Effect of socioeconomic status on dental caries during pregnancy

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ABSTRACT

Background and Objective: It is generally agreed that people with low socioeconomic status have a significantly worse oral and general health compared to people with higher socioeconomic status. The aim of the study was to find out the role of socioeconomic status of pregnant women on their oral health by evaluating the dental caries risk factor, the salivary *Streptococcus mutans* count and DMFT index. **Materials and Methods:** A total of 50 first time pregnant women were randomly sampled and were divided into different socioeconomic strata following the Kuppuswamy socioeconomic status scale. DMFT index and microbiological assessment of dental caries risk factor parameter, the salivary *Streptococcus mutans* colony forming units, were carried out during the three trimesters and postpartum period. The observations were compared with 50 non-pregnant women of same age group. **Results:** Of the randomly sampled subjects, majority of the pregnant women (28/50) of the study group were of middle/lower middle class, 11 pregnant women were of upper middle class, and 11 were of the lower/upper lower class. When followed in their three trimesters and postpartum period, statistically significant increase in the salivary *Streptococcus mutans* colony forming units was noted in 2nd trimester, 3rd trimester and postpartum period (*P* value < 0.05) of all pregnant women. Comparison of the caries risk factor between the pregnant women of three socioeconomic strata, however, revealed that no particular class was at a higher risk for dental caries. **Conclusion:** This study gives an insight into the possible changing trends towards awareness for oral hygiene in various socioeconomic strata of pregnant women.

Keywords: Dental caries, Kuppuswamy socioeconomic status, pregnancy, *Streptococcus mutans*

Introduction

Socioeconomic status is correlated with oral health. It is generally agreed that people with low socioeconomic status have a significantly worse oral and general health compared to people with higher socioeconomic status.[1,2] Pregnancy may have an important effect on oral health, and pregnant women are a population group with special needs in terms of oral health status. International research studies show that oral health care for pregnant women has been inadequate, especially in relation to the areas of education and health promotion with some evidence of disparities by socioeconomic status and ethnicity.[2,3]

Salivary analysis has become an important resource for the evaluation of salivary conditions with physiologic and pathologic implications and is a useful tool for disease diagnosis, mainly due to its origin, composition, functions, and interactions with other organ systems. With the addition of modern techniques and chemical instrumentation equipment, there has recently been an observable increase in the use saliva for laboratory investigations. The value of saliva as a diagnostic tool for oral and systemic diseases has been an area of study for many researchers with the aim of increasing its use as a possible complementary exam.[4]

The primary initiator of dental caries is *Streptococcus mutans* and several studies have demonstrated association of *Streptococcus mutans* and caries in humans. The presence of *Streptococcus mutans* can

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greatly increase the risk of caries if the host's defense mechanisms do not override the bacteria.[5] In order to evaluate the risk of dental caries, microbiological tests that determine the density of *Streptococcus mutans* have a prognostic value and represent a useful diagnostic method in correlation with clinical examination.[6]

The present study was conducted to evaluate the salivary *Streptococcus mutans* count, as a prognostic indicator for dental caries, in various socioeconomic classes during the pregnancy and postpartum period.

Materials and Methods

Total 50 first-time pregnant women in their first trimester were randomly selected from the outpatient department of Gynaecology of Krishna Institute of Medical Sciences, Karad. Fifty non-pregnant women of same age group were considered as the control group. The present research was approved by the ethical committee of Krishna Institute of Medical Science Deemed University, Karad.

Inclusion criteria

Total 50 first-time pregnant women of:
1. First trimester (later followed in 2nd trimester, 3rd trimester, and postpartum period)
2. First-time pregnant
3. Age group of 18–28 years

Exclusion criteria

1. Patients using any form of medication modifying saliva.
2. DMFT score greater than 15.
3. Clinical signs of xerostomia.
4. History of any systemic diseases

Pregnant women showing direct/indirect factors affecting the DMFT scores were excluded from the study.

The pregnant women were evaluated in the following schedule,

1. 6th week of pregnancy (1st trimester)
2. 18th week of pregnancy (2nd trimester)
3. 30th week of pregnancy (3rd trimester)
4. 6th week after delivery (Postpartum period)

The control group was evaluated during the 5th month from the start of the study.

Questionnaire for scoring of Kuppuswamy socioeconomic status

A pretested questionnaire and proforma designed in Marathi language for ease of understanding and response was used for collecting all the required and relevant information. The questionnaire included questions regarding name, age, oral hygiene practices and gravid status.

The modified Kuppuswamy Socioeconomic Status Scale (2014) was used in the current study. Usually education and occupation of head of the family are not changeable with time. The Consumer price index (CPI) value was calculated taking 2001 as the base year. Detailed information of education, occupation and family monthly income was recorded for scoring of Kuppuswamy Socioeconomic Status Scale.

Clinical examination for scoring of DMFT index

During the three trimesters, we evaluated the caries risk in pregnant women. All the clinical procedures were carried out in the middle of morning (around 9 to 11 am), in a comfortable room free of noise and distraction. The dental examinations were conducted under standardized conditions using a dental mirror and dental probe.

DMFT (Decayed, Missing and Filled teeth) indices were scored in accordance with World Health Organization (WHO) criteria.[7] All tooth surfaces were visually examined. The dental probe was used only to remove debris and food particles in order to improve visibility. Caries was recorded as present when a lesion in a pit or fissure or on a smooth tooth surface had an unmistakable cavity, undermined enamel or a detectably softened floor or wall.[8]

Microbiological assay of salivary Streptococcus mutans count

Two hours prior to the saliva collection, all subjects were instructed not to eat anything after a standard breakfast. The subjects were seated comfortably on the chair. The collection of unstimulated whole saliva was performed under resting conditions. Unstimulated whole saliva samples were collected for 10 minutes from each subject at the same time of day (between 09.00 a.m. and 11.00 a.m.). Following standard procedures, subjects were asked to wash their mouth and sit passively for 10 minutes as the saliva accumulated in the floor of the mouth and expectorate in a relaxed position with their heads bent forward, allowing the saliva to drain through the open lips into a sterile graduated collection cup.

Collected samples were maintained in ice after collection and transported to the Microbiology department, not exceeding half hour period since beginning of sample collection.

Culturing of Streptococcus mutans

Mitis Salivarius Agar (MSA) was one of the first media to be developed as a selective medium for culturing Streptococci species in general. Addition of 0.2 U/mL of bacitracin and 10% sucrose has led to an improved medium (MSB) with high selection of *Streptococcus mutans*.[9]

Aliquots of 0.5 mL of saliva were diluted in a 10-fold solution of sterile Phosphate buffered saline (0.05M; pH 7.3) and 20 microliter (μL) was then plated on Mitis-Salivarius agar supplemented with bacitracin (0.2 U/mL) and 10% sucrose. The plates were incubated in a 5% carbon dioxide environment at 37°C for 48 hours.

Identification of colonies

Following incubation, colonies were identified by morphological characteristics of the bacteria. *Streptococcus mutans* can be distinguished from other species by raised, convex, undulate, opaque, pale blue colonies, granular "frosted glass" appearance.[9]

The identification of *Streptococcus mutans* was confirmed by gram staining and biochemical tests like catalase, mannitol, and sorbitol fermentation of randomly selected samples.

Counting of colonies

Colony counting for *Streptococcus mutans* was done under a colony counter and the number of "colony forming units" were multiplied by the number of times the original "mL" of sample was diluted and expressed as the number of Colony Forming Units per milliliter (CFU/mL).

Scoring of colonies

The colonies were scored by following Berkowitz *et al*. criteria.[10]
- 0 = no growth
- 1 = 1-10^3
- 2 = 10^3-10^5
- 3= >10^5 colony forming units (CFU) per ml of saliva.

Results

Total 50 pregnant and non-pregnant women completed the study. The mean age of the pregnant women in the study was 23.92 years and for non-pregnant women in the control group was 22.16 years.

Socioeconomic status in pregnant women

Using Kuppuswamy Socioeconomic Status Scale, the pregnant women were divided into upper middle, middle/lower and lower/upper lower socioeconomic classes [Table 1].

DMFT and socioeconomic status in pregnant and non-pregnant women

The scoring of DMFT index was carried out in the three trimesters of pregnancy and in postpartum period which was then compared with the DMFT scores of the control group. By using Wilcoxon sign rank test, statistically significant difference was noted in the mean DMFT of 50 pregnant women in 3rd trimester and postpartum period when compared to the control group (P value < 0.05) [Table 2].

DMFT score was compared between pregnant women of three socioeconomic statuses and P value was deducted. By using Kruscal wallis test, P value was > 0.05, therefore there was no significant difference in DMFT scores with respect to socioeconomic class at 1st trimester to post-partum period [Table 3].

Table 1: Socioeconomic status in pregnant women

Socioeconomic Class	Number of patients	Percentage (%)
Upper Middle	11	22.00
Middle/Lower Middle	28	56.00
Lower/Upper Lower	11	22.00
Total	50	100.00

Table 2: DMFT in pregnant and non-pregnant women

Period	DMFT score							Median	Total
	0	1	2	3	4	5	6		
1st trimester	6	4	17	11	7	3	2	2	50
2nd trimester	6	4	17	11	7	3	2	2	50
3rd trimester	6	4	14	13	8	3	2	3*	50
Post partum	6	4	14	13	8	3	2	3*	50
Control	2	5	21	15	4	1	2	2	50

* Statistically significant with P value 0.046 (<0.05)

Colony Forming Units (CFU/mL) of Streptococcus mutans and socioeconomic status in pregnant and non-pregnant women

The mean colony forming units (CFU/mL) showed a significant increase during the 2nd, 3rd trimester and postpartum period of pregnancy when compared to the control group (P < 0.01). The colony forming units (CFU/mL) in 1st trimester however did not showed any significant difference compared to the control group [Table 4].

By using ANOVA test, no statistically significant difference was found in mean CFU/mL with respect to socioeconomic status from 1st trimester to post partum (P-value > 0.05) [Table 5].

Discussion

Most of the pregnant women in this study were of middle/lower middle socioeconomic status while others belonged to upper middle or lower/upper lower socioeconomic status. Regarding the educational status, 58% of the pregnant women had completed their high school, 20% had completed their middle school, 8% had completed their graduation while 6% had done diploma course. We did not find any illiterate pregnant woman, which could reflect the growing educational awareness among the rural population. Most pregnant women (46%) were unemployed housewives, 32% were engaged in some unskilled work and the rest (22%) were employed.

The family members of the study group ranged from 3 to 7 with 50% having 5 members. The earners of family were predominantly males with females contributing minimally in the family income. Half of the families of pregnant women had family monthly income ranging from 18,000 to 36,000 rupees. Totally, 22% of pregnant family income ranged from 13,000 to 18,000 rupees, 14% had family income in range of 9000 to 12,000 rupees and 12% had family income in range of 4800 to 8001 rupees.

Table 3: Median DMFT of pregnant women and in postpartum period, in three socioeconomic status

Period	Socioeconomic status	DMFT							Total	P
		0	1	2	3	4	5	6		
1st trimester	Upper Middle	1	1	5	0	2	1	1	11	0.698¶
	Middle/Lower Middle	2	1	8	11	5	0	1	28	
	Lower/Upper Lower	3	2	4	0	0	2	0	11	
2nd trimester	Upper Middle	1	1	5	0	2	1	1	11	0.698¶
	Middle/Lower Middle	2	1	8	11	5	0	1	28	
	Lower/Upper Lower	3	2	4	0	0	2	0	11	
3rd trimester	Upper Middle	1	1	4	1	2	1	1	11	0.772¶
	Middle/Lower Middle	2	1	6	12	6	0	1	28	
	Lower/Upper Lower	3	2	4	0	0	2	0	11	
Post-partum	Upper Middle	1	1	4	1	2	1	1	11	0.772¶
	Middle/Lower Middle	2	1	6	12	6	0	1	28	
	Lower/Upper Lower	3	2	4	0	0	2	0	11	

¶$P>0.05$, Statistically not significant

Table 4: Streptococcus mutans Colony Forming Units (CFU/mL) in pregnant and non-pregnant women

CFU at	Number of cases	Streptococcus mutans CFU/mL ($\times10^5$/ml)					P
		Min	Max	Mean	SD	Median	
1st trimester	50	1.37	5.30	3.21	0.82	2.84	
2nd trimester	50	1.30	5.75	3.71	1.03	3.77	<0.001*
3rd trimester	50	2.37	5.79	4.61	0.88	4.75	<0.001*
Post-partum	50	1.70	5.82	4.50	1.09	4.74	<0.001*
Control	50	1.26	4.79	3.33	0.81	3.45	0.879

*Significant, $P<0.05$

Table 5: Socioeconomic status: *P* in pregnancy and postpartum period with respect to CFU/mL

Socioeconomic status	n	Mean	SD	Minimum	Maximum	P
1st trimester						
Upper Middle	11	3.36	0.92	2	5	0.962¶
Middle/Lower Middle	28	3.36	0.83	2	5	
Lower/Upper Lower	11	3.27	1.10	1	5	
2nd trimester						
Upper Middle	11	3.82	1.08	2	5	0.838¶
Middle/Lower Middle	28	3.75	1.17	1	6	
Lower/Upper Lower	11	3.55	1.13	2	5	
3rd trimester						
Upper Middle	11	4.55	1.21	2	6	0.524¶
Middle/Lower Middle	28	4.82	0.90	3	6	
Lower/Upper Lower	11	4.27	1.19	3	6	
Postpartum						
Upper Middle	11	4.91	1.14	3	6	0.755¶
Middle/Lower Middle	28	4.61	1.17	2	6	
Lower/Upper Lower	11	4.64	1.12	3	6	

¶$P>0.05$, statistically not significant

Pregnancy has several negative effects on the oral cavity environment which includes immune suppression, cravings, hormonal fluctuations, salivary alterations, and other physiological changes that would be expected to adversely affect hosts resistance to caries.[5] *Streptococcus mutans* could be isolated from saliva of all pregnant women in our study group and had higher than 10^5 CFU/mL indicating the increased risk for development of dental caries.[7] Other studies have found high levels of *Streptococcus mutans* in saliva of pregnant study group.[8,10,11]

A fairly strong evidence for an inverse relationship between socioeconomic status and the prevalence of caries has been established in adults[12-14] as well as in pregnant women.[15-22]

Patients who are pregnant for the first time are considered to be a critical group of at-risk women who may be affected by low health literacy and therefore have poor health knowledge.[23] As socioeconomic status is correlated with oral health, it is generally agreed that people with low socioeconomic status have a significantly worse oral and general health compared to people with higher socio-economic status because of their poor oral hygiene practice, lack of awareness, improper food intake, and family status.[1,16] Contrary to this general agreement, in our study we found that there was no significant increase in DMFT index in lower/upper lower socioeconomic status pregnant women. Also, the pregnant women of all the socioeconomic status showed significant increase in salivary *Streptococcus mutans* count in 2nd trimester, 3rd trimester and postpartum period. There was no particular socioeconomic strata which had higher risk for dental caries. The mean CFU/mL of *Streptococcus mutans* with respect to socioeconomic status had no statistically significant difference between the three socioeconomic classes. The probable explanation to this can be that most of the pregnant women of all socioeconomic status had good educational background; many had completed their high school and had basic knowledge about the maintenance of oral hygiene. It has been noted that poor knowledge amongst pregnant women was independent of the socioeconomic class.[24] Most of the patients had habit of brushing their teeth with help of toothbrush and toothpaste with preference for vegetarian diet, reflecting a changing trend towards practicing good oral hygiene in lower socioeconomic strata of the pregnant women.

Conclusion

From findings of our study it can be deduced that the pregnant women are at higher risk for development of dental caries compared to non-pregnant women. However, contrary to the conventional norm that socioeconomic status influences the oral hygiene practice; our study did not find such correlation. Increase in caries risk factor was noted in all socioeconomic status with no particular class at increased risk. These finding may give us insight into the increasing awareness of oral hygiene practices amongst pregnant women of all socioeconomic strata.

This study emphasizes the need for early establishment of a dental care system for the pregnant women. Implementation of preventive oral health practices provides time critical opportunities to reduce the risk of preventable oral/dental conditions for mother and their children.

Conflicts of interest

There are no conflicts of interest.

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