



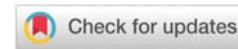
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## Research Article

# Pregnant women's attitudes and knowledge about oral health

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## Abstract

**Background:** Good oral health of pregnant women is important for their own health and the health of the fetus and can reduce the risk of complications in pregnancy. The development of early childhood caries is associated with the transfer of bacteria from the mother's oral cavity, and there is a need to promote oral health during pregnancy and the perinatal period.

**Aim:** This cross-sectional study aimed to evaluate attitudes and knowledge regarding oral health and infant oral health among pregnant women.

**Materials and methods:** The study involved 130 pregnant women in the Republic of North Macedonia who completed an anonymous online questionnaire (Google Forms) from January to June 2022. The questionnaire was divided into three parts. The first part contained questions about the general demographic data of the respondents and their own experience with oral health in pregnancy. The second part was related to the knowledge of the relationship between oral health and pregnancy. The third section consisted of questions related to knowledge about the oral health of children at the earliest age. The results were analyzed with descriptive statistics.

**Results:** The study involved 130 pregnant 19 to 42-year-old women. The women are most informed about oral health in pregnancy from their dentists (30.8 %), but least from doctors of family medicine (3.1%). In pregnancy, gingival bleeding was observed by 60.8 % of respondents, and tooth mobility by 22.3 %. The chi-square test found that there was a difference in attitude regarding the age at which they should stop breastfeeding between respondents who had their first pregnancy and those who already had children (Chi-square value =13.216,  $p = 0.004$ ,  $p < 0.05$ ). Only 20.5 % of respondents are aware that breastfeeding can cause tooth decay.

Linear regression analysis showed that pregnant women's knowledge about the association between pregnancy and periodontal diseases is statistically significantly positively associated with their gynecologist's advice to visit a dentist ( $\beta = 1.282$ ,  $p \leq 0.001$ ). In addition, pregnant women's knowledge about children's oral health is statistically significantly negatively associated with women already having children ( $\beta = -0.693$ ,  $p = 0.043$ ).

**Conclusion:** Pregnant women in the Republic of North Macedonia do not have sufficient knowledge, and they are neither aware of the importance of oral health during pregnancy nor infant oral health.

## Introduction

During pregnancy, due to the growth of the fetus and the preparation of the mother's body for childbirth, many physiological changes occur in the body, which are also manifested in the oral cavity [1]. Oral health is an important part of general health and should be maintained throughout life, including during pregnancy [2]. Good oral health for pregnant women is important for their health and the health of the fetus and can reduce the risk of pregnancy complications. The development of caries in early childhood is related to the transfer of bacteria from the oral cavity to the mother, and there is a need to promote oral health during pregnancy and the perinatal period [3]. The increased pH value of the oral cavity causes vomiting, frequent meals rich in carbohydrates and poor oral hygiene contribute to the easy occurrence of caries during pregnancy. If not treated, it can lead to local and systemic complications [4].

Erosion of the gums is often found in the oral cavity of pregnant women. They most often occur as a result of morning sickness and vomiting, especially in the first trimester. Another reason for back erosion is increased reflux of gastric acid, due to weakened tone of the lower esophageal sphincter and increased intra-abdominal pressure [5].

Due to the increased level of progesterone and estrogen, the periodontal ligament relaxes and there may be increased mobility of the teeth. This condition is reversible and resolves soon after delivery [5].

The most common change in the oral cavity during pregnancy is gingivitis, which affects 36% - 100% of pregnant women [6]. This is caused by increased levels of estrogen and progesterone, changes in the oral flora, and reduced immune response, which reduces the body's ability to repair and maintain healthy gingival tissue.

Periodontal diseases during pregnancy are associated with an increased risk of premature birth, reduced birth weight of the newborn, preeclampsia, and gestational diabetes [6]. Periodontal therapy can reduce the rate of negative pregnancy outcomes in women who are exposed to a high risk of pregnancy complications and improve the general health of pregnant women [5]. The most likely mechanism of the connection between periodontitis and negative pregnancy outcomes is an inflammatory response with suppression of local growth factors (eg IGF-2) in the fetoplacental unit [7].

Premature birth is birth before the 37<sup>th</sup> week of pregnancy. Bacteremia caused by periodontitis stimulates the release of inflammatory cytokines, the passage of which through the placental barrier increases the physiological level of PGE2 and TNF $\alpha$  in the amniotic fluid, which leads to early uterine contractions and premature delivery [8]. It is thought that a similar mechanism also causes the low weight of the baby at birth (less than 2500 g). The release of PGE2 limits placental blood flow and causes placental necrosis and intrauterine growth restriction [5].

Preeclampsia is a disorder in pregnancy that is manifested by elevated blood pressure ( $\geq 140/90$  mmHg sitting, confirmed by two examinations at an interval of 4 hours) and proteinuria ( $\geq 300$  mg in urine during 24 hours) [9]. It occurs in 2% - 10% of pregnant women, usually after the 20<sup>th</sup> week of pregnancy, and is the main reason for premature birth and slow growth of the child. It occurs due to inappropriate development of the uterine spiral arterioles, which results in reduced utero-placental blood flow, which ultimately leads to ischemia of the placenta [6]. Periodontitis can affect the development of preeclampsia in pregnant women because periodontal pathogens can cause systemic inflammatory endothelial dysfunction in the uterus and placenta with the release of inflammatory cytokines [9].

Gestational Diabetes Mellitus (GDM) is glucose intolerance with the first onset during pregnancy and is associated with serious complications for the mother and fetus. Periodontal disease has a potential role in the development of GDM [10].

Pregnant women with poor oral health have large amounts of *Streptococcus mutans* bacteria in their saliva, which can easily be transmitted to the newborn after delivery through a procedure such as spoon-feeding. The bacteria present in the mother's mouth increase the probability of colonization of the newborn's mouth and the subsequent formation of caries in early childhood.

## Aim of the study

The aim of this cross-sectional study was to determine the attitudes and knowledge of pregnant women in the Republic of North Macedonia regarding the relationship between oral health and pregnancy. Furthermore, this research examined the attitudes and meanings of pregnant women for preserving the oral health of children at an early age. To the best of our knowledge, this is the first such study conducted in our country. Previous studies conducted around the world have shown that mothers play an important role in the prevention of oral diseases in children [11,12]. The knowledge of pregnant women is of essential importance in the prevention of all conditions and diseases previously mentioned, and pregnancy provides adequate time for health education, if there is a need for it [13,14].

## Material and method

### Study design and setting

This cross-sectional survey was conducted from January to June 2022 through printed questionnaires and online questionnaires (Google forms) among the population of pregnant women in the Republic of North Macedonia.

### Data collection tool and technique

The online questionnaire was distributed through the social platform Facebook. Since Facebook is the largest social network in the Republic of North Macedonia, questionnaire distribution on the pregnancy forum was the easiest way to rapidly obtain representative survey data.



According to data from the North Macedonian State Statistical Office in the year 2022, 18 648 children were born [15]. Consequently, the sample size was calculated with a confidence level of 90%, a margin of error of 10%, and a population proportion of 50%, resulting in a sample size of 68. Furthermore, this study employed a chi-square test to analyze the association between attitudes about breastfeeding and two categories based on whether individuals already have or do not have children. With a significance level of 0.05, a power of 80%, and an effect size of 0.5, the minimum sample size per group was determined to be 32.

The questionnaire was completely anonymous. All respondents were informed in detail about the purpose of the research and signed written consent before completing the printed questionnaire, while those who completed the online questionnaire confirmed their voluntary participation. The questionnaire consisted of 27 questionnaires and was divided into three parts. The first part of the questionnaire contained questions about the respondents' general demographic data and their own experiences with oral health during pregnancy. The second part was related to knowledge of the relationship between oral health and pregnancy. The questionnaire from the study of Hashim and Akbar was adapted and supplemented with new questions [16]. Cronbach's alpha coefficient of internal consistency for this questionnaire translated into Macedonian was 0.719, which implied a very good reliability [17].

Finally, the third part consists of questions related to the knowledge about the oral health of children from the earliest age. The third part of the questionnaire was taken from the research of Di Giuseppe and colleagues from 2006 [18]. Both forms used close-ended questions.

The arithmetic means of all the answers given was determined as the boundary between the insufficient and sufficient knowledge of the respondents [19]. For each correct answer, the respondents got 1 point. The final sum for the second part could range from a minimum of zero to a maximum of 8 points. Similarly, the final sum for the third part ranged from 0 to 7 points.

For each correct answer to questions related to the knowledge about the relationship between oral health and pregnancy, respondents were awarded one point, and the final total could be from a minimum of zero to a maximum of eight points. For each correct answer to the questions related to the oral health of children from the earliest age, the respondents were awarded one point, and the final sum of points was from zero to seven points. Arithmetic means of the maximum possible sums were calculated as the border between insufficient and sufficient (good) knowledge of the respondents [19].

### Statistical analysis

All correctly completed questionnaires were entered into the database and statistically processed using the SPSS software package (IBM Corp., Armonk, New York). The descriptive

statistics method was used to determine the basic statistical parameters (mean values, standard deviations, medians, and minimum and maximum values). The basic statistics method was used to describe the population and to calculate Spearman correlation coefficients. Differences in responses related to the attitudes of pregnant women considering whether they already have children or not were examined by the Chi square test and multiple regression analyses. All analyses used a significance level of  $p < 5\%$  (0.05).

### Ethical consideration

The research was approved by the Ethics Committee of the Faculty of Dental Medicine of the University Ss. Cyril & Methodius Skopje, (Class: 003 08/19 03/0003; Reg. No.: 2589 198 03 04 19 0027) confirmed that the study was in full accordance with ethical principles including the World Medical Association Declaration of Helsinki.

### Results

The study involved 130 pregnant women aged 19 years - 42 years. The average age was  $28.89 \pm 5.23$ . There was no missing data.

The degree of pregnancy of the respondents ranged from the 6th to the 41<sup>st</sup> week (mean  $27.78 \pm 9.91$  weeks). This was the first pregnancy for 74 women (56.9%), while 56 of them (43.1%) stated that they already had children.

Table 1 represents respondents' answers on how they get informed about the relationship between oral health and pregnancy, as well as dental treatments they consider safe in pregnancy. 30.8 % of pregnant women ( $n = 40$ ) stated that they were advised by a gynecologist to have a dental examination.

In pregnancy gingiva, bleeding was noticed by 79 respondents (60.8 %), whereas tooth mobility was noticed by 29 (22.3 %). 47.7 % ( $n = 62$ ) of pregnant women knew what preeclampsia was. 43.8 % of pregnant women ( $n = 57$ ) believe that the child should be taken to a dental examination around

**Table 1:** The total sample surveyed on how they get informed about the relationship between oral health and pregnancy and about the dental treatment they consider safe.

Attitudes about the safety of treatment during pregnancy	N(%)
Routine teeth cleaning	106(81.5%)
Production of fillings and crowns	18(13.8%)
Periodontal treatment	3(2.3%)
Extractions	3(2.3%)
Intraoral/extraoral radiograms	/
Source of information about the relationship between oral health and pregnancy	N(%)
Dentist	40(30.8%)
Gynaecologist	2 (20.8%)
Family physicians	4(3.1%)
Books, journals, brochures	11(8.5%)
Television and internet	25(19.2%)
Other	23(17.7%)



the 1st year of life. one-third of respondents or more precisely 36.2 % (n = 47) believe that this should be done when all the deciduous teeth erupt. Eighteen respondents (13.8%) state that the time for the first examination is when the permanent teeth erupt while six of them (4.6%) believe that the first examination should be done only when the first carious appears.

Pregnant women get the most information about oral health and pregnancy from their dentist (40 of them, or 30.8%), and the least from family medicine doctors (4 pregnant women, or 3.1%). The second source of information related to oral health and pregnancy is the gynecologist, through whom 20.8% of pregnant women (n = 27) are informed. While 19.2% of pregnant women (n = 25) receive information through television or the Internet. Of the surveyed pregnant women, 47.7% indicated that their gynecologist advised them to have an examination with a doctor of dental medicine.

Seventy-three of pregnant women (56.2%) think that their child should start brushing their teeth as soon as the first tooth appears in their mouth while 46 respondents (35.4%) think that the right time to start brushing their child's teeth is when all teeth erupt. Seven respondents (5.4%) answered that the child should start brushing their teeth with the appearance of first carious.

The total sample surveyed answers to the question at what age of life should the child stop breastfeeding are shown in Figure 1, while responses about do pregnant women have more children are shown in Figure 2.

The answers of pregnant women about the relationship between oral health and pregnancy are shown in Table 2, while the responses about the oral health of toddlers are shown in Table 3.

A large part of 81.5% of the surveyed pregnant women think that routine cleaning of the back is a safe procedure during pregnancy. Of the pregnant women surveyed, 13.8% answered that the procedures for the application of restorations or crowns are considered safe, while only 2.3% (3) consider that tooth extraction is a safe procedure during pregnancy. During pregnancy, gingival bleeding was noted by 79 (60.8%) of the respondents, and mobility of the teeth was noted by 29 (22.3%) of them. 47.7% of pregnant women (n = 62) knew what preeclampsia was. 43.8% of pregnant women (n = 57) think that the child should be taken to the dentist for the first examination around the first year of life, and 36.2% think that it should be when all the milk teeth appear. 13.8% stated that the time for the first examination of the child will be when permanent teeth begin to sprout, while 4.6% (n = 6) stated that the child should be taken to the dentist when the first carious tooth appears. 73 pregnant women (56.2%) think that the child should start brushing as soon as the first tooth appears in the mouth, while 46 respondents (35.4%) think that the right time to start brushing is when the child's teeth have erupted. milk dentition. Seven respondents (5.4%) answered that they should stick to the child to predict when the first carious lesion will appear 21(16.2)% of pregnant women think that

In what month of the child's life should you stop breastfeeding?

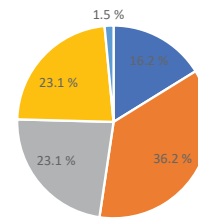


Figure 1: Graphic representation of the total sample surveyed answers to the question at what age of life should the child stop breastfeeding.

Do you have more children?

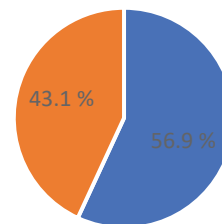


Figure 2: Graphic representation of the total sample surveyed answers to the question do they have more children?

Table 2: The knowledge of pregnant women about the relationship between oral health and pregnancy (n = 130).

Questions	Yes n(%)	No n(%)
Does pregnancy increase the risk of gingivitis?	71(54.6)	59(45.4)
Is there a connection between dental and gum health and pregnancy?	99(76.2)	30(23.1)
Can inflammation of the gingiva/periodontium affect the outcome of pregnancy?	48(36.9)	82(63.1)
Periodontal diseases can lead to premature birth and low birth weight?	31(23.8)	98(75.4)
Is local anesthesia safe for pregnant women?	59(45.4)	71(54.6)
Is the second trimester the safest for dental treatment?	62(47.7)	68(52.3)
Can periodontal disease lead to high blood pressure during pregnancy?	40(30.8)	88(67.7)
Do you know what preeclampsia is?	62(47.7%)	66(50.8%)

Table 3: The knowledge of pregnant women about the oral health of children from the earliest age (n = 130).

Question	Agree n(%)	Disagree n(%)
Dental caries can be prevented	104(80.0)	26(20.0)
Oral hygiene is important to prevent dental caries	115(88.5)	15(11.5)
Fluoride supplements are important for the prevention of dental caries	69(53.1)	61(46.9)
Routine dental visits are important for the prevention of oral diseases	114(87.7)	16(12.3)
Gingivitis is preventable	75(57.7)	55(42.3)
Malocclusion can be prevented	69(53.1)	61(46.9)
Breastfeeding can cause tooth decay	28(21.5)	102(78.5)



the child should be breastfed from 6 to 8 months, 47(36.2%) think that it should be delivered until 9 months - 12 months, and 30(23.1%) think that the baby should be breastfed until 13 months - 18 months, 31(23.8%) are concerned that it should reach 19 months - 24 months. Only two pregnant women are bothered that breastfeeding should be stopped when the child starts to refuse breastfeeding. The attitudes of pregnant women regarding the relationship between oral health and pregnancy are shown in Table 1, while the attitudes of pregnant women regarding the oral health of children at the earliest age are shown in Table 2.

The average score of the second part of the questionnaire was 3.63, while the average score of the third part of the questionnaire was 4.42. About 46. 15% of respondents (n = 60) showed sufficient knowledge about the relationship between oral health and pregnancy, while 50.77% (n = 66) demonstrated sufficient knowledge about the oral health of children at the earliest age.

**Chi-square test**

The Chi-square test showed that there was a difference in the attitudes of the respondents about when they should stop breastfeeding between those who already had children and

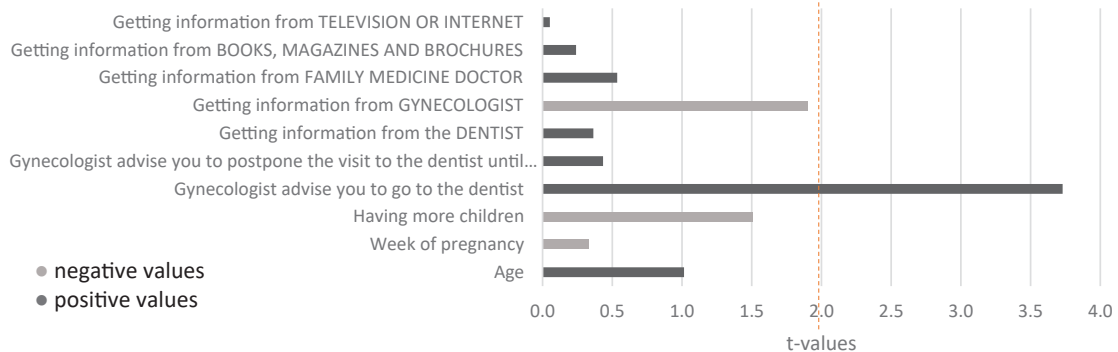
those who had their first pregnancy (p = 0.004). It is surprising that most mothers who have their first pregnancy know that breastfeeding should be interrupted around the first year of the child's life (Table 4).

Multiple regression analysis showed that pregnant women's knowledge about the association between pregnancy and periodontal diseases is statistically significantly positively associated with their gynecologist's advice to visit a dentist (β = 1.282, p ≤ 0.001) (Figure 3). In addition, pregnant women's knowledge about children's oral health is statistically significantly negatively associated with women already having children (β = -0.693, p = 0.043) (Figure 4).

**Table 4:** The total sample surveyed about attitudes of pregnant women given the fact that they already have children.

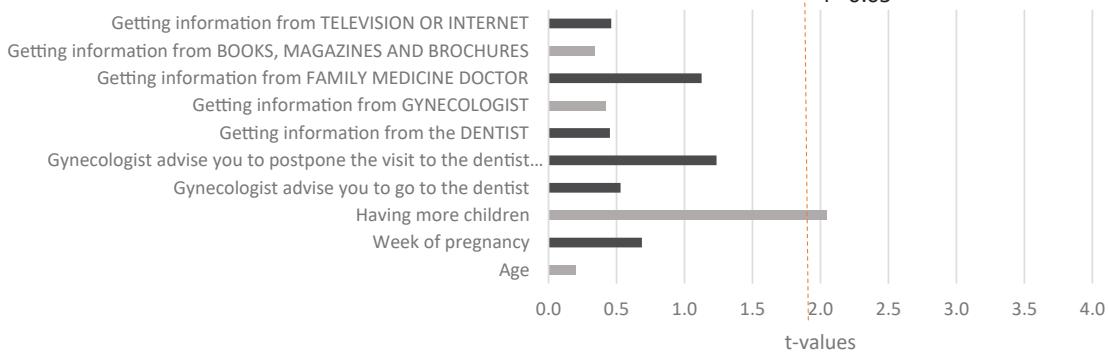
Crosstabulation		When should a child stop breastfeeding?					Total
		6 - 8 months	9 - 12 months	13 - 18 months	19 - 24 months	When a child begins to refuse breastfeeding	
Do you have more children?	No	8	35	18	12	0	73
	Yes	13	12	12	18	2	57
Total		21	47	30	30	2	130
Chi-square value; p - value		13.216;0.004* df = 3 p = 0.004*					

Pregnant women's knowledge about association pregnancy and periodontal diseases P=0.05



**Figure 3:** Multiple regression analysis - pregnancy knowledge about the connection between oral health and pregnancy.

Pregnant women's knowledge of children's oral health P=0.05



**Figure 4:** Multiple regression analysis - knowledge of pregnant women about the oral health of children at an early age.

## Discussion

The aim of this study was to assess the knowledge of pregnant women about the importance of maintaining oral health for oral health. When it comes to knowledge about oral health and pregnancy, 46.15% of pregnant women answered below the average score of 3.63. This means that 46.15% have insufficient knowledge of the relationship between oral health and pregnancy.

The results of this study are close to the results of a study conducted by Mousa, et al. which showed that 65% of pregnant women have a high level of knowledge about oral health during pregnancy [11].

On the other hand, when the oral health of the children at the earliest age is considered, 50.77% of respondents answered above the average score of 4.42. This means that 50.77% of pregnant women show sufficient knowledge of the topic.

(Average score of 3.63 points out of a maximum of 8) and good knowledge of children's oral health from an early age was shown by 50.77% of pregnant women (average total of 4.42 points out of a maximum of 7).

Pregnant women receive the most information related to oral health and pregnancy from doctors of dental medicine (30.8%). Such answers are in agreement with the results of the research among pregnant women in Poland, where, also, the doctor of dental medicine is the most frequent source of information for oral health for 58% of pregnant women [20], as well as in Croatia where 53.54% of the surveyed pregnant women stated that they get the most information about the connection between oral health and pregnancy from doctors of dental medicine [21].

In our study, 47.7% of pregnant women indicated that the gynecologist advised them to have a dental examination, while in the research conducted in Croatia by Gavic L, only 25.85% of pregnant women indicated the same [21]. The results recorded in the research of Gaszynska E, et al. [20] indicate that a very small percentage of pregnant women (3%) are referred to a dentist by a gynecologist and that most pregnant women come to the doctor for dental medicine on their own initiative. During pregnancy, gingival bleeding was noted by 60.8% of the respondents, and motility occurred in 22.3%, while 52.31% of pregnant women from Croatia noted gingival bleeding and 12.31% had teeth mobility [21]. Very similar results were recorded by Naga and co-workers in their study [22], where 50.1% of pregnant women had gingival bleeding, and 25% had gingiva mobility. In the same study, 44.9% of respondents were aware that the first and third trimesters of pregnancy are not the best period for treating hemorrhoids [22]. However, in our research, 47.7% of pregnant women knew that the second trimester was the safest, which is almost 20% less than the results obtained by Gavic, et al. (68.92%).

A large number of surveyed pregnant women (54.6%) do not know that local anesthesia is safe during pregnancy. By 10%, the percentage of pregnant women who did not know that

local anesthesia is safe during pregnancy was higher than the surveyed pregnant women from Croatia (44.62%) [21].

A large number of surveyed pregnant women (54.6%) do not know that local anesthesia is safe during pregnancy. However, a large percentage (81.5%) showed a good knowledge of the safety of routine cleaning of the back during pregnancy, which is considered safe. Opinions are divided for other dental procedures. In the research conducted among pregnant women in Northern Greece [23], the majority of respondents (72.2%) believe that dental procedures during pregnancy can have a negative impact on the outcome of the pregnancy.

The recommendations of the American Academy of Pediatrics (AAP) are exclusive breastfeeding in the first six months of a child's life and from the first six months to one year of breastfeeding with the gradual introduction of appropriate complementary foods. After the first year of a child's life, the infant can continue to breastfeed as long as the mother wants and the child does not refuse breastfeeding [24]. Children who are breastfed for longer than 12 months have an increased risk for the development of early childhood caries, especially due to nocturnal and frequent breastfeeding [25].

Early childhood caries still is a major public health problem worldwide [26] and also in our country. Ambarkova, et al. conducted an epidemiological survey of 5 years old children from two municipalities in the Eastern region of our country and the mean was 6.01, with a standard deviation (sd) of 3.93 and a 95% confidence interval of 3.42 - 4.44 and prevalence of 84.2% [27]. Similar results for the prevalence of early childhood are found also in our neighboring countries, Albania at 84.1% [28], Bulgaria at 71.6% [29], and Srbija at 79.8% [30], with the exception of Greece where the prevalence is much lower at 25.2% [31].

The majority of pregnant women who are pregnant for the first time believe that they should stop breastfeeding from the 9<sup>th</sup> to the 12<sup>th</sup> month of the child's life, and the largest number of those who already have children believe that breastfeeding should be stopped when the child starts to refuse breastfeeding. Only 21.5% of respondents are aware that breastfeeding can cause caries.

According to the AAPD (American Academy of Pediatric Dentistry) guidelines, the child should start brushing his/her teeth as soon as the first tooth erupts [23]. The American Dental Association (ADA) recommends that the first examination of the child by a doctor of dental medicine be done six months after the eruption of the first tooth, no later than the first birthday [32]. 43.8% of the respondents know that the child should be taken to the dentist for the first examination around the first year of life, but still, 36.2% mistakenly believe that the real-time first examination is when all deciduous teeth erupt. A study conducted in India by Nagaraj A, et al. [33] shows an even worse level of knowledge among pregnant women during their child's first visit to the dentist, in which only 22.3% of pregnant women answered that the child should be taken for the first examination in the period of the first tooth eruption.



## Limitation and recommendation

This study has a certain limitation. Since this was a study with online data collection, it is based on volunteer sampling instead of probability sampling [34]. Furthermore, the study involved only pregnant women who used a computer and sought information on the home page where the survey was linked. Despite that, according to Lefever, et al., the relatively large number of volunteer respondents gives confidence to the data's general reliability [28]. The recommendation for future research is to include pregnant women who do not have access to the Internet. Furthermore, it would be desirable to make a clinical oral examination of pregnant women which would help to compare their subjective oral health condition with the objective one.

Considering the above results from our research, it is important to emphasize the need for good education for pregnant women and all women who plan to become pregnant. Doctors of dental medicine should raise awareness among pregnant women about the importance of oral health during pregnancy and the perinatal period and give them instructions for the proper implementation of oral hygiene. They should also be educated about possible oral changes during pregnancy and about the connection between periodontitis and negative pregnancy outcomes. More attention must be paid to pregnant women and they should be examined by a dentist and act prophylactically. Recommendations to all women who are planning to become pregnant are to arrange an examination and consultation with their dentist for oral health. In view of the results obtained, according to which 47.7% of pregnant women state that the gynecologist refers them to a doctor of dental medicine for an examination, additional communication between the gynecologist and the doctor of dentistry is necessary in order to increase this percentage. In this way, gynecologists would become fully aware of the importance and safety of dental treatment and would be able to explain it to them and recommend that pregnant women visit their dentist regularly. Furthermore, it is necessary to make decisions at the level of the Republic of North Macedonia for certain preventive programs that would not only improve the oral health of pregnant women and all women of reproductive age but would also protect and preserve the oral health of the future child.

## Conclusion

Pregnant women have an average understanding of the relationship between oral health and pregnancy and have average knowledge about preserving the oral health of children at an early age. Preventive programs should be created on the global level and implemented by each country and adapted to their own needs. In this way, not only the oral health of pregnant women would improve but also the oral health of the child would be protected and preserved.

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