a bachelor's degree or higher which is a key factor in oral health knowledge and awareness.

Slightly more than half (52%) of women who participated in this study noticed deterioration in their dental health during pregnancy, contraindicating to what was reported by Swiss women as the majority (71%) did not experience any changes in their oral health during pregnancy.<sup>33</sup> Oral health status is affected by many factors such as personal factors (socioeconomic status and educational level), proper oral hygiene practices as well as relevant oral health knowledge.<sup>34</sup> Western societies have always reported better oral hygiene measures as well as access to correct oral health information,<sup>35</sup> all these factors collectively might explain the observed differences in oral health status during pregnancy. Inadequate oral health care during pregnancy has been linked to negative outcomes for both mothers and their newborns, according to previous studies.<sup>1,3,6</sup> It is critical to provide pregnant and conceiving women with accurate oral health

information and care. A combination of personal and professional care is essential during pregnancy, as it plays a significant role in improving oral health.

The majority of women in the current study suffered from gingival bleeding, dental discomfort, bad breath, or gingival swelling which are all signs of periodontal diseases. Periodontitis can cause the loss of connective tissue and alveolar bone, which can lead to tooth loss. Preterm birth, fetal growth restriction, low birth weight, pre-eclampsia, and gestational diabetes are all linked to periodontal disease.<sup>25</sup> Periodontal diseases' potential effect could be explained by two mechanisms: periodontal pathogen translocation to the fetoplacental unit or the effect of inflammatory mediators.<sup>36</sup> Although periodontal diseases start with objective signs that women can easily detect but misconceptions about dental treatments during pregnancy may prevent them from seeking dental care.<sup>37</sup> Less than half of the women surveyed rated their oral health as fair, and a quarter visited the dentist during their pregnancy, which is consistent with previous research that pregnant women are less likely to visit the dentist.<sup>31,38,39</sup> Many pregnant women do not seek or receive oral care, even if they have signs or symptoms of oral disease.<sup>40</sup> Financial barriers, a lack of awareness of the importance of oral health, perceived quality of care, access to technical aids, and the information provided have all been reported as barriers to dental visits during pregnancy.<sup>12</sup> Although some recommend that no treatment can be delivered during the first trimester,<sup>41</sup> there is a consensus agreement that it is safe to perform tooth extractions as well as preventive, emergency dental, restorative, and periodontal procedures during pregnancy, including the use of local anesthetics and radiographs given that the appropriate protection and precautionary measures are implemented.<sup>42</sup>

It is crucial to be aware of the oral changes that occur during pregnancy in order to alleviate the psychological burden or concerns that women may experience. In the current study, half of the participants were aware that hormonal changes during pregnancy cause gingival inflammation. Consuming more refined carbohydrates will provide a suitable substrate for carcinogenic bacteria and may predispose some people to tooth decay. Frequent vomiting in some women during pregnancy has also been linked to the development of dental erosion.<sup>40</sup> However, reports on the knowledge of pregnant women about the causes and consequences of oral problems from elsewhere were controversial.<sup>31,33,38,43,44</sup> This might be due to differences across countries in prenatal care and maternal education provided.

More than two-thirds of pregnant women (74.4%) in the current study did not receive any oral health education during pregnancy, and the dentist was the primary source of oral health information, followed by the media. Pregnancy and postpartum period are ideal times for health education because women are concerned about the well-being of their newborns.<sup>42</sup> According to the American Dental Association (ADA) and the American College of Obstetricians and Gynecologists (ACOG), both obstetricians and dentists should advise pregnant women on the importance of good oral hygiene throughout their pregnancy.<sup>45-47</sup> There is a need for the inclusion of oral health within prenatal care and the collaboration of health professionals who are part of the prenatal care in oral health education and in correcting the misconceptions regarding dental treatment during pregnancy. In addition, there is a need to plan and evaluate multi-disciplinary interventions that can promote maternal health and wellbeing.<sup>48</sup>

There are certain limitations in the current study that we would like to acknowledge, first its cross-sectional design can only identify the associated risk factors but does not prove causation. The self-reporting nature of the study might have led to a social desirability bias as well as over or under-reporting of the variables investigated. The sample was recruited from only two cities, samples from other cities might lead to different findings. Additionally, the "adverse pregnancy outcomes" measure combined three undesirable pregnancy outcomes many women might have had more than one of the listed complications so, women having one, two or the three undesirable pregnancy outcomes were included in the same group with women having only one complication. Future studies should analyze these outcomes separately. Despite the limitations, the use of a validated questionnaire and the representative sample allow for generalizing of the study findings by policymakers and different stakeholders to develop policy and plans to address the highlighted gaps.

## Conclusion

Dental complaints during pregnancy, oral health perceptions, lack of dental visits, and gingival inflammation were significantly associated with adverse pregnancy outcomes. This study sheds the light on the low level of oral health awareness among pregnant women and the high prevalence of oral problems they experience during pregnancy. It also highlights the need for combined efforts of dentists and obstetricians in correcting the misconceptions with regard to

dental treatments and oral health care. Cohort studies using both surveys and clinical examinations may allow for a better understanding of the key factors associated with adverse pregnancy outcomes. Oral health educational campaigns are also needed to clarify misconceptions among pregnant women and encourage regular dental visits during pregnancy.

## Disclosure

The authors declare no conflicts of interest in this work.

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