



## **Dental Considerations in Pregnancy – A Systematic Review**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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### **ABSTRACT**

**Background:** Good oral health during pregnancy can not only improve the health of the pregnant mother, but also potentially the health of her child. There is inconclusive and contrasting nature of evidence regarding the effect of pregnancy on oral health. So the purpose of this study was to systematically review the dental considerations during Pregnancy for further investigation.

**Methods:** For the identification of the studies included in this review, we devised the search strategy for each database. The search strategy used a union of controlled vocabulary and free text terms. The main electronic database used to access the studies were PubMed, PubMed Central, Cochrane Review, Embase and Google Scholar.

**Results:** A total of 28 articles fulfilled the criteria and were selected for the review. Some prenatal oral health conditions have adverse effects on the child. Periodontitis is associated with preterm birth, low birth weight infants and high level of cariogenic bacteria in pregnant mother can lead to increased risk of dental caries in the infant. Oral lesions such as gingivitis and pregnancy tumours are benign in nature and require only reassurance and monitoring.

**Conclusion:** It has been suggested that some oral conditions may have adverse consequences on their children awareness related to oral health during pregnancy. Oral health care services should be routinely integrated with prenatal care services for all the pregnant women and specific preventive oral health care program should be made an integral part of antenatal care.

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## 1. INTRODUCTION

The mouth is an obvious portal of entry to the body, and oral health reflects and influences general health and well being. Maternal oral health has significant implications on birth outcomes and infant oral health [1]. Pregnancy is a state of physiological condition that brings about various changes in the oral cavity along with other physiological changes taking place throughout the female body [2]. It affects almost all systems and parts of the body including the oral cavity. Due to changes in the hormones, many opportunistic organisms gain access to various parts of the body in the absence of proper care [3]. The oral cavity is also affected by such endocrine actions and may present both transient and irreversible changes as well as modifications that are considered pathological [4].

## 2. CAUSES OF POOR ORAL HEALTH DURING PREGNANCY

Women are particularly susceptible to poor oral health as result of various factors such as limited medical and dental insurance can leave women unable to obtain oral health care when needed, resulting in the worsening of many conditions and health status [5]. Hormonal changes occurring throughout the lifespan can increase a woman's chance of developing oral diseases [6]. Barriers in obtaining dental care including limited access to affordable dental services and lack of awareness about the importance of maternal oral health [7].

## 3. COMMON DENTAL PROBLEMS DURING PREGNANCY

**Gingivitis and periodontitis:** The most common oral health disease experienced during pregnancy is gingivitis, with over half of all women develop gingivitis during pregnancy, [8] due to decreased immune response, hormonal fluctuations of estrogens and progesterone and changes in normal oral flora [9,10]. The inflammatory changes in gingiva during pregnancy have been termed as pregnancy gingivitis (gingivitis gravidarum), which is most prevalent oral manifestation associated with pregnancy, [11] frequently ranges from 60% to 75% [12].

**Dental Caries:** One fourth of women of reproductive age have dental caries pregnant women are at higher risk of tooth decay for several reasons, including increased acidity in the oral cavity, sugary dietary cravings, and limited attention to oral health [13]. It may occur due to increased acidity in the mouth from gastric acids from vomiting, greater intake of sugary snacks and drinks secondary to pregnancy cravings, and decreased attention to prenatal oral health maintenance [14]. Children whose mothers have poor oral health and high levels of oral bacteria are at greater risk for developing dental caries compared to children whose mothers have good oral health and lower levels of oral bacteria [15].

**Pregnancy Tumor:** Pregnancy tumor is a non-cancerous gingival hyperplasia usually near the upper gum line. Pregnancy tumors form on inflamed gum tissue and are caused by increased hormone levels, such as estrogen and progesterone, in combination with bacteria [16]. Oral tumors occur in up to 10% of pregnant women and often in women who also have pregnancy gingivitis [17]. The likelihood of pregnancy tumors developing usually occurs during the second trimester and usually disappear after delivery. It is indistinguishable from pyogenic granuloma. Management is usually observational unless the tumors bleed, interfere with mastication, or do not resolve after delivery [18].

**Mobility of Teeth:** Teeth can loosen during pregnancy, even in the absence of gum disease, because of increased levels of progesterone and estrogen affecting the periodontium (i.e., the ligaments and bone that support the teeth) [19].

**Dental erosion:** While no one enjoys the taste of vomit during pregnancy. It actually damage the teeth if the pregnant women reach for toothbrush too soon. Due to the presence of gastric acids, which can erode tooth enamel. If brush too soon after vomiting, it can reduce the teeth's natural defences, leaving them more susceptible to cavities, sensitivity and fractures [20].

**Habits During Pregnancy:** Certain ill- habits during pregnancy which has harmful effects during pregnancy are Tobacco consumption, Alcohol ingestion and sedentary lifestyles during pregnancy, the consumption of 10 or more cigarettes per day during pregnancy was

associated with greater odds of having a child with hypodontia. Maternal smoking during pregnancy is associated with hypodontia [21].

Alcohol in the mother's blood passes to the baby through the umbilical cord. Drinking alcohol during pregnancy can cause miscarriage, stillbirth, and a range of lifelong physical, behavioural, and intellectual disabilities. These disabilities are known as fetal alcohol spectrum disorders (FASDs) [22].

**Myths During Pregnancy:** When it comes to understanding the relationship between pregnancy and oral health, it helps to know fact from fiction. Myths can keep pregnant women from taking smart precautions when they are expecting and prevent their oral health. Women with severe or moderate gum disease are at a higher risk for low birth weights and early deliveries. Women are more prone to tooth decay not because of leaching of calcium from teeth. Vomiting can dissolve tooth enamel and reduce teeth's defences against decay as morning sickness is harmful [20].

**History of previous Diseases:** Negative health outcomes associated with sedentary behaviour in the general population, also occur in pregnancy, this could have implications for development of cardio metabolic complications such as gestational weight gain, gestational diabetes mellitus and hypertension, as well as mental wellbeing [23].

#### 4. NEED FOR THE STUDY

Considering the importance of oral health care in pregnancy, It is a mandate to have a proper knowledge about the effect of oral health in pregnancy as it is vital for maternal and foetal health. The inconclusive and contrasting nature of evidence regarding the effect of pregnancy on oral health warrants the need for further investigation into the topic. Hence, review was conducted . Since most of the women are unaware of the potential consequences of neglecting oral health during Pregnancy.

#### 5. AIM

**Research Question:** To review the dental health considerations among Pregnant women.

To estimate the unmet need for dental caries, periodontal health, Oral hygiene status and self-care practices among the population surveyed.

## 6. METHODS

### Information Sources and Search Strategy-

This systematic review was performed in accordance with the Cochrane Collaboration guidelines and the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) Statement. The controlled vocabulary (MESH terms) and free keywords in the search strategy were defined based on the PECO question:

1. Population (P): Pregnant women
2. Exposure (E): Not applicable (determinants that influence the use of dental care and have been found during this systematic review)
3. Comparison (C): Not applicable
4. The outcome (O): Dental caries, periodontal status, oro-mucosal lesions, oral health related quality of life

### Search method for identification of studies:

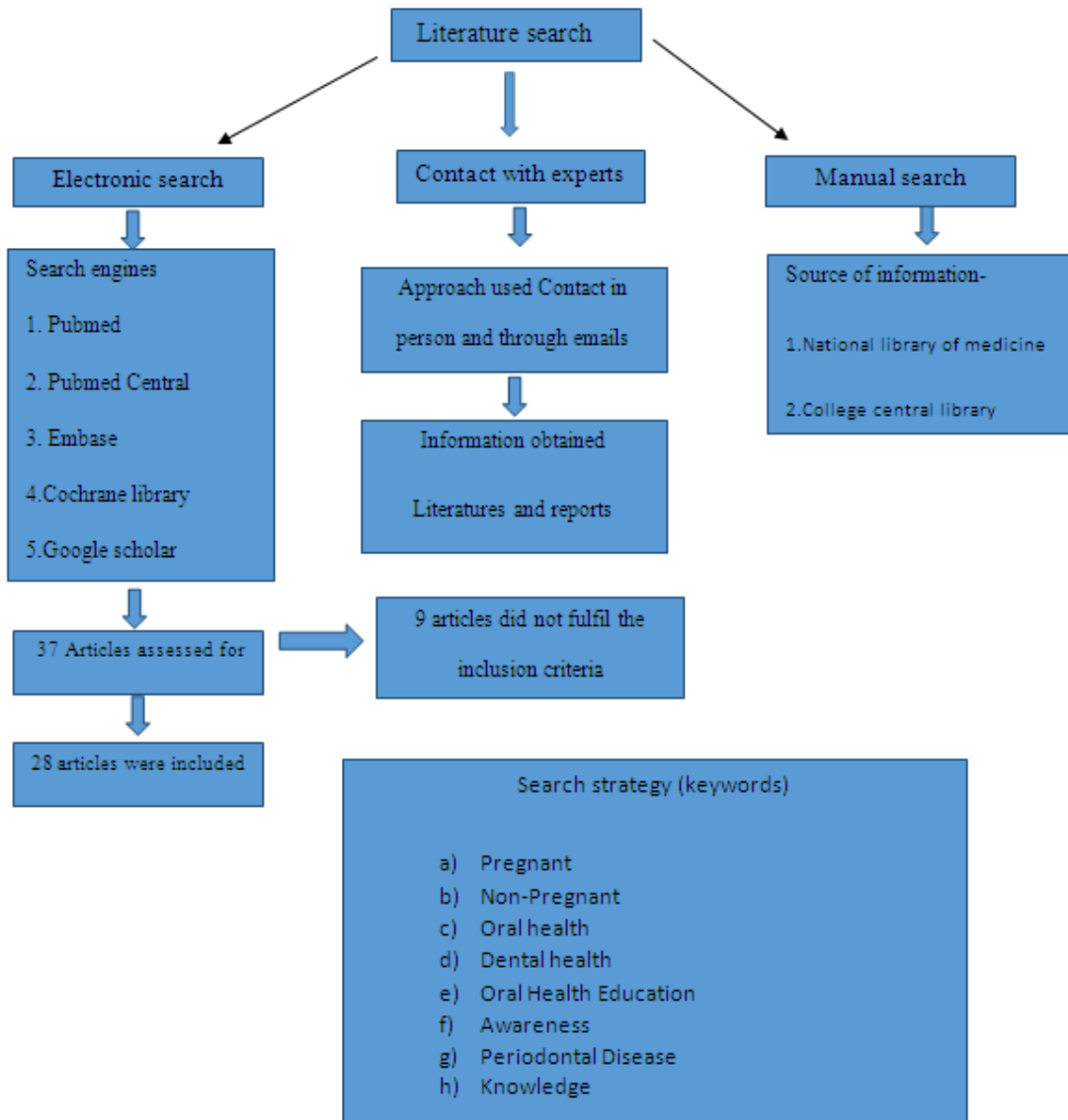
For the identification of the studies included in this review, we devised the search strategy for each database. The search strategy used a combination of controlled vocabulary and free text terms. The main electronic database used to access the studies were PubMed, PubMed Central, Cochrane Review, Embase and Google Scholar [Fig. 1] A manual search was performed of the reference lists for all primary studies to obtain additional relevant publications. The related article links of each primary study in the PubMed database were also assessed. Full-text versions of the papers that appeared to meet the inclusion criteria (described below) were retrieved for further assessment and data extraction. The search strategies for all databases are included in Table 1.

### 6.1 Eligibility Criteria

We included cross sectional studies that assessed the dental considerations among pregnant women as an outcome. The articles published in English dated from the year 2003 to 2020 were included in this review. The search terms for articles were the terms either in the title or abstract. The focus was to include broadly as much relevant existing data as reasonably possible.

### Inclusion criteria-

- a) Original research articles
- b) In vivo studies
- c) The articles emphasizing on the dental considerations among Pregnant women



**Fig. 1. Search strategy**

**Exclusion criteria-**

- a) Narrative reviews
- b) Case reports and case series
- c) Unpublished articles in press and personal communications

**6.2 Study Selection and Data Collection Process**

Initially, we selected the papers by title and abstract and deleted duplicate studies. Full reports were also obtained when there was insufficient information in the title and abstract to

make a clear decision. Subsequently, full-text papers were acquired and 2 reviewers classified those that met the inclusion criteria. The following information was recorded for each included study that is authorship and year of publication, methods including study design and setting , outcome of interest and statistical analysis.

**6.3 Summary Measures and Synthesis of the Results**

We conducted data analyses with the following extracted information: author/year, title, country,

study design, sample size, characteristics and source of the study population, outcome, and study findings (demographic factors, socioeconomic, psycho-logical, and behavioural factors, and perceived need). Study characteristics and results were tabulated, and statistically significant factors were reported. The explanatory framework for the dental considerations among pregnant were included.

## 7. RESULTS

After the removal of duplicates and title screening, 37 papers remained for assessment. Careful reading of full texts led to the exclusion of 9 papers due to the following reasons: the use of dental services was not the main outcome, the target population was not within the objectives of the review; a statistical analysis was not included, the study was qualitative and full text was not found. A total of 28 studies were included to analyse the dental considerations in pregnancy. The summary of the results has been provided in [Table1].

## 8. DISCUSSION

Pregnancy causes a variety of generalized changes in a woman's body due to the progressive cycle of hormonal influences [11]. The increased hormonal secretion may result in different signs and symptoms which can alter the person's overall health and perceptions [52]. The pregnancy related effects have a negative impact not only on the mother, but also on the infant if not handled properly [53]. At the same time, oral health is key to overall health and well-being. Preventive, diagnostic, and restorative dental treatment is safe throughout pregnancy and is effective in improving and maintaining oral health. In addition to providing pregnant women with oral health care, educating them about preventing and treating dental caries is critical, both for women's own oral health and for the future oral health of their children. Evidence suggests that most infants and young children acquire caries-causing bacteria from their mothers. Providing pregnant women with counseling to promote healthy oral health behaviors may reduce the transmission of such bacteria from mothers to infants and young children, thereby delaying or preventing the onset of caries [54].

It was observed by Patil et al.[ 55] that nearly 63.3% of pregnant women had dental caries, while in the non - pregnant group, the percentage

of caries was around 44.5%. and the difference came out to be statistically significant ( $P = 0.0001$ ). Moreover, it was found that 71.9% of pregnant women had caries in comparison to 60.5% among non - pregnant women. while as according to Rachanok et al. [28] pregnant women were more likely to have dental caries while compared to non-pregnant women they observed that three-quarter of pregnant women had dental caries, while in the non-pregnant group the percentage of caries was around 50.0. Thus, significant differences were revealed between pregnant and non-pregnant women with regard to dental caries. ( $P < 0.001$ ). While as Ingle et al. [33] observed that the mean number of decayed, missing, and filled teeth were  $3.42 \pm 2.66$ ,  $2.91 \pm 2.01$ , and  $3.01 \pm 1.98$ , respectively, and was well formed among the pregnant group. The mean scores for self-reported Oral Hygiene Score, among pregnant group was  $64.38 \pm 5.59$  for decayed teeth and non -pregnant group was  $65.81 \pm 5.36$ .

Gingival changes in Pregnancy were described as early as late 1800, even before any knowledge about hormonal changes in pregnancy was available. Pregnancy gingivitis is very similar to the gingivitis that occurs outside of pregnancy and can include a mild inflammation of the gums due to plaque buildup, with red and sore gums that bleed when probed. Pregnancy affects the severity of previously inflamed areas but does not alter healthy gingiva. Tooth mobility, pocket depth, and gingival fluid are also increased in pregnancy. Taani et al. [33] observed that probing pocket depth scores were higher in females pregnant for the first time than the females with multiple pregnancies ( $P < 0.005$ ) While as Amin et al. [34] observed in a study that Periodontal index tended to be significantly higher ( $P < 0.001$ ) in pregnant women ( $0.737 \pm 0.476$ ) than that in non-pregnant women ( $0.378 \pm 0.401$ ). It is also evident from studies that there is a relationship between maternal periodontal disease and low weight birth. Ardakani et al. [56 ] in the year 2013 observed that maternal periodontal disease can be a potential independent risk factor for Low birth weight of newborns.

Oral mucosal lesions are influenced by hormonal changes that occur during pregnancy which in some cases exacerbate or ameliorate minor pathologies such as vascular epulis and aphthous ulcer. Annan et al. [26] observed in a study that Vascular epulis along with aphthous ulcer was present in pregnant women when compared with

**Table 1. Dental considerations in pregnancy—a review**

Author	Objective	Sample size	Age group	Study type	Result	Conclusion
Taani DQ, Habashneh R, Hammad MM , Batieha A, [24]	To Assess the Periodontal health and oral Hygiene Status of pregnant controls and to evaluate the effect of socio demographic and other variables on periodontal status.	200-Pregnant women 200-Non pregnant	20-40 years.	Case-control Study	GI and PPD scores were higher in females pregnant for the first time than the females with multiple pregnancies. (P<0.005) No statistically significant differences in PI.1 or PAL Scores was found.(P<00.1) Significantly higher GI and PPD scores were found compared with those who did not vomit.(P<00.5)	Gingival inflammatory symptoms are aggravated during pregnancy And are related to increased age, lower level of education and non-employment
Vasiliauskiene I, [25]	To determine the prevalence and severity of periodontal disease among pregnant women and also to evaluate the status of oral hygiene.	1070 pregnant women	15-45 Years	Cross sectional Study	The prevalence of Caries was 99.9%. Periodontal diseases was 93.09%. CPITN: 6.91% healthy periodontium (code 0), 15.14% – bleeding on probing (code 1), 58.60% – supra gingival and sub gingival calculus (code 2), 18.97% – periodontal pockets 4–5 mm depth (code 3), 0.37% gum pockets 6 mm and more depth (code 4). The mean of OHI-S was 1.51±0.017(0.542) The mean of Silness-Loë gum index was 1.48± 0.021 (0.69).	All preventive methods and measures are necessary in order to improve oral hygiene among pregnant women.
Annan BDRT, Nuamah K, [26]	To find out if any oral condition was particularly prevalent in the pregnant women but not in the non-pregnant women.	100 Pregnant women 100-Non Pregnant women	Pregnant 15-39 years. Non- Pregnant 18-45 years.	Case-control Study	The incidence of vascular Epulis was 3% in pregnant women and absent in non-pregnant. One pregnant women had aphthous ulcer and severe gingival bleeding. TMJ symptoms were 7% among the pregnant women and 17% among the non-pregnant women.	Pregnancy has an effect on the oral health status. However this effect is more likely due to the physiological changes associated with pregnancy than any other specific factors.
Thomas JT, Middleton PF, Crowther CA [27]	To Assess knowledge and experiences of dental health in pregnancy and to examine the self-care practices of pregnant women in relation to their oral health.	388 women	More than 30	Cross sectional study	Majority of women were Caucasian (89%). 48% had some form of tertiary education. 51% and lived in a low to mid socio-economic index area 56%. 99% women agreeing brushing their teeth would help prevent gum disease. 84% of women understood that dental floss	Most women were knowledgeable about oral and dental health. Lack of knowledge about oral health and dental health was strongly linked to women with lower education achievements and lower socio- economical backgrounds.

Author	Objective	Sample size	Age group	Study type	Result	Conclusion
					would help prevent gum problems. Fluoride, whether in toothpaste 90% or water 80% helped to prevent tooth decay.	
Rakchanok N, Amporn D, Yoshida, Rashid MH, Sakamoto J, [28]	To identify dental caries and gingivitis among pregnant women, and to compare it with those in non-pregnant women in Chiang Mai, Thailand.	197 women 94 pregnant 103 Non-pregnant	15-24 Years 25-34 Years 35 and over	Case-control Study	Three-quarter of pregnant women had dental caries, while in the non-pregnant group the percentage of caries was around 50.0%. 86.2% of pregnant women had gingivitis in comparison to 72.8% in non-pregnant.	Dental caries and gingivitis were more prevalent among pregnant than non-pregnant women. Those with a poor oral hygiene status, inadequate knowledge of dental health care, and poor dental hygiene practice were two to three times more at risk of developing dental diseases.
Abiola A, Olayinka A, Mathilda B, Ogunbiyi O, Sorunke M, Onigbinde O [29]	To describe the self-reported oral health knowledge, attitudes and oral hygiene habits, among pregnant women receiving antenatal care at the Lagos State University teaching Hospital (LASUTH) in an antenatal clinic during the period January – June 2008	453 pregnant women	20-44 Years	Cross-sectional Study	32.0% reported having heard the term dental caries while 19.4% of the respondents understood the term to mean tooth decay. A smaller proportion of the respondents 37.5% had heard of the term periodontal disease. 41% could not identify one constituent of toothpaste although 25.4% identified fluoride as a constituent of toothpaste. 65.1% clean their mouths once daily while 34.2% clean their mouths two or more times daily.	The provision of oral health education during antenatal care to educate women on the importance of maintaining good oral health is essential. Apart from the benefit to the health of the women, mothers play a crucial role in transferring and demonstrating health habits to their children.
Ghalayani P, Tavangar A, Firoozeh N, Khalighinejad N [30]	Comparison of level of salivary estrogen and progesterone in pregnant women with and without Geographical tongue.	26 Pregnant women- 13 with geographical tongue. 13 without geographical tongue.	18-45 Years	Cross-Sectional study	Mean level of estrogen was $49.4 \pm 1.2$ ng/ml and $52.32 \pm 1.3$ in the 1st, $71.05 \pm 1.7$ and $74.12 \pm 2.2$ in the 2nd and $109.1 \pm 0.7$ and $112.16 \pm 1.2$ in the 3rd trimester. Mean level of progesterone was $0.72 \pm 0.09$ ng/ ml and $0.72 \pm 0.04$ in the 1st, $1.14 \pm 0.11$ and $1.21 \pm 0.13$ in the 2nd and $1.3 \pm 0.14$ and $1.28 \pm 0.24$ in the 3rd trimester of pregnancy. Increased level of sex hormones was not the cause for the incidence of Geographical Tongue.	The increased level of sex hormones is not the only etiological factor of Geographical Tongue in pregnant women and other factors such as genetic potential, human leukocyte antigen marker and stress may aggravate the incidence of this lesion.

Author	Objective	Sample size	Age group	Study type	Result	Conclusion
Patil SR [31]	To find the incidence of oral conditions seen particularly in the pregnant women than in the non-pregnant women.	120 pregnant 120 non-pregnant women	17-40 years	Case-control Study	The mean levels of progesterone in both groups revealed no significant difference in each trimesters of pregnancy ( $P = 0.06$ ). Higher incidence of gingivitis (100), Dental caries (98), and pyogenic granuloma (10) was present among pregnant. Incidence of gingivitis and pyogenic granuloma in the pregnant and non pregnant women was statistically significant ( $P < 0.05$ ). Incidence of dental caries was not statistically significant ( $P > 0.05$ ) in the pregnant group.	Oral healthcare needs should be a part of the training of medical students, nurses and healthcare workers so as to enable them to identify the main dental manifestations of pregnancy. They should also be able to advise pregnant women on how to maintain good dental health.
Naveen S, Asha ML , Shubha G, Bajoria AA, Jose AA [32]	To evaluate salivary flow rate, pH and buffering capacity of saliva in pregnant and non - pregnant women.	30 pregnant 30 non- pregnant	19-34 Years	Case-control Study	Mean stimulated and unstimulated salivary flow rate in the study group was 8.38, 4.82 and that of the control group was 6.76, 3.47 respectively. There was a reduction in the pH and buffering capacity in the study group with a mean pH and buffering capacity of 6.36 and 7.50. The control group had a mean pH of 6.87 and the buffering capacity of 9.93.	A significant increase in the flow rate of both unstimulated and paraffin stimulated saliva was seen in pregnant women in the third trimester with a reduction in pH and buffering capacity when compared to the non-pregnant women in the same age group.
Ingle NA, Sirohi R, Kaur N, Gupta R [33]	To compare the Oral Health Status (OHS) among pregnant and non pregnant women of Agra city.	425 pregnant 425 non-pregnant	18-45 Years	Case-control Study	48% Pregnant women had poor OHI-S scores. 46.58% had moderate gingivitis. 14.35% had CPI Score of 4. 8.71% had loss of attachment Score 2. Mean number of decayed, missing, and filled teeth were $3.42 \pm 2.66$ , $2.91 \pm 2.01$ , and $3.01 \pm 1.98$ , among pregnant group.	There is a need for the health care professionals to acknowledge the importance of good oral health in ensuring a safe and successful pregnancy and overcome misconceptions regarding rendering of essential dental care during this vital period in a woman.
Amin R, Shetty P [34]	To assess the oral health status of pregnant and non-pregnant women in the age group of 18 to 35 years in Mangalore.	153 pregnant 168 non- pregnant	18-35 Years	Case-control Study	Dental caries in pregnant women was not significantly different from ( $p=0.659$ ) that in non-pregnant women. Oral hygiene index-simplified(OHI-S) value ( $1.031 \pm 0.998$ ) was significantly higher	Every pregnant woman should be given instructions to maintain the oral hygiene & encourage their visit to the dentist, thus establishing a personal sense of responsibility to



Author	Objective	Sample size	Age group	Study type	Result	Conclusion
					( $p < .001$ ) in pregnant women than that ( $0.592 \pm 0.464$ ) in non-pregnant women. Periodontal index tended to be significantly higher ( $P < 0.001$ ) in pregnant women ( $0.737 \pm 0.476$ ) than that in non-pregnant women ( $0.378 \pm 0.401$ )	attain and maintain optimum dental health so as always prevention is better than the cure.
Neiswanger K, McNeil DW, Foxman B, Govil M, Cooper ME, Weyant RJ [35]	To describe the COHRA2 protocol and the oral health of the sample of COHRA2 pregnant women recruited from 2011 to 2015, including their oral health behaviors, personal and household demographics and social behaviors.	574 pregnant women	Above 18 years	Cohort study	DMFT scores were significantly elevated in West Virginia, compared to Pittsburgh, indicating higher rates of caries in West Virginia. 75% of the women in Pittsburgh have Oral Rating Index (ORI) scores of excellent or good, compared to 55% of the women from West Virginia.	Different levels of oral health problems and have several different demographic properties.
Singh S, Dagrus K, Kariya PB, Singh S, Darmina J, Hase P [36]	To assess the awareness regarding periodontal health among pregnant females in Bangalore, India.	300 pregnant women	18-35 Years	Cross-Sectional study	The awareness among pregnant women came out to be statistically non significant ( $p$ value $> 0.05$ ) irrespective of the age. The awareness among pregnant women came out to be statistically non significant ( $p$ value $> 0.05$ ) irrespective of educational qualifications.	Most pregnant women need more information about oral health, and prevention of gingival and periodontal diseases. Longitudinal studies are needed to assess the long-term effect of oral health education programs in maternity care centers on dental health, knowledge and behavior of pregnant women.
Sousa LLA de, Cagnani A, Barros AM de S, Zanin L, Florio FM [37]	To evaluate the pregnant women's knowledge and perception of oral practices as well as their relationship with periodontal Disease.	302 Pregnant Women	18-35 Years	Cross – sectional study	11.6% of the women had Community Periodontal Index (CPI) consistent with periodontal health and 45.7% had bleeding on probing. Oral hygiene orientation (CPI: 0 and 1) presented the highest demand as treatment needs are concerned and 57.3% of the pregnant women need to be treated. Socio demographic variables and the	A high prevalence of periodontal disease was observed in addition to many pregnant women. Questions regarding oral health care during pregnancy, with no information increase concerning prenatal care.

Author	Objective	Sample size	Age group	Study type	Result	Conclusion
Khan FR, Ahmed T, Hussain R, Bhutta ZA [38]	To compare pregnant and non pregnant females for vitamin D level and periodontal status and to determine if there is any association between the periodontal health and hypovitaminosis D in pregnant women.	36 pregnant 35 non-pregnant	26-30 years	Cross-sectional study	presence of periodontal disease was associated with the presence of periodontal disease ( $p=0.0460$ ). Major differences were observed in the weight and blood indices of the subjects. 89% pregnant women were found to be vitamin D deficient compared to 54% non-pregnant ( $P < 0.001$ ). One-third of pregnant women had severe deficiency (vitamin D $\leq 10$ ng/ml) compared to only 3% non-pregnant ( $P < 0.001$ ). No statistically significant association between hypo vitaminosis D and periodontal disease.	Vitamin D deficiency was more prevalent among pregnant than the non-pregnant participants. There was no statistically significant association between hypo vitaminosis D and periodontal disease among pregnant and non-pregnant women.
Gupta R, Acharya AK [39]	To assess the oral health status and treatment needs among pregnant women of Raichur district, Karnataka, India.	300 pregnant women	18–20 Years 21–23 Years 24–26 Years	Cross-Sectional study	93.7% of the pregnant women had healthy mucosa. 0.3% had leukoplakia, 0.3% had ulceration. 3.4% had oral submucous fibrosis. 0.3% had fissured tongue. 2.0% had pyogenic granuloma and all were in their third trimester of pregnancy. Only 5.0% of the pregnant women had healthy periodontium. No periodontal loss of attachment in 91.0% of the pregnant women. The prevalence of dental caries among pregnant women was 62.7%.	Prenatal and perinatal oral health along with infant oral health is one of the foundations upon which preventive education and dental care must be built to enhance the opportunity for a child to have a lifetime free from preventable oral diseases.
Payal S, Kumar GS, Sumitra Y, Sandhya J, Deshraj J, Shivam K, Parul S [40]	To evaluate the oral health status of pregnant females in Central India including the assessment of their knowledge, attitude, and awareness about oral health.	320 Pregnant women	19-36 years	Cross-sectional Years	Community Periodontal Index(CPI) score for pregnant females was 2.16 in comparison to 1.29 of the control group and difference was statistically highly significant ( $P < 0.01$ ). CPI score was significantly higher ( $P < 0.05$ ) for subjects with age below 25 years (2.07) in comparison to older age group (2.27). Education status also showed the direct	Educating and motivating pregnant females to maintain good oral hygiene and providing affordable dental health care was fundamental in reducing dental disease.

Author	Objective	Sample size	Age group	Study type	Result	Conclusion
					effect as the illiterate group has significantly higher (P < 0.01) CPI score of 2.26 in comparison to the educated group (2.03).	
Chawla RM, Shetiya SH, Agarwal DR, Mitra P, Nikhil A, Bomble NA, Narayana DS [41]	To motivate the patient toward oral health and implement the needed prophylactic measures.	112 pregnant women	18-35 Years	Longitudinal study	The practice was poor regarding oral health care during pregnancy in pregnant women belonging to different socioeconomic groups.	Intensive oral health education during pregnancy leads to drastic improvement in knowledge attitude and Practice.
Rajesh KS, Ashif A, Hedge S, MS Kumar A [42]	To assess the knowledge and awareness of pregnant women about periodontal health and its effect on pregnancy.	100 pregnant Women	21-25 Years	Cross-sectional Study	Majority 79% of the patients didn't know how to prevent gum disease and that swelling of gums can occur during pregnancy. About 75% of participants were not aware about the importance of dental check-up during pregnancy and 48% of them fear that dental treatment can affect the health of newborn. 72% of participants were not aware about the oral health practices to be considered during pregnancy.	Awareness and knowledge level of periodontal health among pregnant women was found to be very low.
Kateeb E, Momany E [43]	To assess the dental caries experience of Palestinian pregnant women and examined its relationships to their oral health knowledge, beliefs, behavior, and access to dental care.	152 Pregnant women	Not Mentioned	Cross-sectional study	Mean Decayed, Missing, filled, Teeth (DMFT) in this sample was $15.5 \pm 4.5$ and an average DMFS of $31.8 \pm 21$ . Age, level of education, providers, advice on utilizing dental care during pregnancy, and the belief that a woman can lose a tooth just because she is pregnant explained 22% of the variation in DMFT scores.	Women had a high prevalence of dental diseases and knew little about dental care during pregnancy. Faulty beliefs about dental care during pregnancy among women and health care providers were major factors in the high levels of disease.
Naorungroj S, Hunsrisakhun J, Talungchit S [44]	To determine oral hygiene status, self-reported oral malodour, oral hygiene practices, oral health knowledge, and the differences across educational levels in a group of Muslim Thai	88 Pregnant women	26-27 years	Cross-Sectional study	61% pregnant women reported bad breath experience. 41% were not sure or able to detect an odour when they were asked for oral malodour self-testing by smelling their breath in the cupped hands. The pregnant women had moderate levels of gingival inflammation.	Poor self-reported compliance with regard to oral health and oral health knowledge were in evidence among these pregnant women. To improve oral health status, effective oral health promotion including oral health education and intervention programs are needed.

Author	Objective	Sample size	Age group	Study type	Result	Conclusion
	pregnant women.				Half of the participants stated that they had regular tongue cleaning and had visited a dentist for a dental check-up.	
Lasisi TJ, Salam RAA [45]	To describe pattern of oral health among a cohort of pregnant women.	77 Pregnant Women	29-30 years	Cross-Sectional study	96.1% never had dental checkup and only 3.9% of participants ever had previous dental checkup. 6.5% of the respondents had dental complaints and the dental complaints elicited included tongue blisters, swollen gums, tooth decay and toothache. The tongue, palate, buccal mucosa status was normal in 100%. Oral hygiene, periodontal, gingival indices scores were good. Good oral hygiene score and calculus were observed in 40.3% and 87.0% of the participants. A healthy gingival status was observed in only 10.4% while caries was seen in 10.4%	Oral health disease prevention and health promotion will be useful interventions to reduce the burden of disease. A national oral health care policy in Nigeria especially for pregnant women and children.
Lubon AJ, Erchick DJ, Khatry SK, LeClerq SC, Agrawal NK, Reynolds MA et al [46]	To understand dental care-seeking behaviour, as well as oral health knowledge and attitudes of oral health among pregnant women in rural Nepal.	39 Pregnant Women	16-29 Years	Cross-Sectional Study	Madhesi participants (i.e. all IDI (In-depth interviews) participants and those from the Madhesi-comprised FGDs (Future group discussions) reported that their usual teeth cleaning practice was to use either a toothbrush and toothpaste or datuwan, a teeth cleaning twig that serves as both a toothbrush and toothpaste, once a day prior to their morning meal. In terms of maintaining more frequent brushing (i.e. twice per day), IDI( In- depth interviews participants identified the most pertinent barrier to be accessibility to a toothbrush and toothpaste. In both Madhesi and Pahadi communities, other commonly mentioned barriers were lack of time due to work obligations,	Future efforts involving oral health and pregnant women in low-income settings focus on providing tools and resources to maintain dental hygiene, promoting good oral health behaviors and knowledge and increasing access to qualified and fully trained dentists to improve the overall oral health of pregnant women.

Author	Objective	Sample size	Age group	Study type	Result	Conclusion
Kashetty M, Kumbhar S, Patil S, Patil P [47]	To assess oral hygiene status, gingival status, periodontal status, and treatment needs among pregnant and non-pregnant women.	120 Pregnant women 120 Non-Pregnant women	18-44 years	Cross-Sectional Study	laziness, sleepiness, forgetfulness, and lack of awareness. The pregnant women showed poor oral hygiene with the mean OHI-S score as 2.68. Gingivitis was prevalent in almost all the pregnant and non-pregnant women. More severe in pregnant women with mean gingival score as 1.25. Definite increase in gingivitis was found from trimester 2 to trimester 3.	Pregnant women showed poor oral hygiene, more gingival inflammation, and more periodontal disease as compared to non-pregnant women. The severity of gingivitis increased in Trimester III. Proper oral hygiene practice can prevent these diseases and further complications.
Africa WJC, Turton M [48]	To assess the oral health status and treatment needs of pregnant women attending antenatal clinics in KwaZulu-Natal, South Africa.	443 Pregnant Women	18-42 Years	Cross-Sectional Study	81.26% who constitute the majority of public health facility users in South Africa, followed by Coloured 12.64%, Indian 23%, and White 4%. No significant correlations were observed between pregnancy stage and regional distribution, between pregnancy stage and educational levels, and between pregnancy stage and race of the participants ( $p < 0.05$ ). Coefficients demonstrate significant correlations between DMFT and patient.	Make every attempt to facilitate an improvement in oral health and quality of life through assessment, education, and proper treatment planning.
Hans M, Hans VM, Kahlon N, Ramavat PKR, Gupta U, Das A [49]	To assess the oral health awareness, methods adopted to maintain hygiene, prevalent myths regarding oral health in pregnancy.	225 Pregnant women	20-39 years	Cross-Sectional Study	80% of participants were unemployed and homemakers. 72.3% participants had bleeding gums as a chief complaint. 36.8% reported any effect on eating choices due to oral problems. 62.2% used paste and toothbrush as oral hygiene aids. The use of other aids taken together was significantly less ( $P < 0.05$ ) than toothbrush and paste. 79.5% brushed at least once daily, The	Oral health care still remains on the backseat in care provided to pregnant female. A complete overhaul of understanding through individual, family, and community counselling is required to spread awareness.

Author	Objective	Sample size	Age group	Study type	Result	Conclusion
					participants not brushing at all were significantly less ( $t=3.774$ , $P<0.001$ ). The frequency of brush the number of participants giving the correct responses was significantly less than the incorrect responses ( $P<0.001$ ).	
Deghatipour M , Ghorbani Z, Ghanbari S, Arshi S, Ehdavivand F, Namdari M, Pakkhesal M [50]	To assess the oral health status and associated factors in pregnant women.	407 Pregnant women	15-45 Years	Cross-Sectional Study	Dental decay accounted for approximately 67% of DMFT while dental filling accounted for only 10%. The mean (SD) DMFT, D,M and F in study participant group were 10.34(5.10), 6.94(4.40), 2.22 (2.68) and 1.19(2.23) respectively.  The percentage of D/DMFT in 15–25 years age group was 78% and in 35–44 years age was 44%, while percentage of M/DMFT in 15–25 years and 35–44 years age group were 14 and 44%, respectively. Women in third trimester of pregnancy had significantly more periodontal pocket > 3.5 mm, compared to women in second trimester ( $p < 0.05$ ).	Oral health status of pregnant women was not satisfactory, having an average of seven decayed teeth in their mouth. Older women had less dental caries but apparently more missing teeth indicating improper received dental care.
Agarwal A., Chaturvedi J, Jyotsna Seth J, Mehta R [51]	To assess the cognizance & oral health status among pregnant females.	600 Pregnant Females	20-36 years	Cross-sectional	OHI score in pregnant females in Ist Trimester was 1.99, in IInd 2.17 and in IIIrd 2.07 and this difference was statistically highly significant ( $P < 0.01$ ). Trimester wise comparison showed a time-dependent increase in OHI score with duration of pregnancy. GI score in pregnant females in Ist trimester was 0.88, in IInd 1.41 and in IIIrd Trimester 1.84. and the difference was statistically highly significant ( $P < 0.01$ ).	There is need of interaction between dental practitioners and gynaecologists / other antenatal care providers to include routine dental checkup as a mandatory element during antenatal visits of pregnant females.

Non-pregnant Females While as according to Ghalayani et al. [30] the level of sex hormones during pregnancy lead to aggression of lesions such as geographical tongue along with presence of other etiological factors such as genetic potential, human leukocyte antigen marker and stress.

Richards et al. [57] observed that patients aged between 10 and 50 years of age with the prevalence of disorders ranging from 0.22% to 31%.The main lesions reported were gingival hyperplasia, morsicatio buccarum (chronic cheek biting), oral candidiasis, pyogenic granuloma and benign migratory glossitis.

Oral health may be considered an important part of prenatal care, given that poor oral health during pregnancy can lead to poor health outcomes for the mother and baby [58]. There is no gain saying the fact that good oral health during pregnancy is important because poor oral health may result in unfavorable pregnancy outcomes [36]. All preventive methods and measures are necessary in order to improve oral hygiene among women. Vasiliauskiene et al. [25] observed that all preventive methods and measures are necessary in order to improve oral hygiene among pregnant women While as according Amin et al. [34] observed that inadequate knowledge of dental health care, and poor dental hygiene practice were two to three times more at risk of developing dental diseases. Naorungroj et al. [44] observed that poor self-reported compliance with regard to oral health and oral health knowledge were in evidence among pregnant women and Rakchanok et al. [28] observed in a study that community awareness programs should be conducted in order to increase the women's awareness regarding oral hygiene practices during pregnancy to highlight the importance of good oral health and health for the mother and her baby. Also according to the "committee on healthcare for undeserved women" the committee stated that improved oral health of the women may decrease transmission of cariogenic bacteria to infants and reduce children's potent future risk of caries. gynecologists and dentists are the most easily accessed health care professional, which creates a unique chance to educate women throughout their lifespan, about the importance of dental care and good oral hygiene [59].

## 9. CONCLUSION

It is concluded that pregnant women should be stressed on the association of maternal oral health with foetal health and made aware of the possible risk of preterm low birth weight owing to periodontal infection. Oral health care services should be routinely integrated with prenatal care services for all the pregnant women. Specific preventive oral health care program should be made an integral part of antenatal care by including a dentist or dental hygienist in the antenatal team along with gynaecologist and paediatrician. Their needs should primarily be handled through a prevention-oriented treatment plan that places a greater emphasis on self-care measures, with dental care supplied based on the pregnant trimester.

## 10. RECOMMENDATIONS

1. Improvement in diagnostic and therapeutic systems used in antenatal care may reduce the burden of complications of pregnancy.
2. There is a need for the health care professionals to acknowledge the importance of good oral health in ensuring a safe and successful pregnancy.
3. Oral healthcare needs should be a part of the training of medical students, nurses, and healthcare workers so as to enable them to identify the main dental manifestations of pregnancy.
4. There is a need to incorporate oral health education and motivation interventions in the pre and postnatal care programs administered by the ministry of health in public clinics.
5. All women should be encouraged at the first prenatal visit to schedule an oral health examination if one has not been performed in the last six months, or if a new condition has occurred.
6. Future efforts involving oral health and pregnant women in low-income settings should focus on providing tools and resources to maintain dental hygiene, promoting good oral health behaviours and knowledge possibly through context-appropriate cadres of trained community-based workers, and increasing access to qualified and fully trained dentists to improve the overall oral health of pregnant women.
7. Education about oral health and its effect on pregnancy should be encouraged in all

anganwadi centres through pamphlets, power point presentations and group discussion.

## CONSENT

It is not applicable.

## ETHICAL APPROVAL

Ethical approval was taken from the Institutional Review Board Committee prior to the conduct of the study.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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