
Caries Risk Among 15-40 Years Old Patients Visiting Private Dental Institution - A Retrospective Study

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Abstract: Various models for predicting caries risk have been developed with good results. One such recently developed model is Cariogram. Cariogram systematize the evaluation of various risk factors for caries and recommend targeted preventive intervention based on caries risk. The aim of this study was to evaluate the caries risk among 15-40 years adults in Chennai. A retrospective study was conducted using records of patients visiting private dental college during the month of Feb 2020 to March 2020. A total of 112 case records were retrieved and analysed. Descriptive statistics in terms of frequency distribution was done to present the result. Mean chance to avoid caries was high in 36-40 years (57.8±27.1). Mean bacterial count was high for in the age group 31-35 years (14.6±7.153). Mean susceptibility was high among 21-25 years (23.6±18.8). Mean diet sector was high among 31-35 years (11.6±5.66). The association of age and chances to avoid new caries was p=0.119, circumstances was p=0.386; bacterial sector was p=0.919; susceptibility was p value=0.358 and diet was p=0.513 which was found to be statistically not significant. Males and females of age group 31-35 years have high risk for caries. Young adults have higher risk for caries with no association between age and all five components of cariogram.

Keywords: adults; caries risk assessment; cariogram; diet; risk.

INTRODUCTION:

Caries risk assessment could be a critical part of a patient-centred caries management. The procedure assists clinicians in selecting the acceptable management supporting a person's caries risk level and to make a decision on the acceptable recall interval. [(Bratthall and Petersson, 2005; Fontana and Zero, 2006; Tellez *et al.*, 2013)]. Caries risk assessment with identification of leading risk factors provides the idea for the possibility of developing effective preventive programs which will be implemented at different levels. [(Fontana and Zero, 2006; Tellez *et al.*, 2013)].

The multifactorial etiology of caries points to the need of developing new caries risk assessment models that might include the various factors or parameters which influence formation of new carious lesions. Two different approaches were described for caries risk assessment models: the danger model that describes risk factors but doesn't predict caries outcome and prediction model that estimates the danger of caries progression in future [(Beck, 1998)].

Bratthall in 1996 presented a cariogram for illustrating the interactions of caries related factors. The model makes it possible to rule out individual risk or resistance factors. Its speciality is that it has an interactive version for the estimation of caries risk. The first Cariogram consisted of three sectors which were divided depicting a circle, each representing factors strongly influencing carious activity: diet, bacteria, and susceptibility. The event of the model supported the necessity to elucidate why, in certain individuals, caries activity might be low in spite of other influencing factors like high sucrose intake, poor oral hygiene, high Streptococci load, or non use of fluorides. Based on the Cariogram concept, an interactive version for caries risk estimation was developed by Bratthall *et al.*, in 1997 [(Bratthall and Petersson, 2005; Naik *et al.*, 2018)].

There are a couple of fundamental differences between this program and the original version. First, the danger for future caries activity varies on a scale from 0-100%, but it can't be quite 100%. Thus, the sectors cannot overlap one another. Second, an extra sector circumstances was included. This sector includes factors like caries experience and systemic diseases factors to think about when the danger is calculated, in spite of the very

fact that these factors themselves don't participate directly within the development of the lesion. Since only a few studies are conducted on Cariogram and just one Indian study has been published [(Utreja *et al.*, 2010)]. Previously our Institutional team had conducted numerous awareness studies [(Prabakar, John and Srisakthi, 2016; Kannan *et al.*, 2017; Kumar and Preethi, 2017; Kumar and Vijayalakshmi, 2017; Harini and Leelavathi, 2019; Neralla, Jayabalan and George, 2019; Pavithra and Jayashri, 2019)], clinical trials [(Prabakar, Sankriti and Murthy, 2011; Prabakar, John, Arumugham, Kumar and Sakthi, 2018; Khatri *et al.*, 2019; Pratha, Ashwatha Pratha and Prabakar, 2019; Mebin George Mathew *et al.*, 2020; Samuel, Acharya and Rao, 2020)] and in-vitro studies [(Prabakar, John, Arumugham, Kumar and Srisakthi, 2018; Mohapatra *et al.*, 2019)] over the past 10 years. Now we are focussing on epidemiological surveys. The thought for this study stemmed from the present interest in our community. The aim of this current study was to assess the caries risk profiles among 20 -40 years old adults of Chennai city using the Cariogram program. Our team has rich experience in research and we have collaborated with numerous authors over various topics in the past decade (Deogade, Gupta and Ariga, 2018; Ezhilarasan, 2018; Ezhilarasan, Sokal and Najimi, 2018; Jeevanandan and Govindaraju, 2018; J *et al.*, 2018; Menon *et al.*, 2018; Prabakar, John, Arumugham, Kumar and Srisakthi, 2018; Rajeshkumar *et al.*, 2018, 2019; Vishnu Prasad *et al.*, 2018; Wahab *et al.*, 2018; Dua *et al.*, 2019; Duraisamy *et al.*, 2019; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Gheena and Ezhilarasan, 2019; Malli Sureshbabu *et al.*, 2019; Mehta *et al.*, 2019; Panchal, Jeevanandan and Subramanian, 2019; Rajendran *et al.*, 2019; Ramakrishnan, Dhanalakshmi and Subramanian, 2019; Sharma *et al.*, 2019; Varghese, Ramesh and Veeraiyan, 2019; Gomathi *et al.*, 2020; Samuel, Acharya and Rao, 2020)

MATERIALS AND METHOD:

Study design and study setting:

This retrospective study was conducted using 86000 case records of authors University hospital from a period of Feb 2020 to March 2020. The study was initiated after approval from the Institutional Ethical committee. Ethical approval number was SDC/SIHEC/2020/DIASDATA/0619-0320.

Sampling :

About 112 consecutive case records with signed informed consent containing information of caries risk assessment was retrieved. The records of patients with age group 15 - 40 years had been sorted. An effort was made to confirm that all sorted case records were subjected to selection criteria that all patients had more than 13 teeth present in their oral cavity.

Data collection:

The case records of the patients from Feb 2020 to March 2020 were examined by a single calibrated examiner. Relevant factors such as age and the cariogram assessment which were recorded in the digital case records were retrieved. The caries risk in all case records was assessed using the Cariogram tool with five sectors [(Bratthall and Petersson, 2005)]. The cariogram, a pie diagram divided into five sectors of following colors.

1. **Green:** Shows an estimation of actual chance to avoid new cavities / caries. Chance of avoiding caries and risk of caries are expressions of the same process but illustrated inversely i.e. when the chance of avoiding caries are high, caries risk are smaller.
 2. **Dark Blue:** Shows "Diet" which is based on a combination of diet contents and frequency. Diet content measure the colony forming units of Lactobacillus
 3. **Red:** This sector shows bacteria and based on a combination of plaque and mutans streptococci.
 4. **Light Blue:** This sector denotes susceptibility based on a combination of fluoride programs, saliva secretion and saliva buffering capacity.
 5. **Yellow:** Shows circumstances and is based on a combination of past caries experience and related diseases.
- The bigger the green sector, low the risk for caries. Small green sector means a high risk of caries. The bigger the other sectors, the bad will be the oral health of an individual.

Statistical analysis:

Data on the percentage of each five sectors was collected and entered in Microsoft Excel 2010 and subjected to statistical analysis using IBM SPSS version 20.0. Descriptive statistics was done to find the prevalence of caries among different age groups and chi-square association was performed to find association of age and all five sectors of cariogram.

RESULTS:

In our study, among 112 patients, The mean distribution of chances to avoid caries among 15-20 years was 51.20 ± 35.815 while for 21-25 years was 46.48 ± 24.925 , 26-30 years was 56.58 ± 25.279 , 31-35 years was 47.69 ± 23.902 , 36-40 years was 57.89 ± 27.179 . There was no statistical significant association elucidated between age groups and the green sector. The mean distribution of circumstances among 15-20 years was 5 ± 5.244 , 21-25 years was 6.70 ± 3.695 , 26-30 years was 6.32 ± 5.782 , 31-35 years was 7.38 ± 7.702 , 36-40 years was 6.32 ± 5.722 . No significant association found between age groups and circumstances (yellow) sector of

cariogram. The mean distribution of bacteria among 15-20 years was 12.20 ± 8.786 , 21-25 years was 13.94 ± 7.146 , 26-30 years was 12.23 ± 7.504 , 31-35 years was 14.69 ± 7.153 , 36-40 years was 12.61 ± 8.452 . No statistically significant association between age groups and bacteria. The mean distribution of susceptibility among 15-20 years was 23.20 ± 23.015 , 21-25 years was 23.61 ± 18.801 , 26-30 years was 15.13 ± 11.715 , 31-35 years was 19.19 ± 13.303 , 36-40 years was 13.89 ± 10.361 . No statistical significant association between age groups and susceptibility. The mean distribution of diet among 15-20 years was 8.60 ± 4.827 , 21-25 years was 9.45 ± 6.295 , 26-30 years was 9.74 ± 6.271 , 31-35 years was 11.69 ± 5.665 , 36-40 years was 9.96 ± 8.235 . No significant association between diet sector and age groups. [Table 1]

In the present study, the distribution of chance to avoid new caries [Green sector] among different age groups. No significant association was found between the chance to avoid new caries and the age groups (Chi square analysis, $p=0.761$; $p>0.05$ statistically not significant). However the chance to avoid new caries was high among 36-40 years [Figure 1]. In the present study, the distribution of circumstances [Yellow sector] among different age groups was assessed. No significant association was found between the circumstances sector and the age groups (Chi square analysis, $p=0.704$; $p>0.05$ statistically not significant). However, patients of 31-35 years had high risk for caries based on the circumstances sector [Figure 2]

In the present study, the distribution of bacterial count [Red sector] among different age groups was assessed. No significant association was found between the bacterial sector and the age groups (Chi square analysis, $p=0.308$; $p>0.05$ statistically not significant). However, the 31-35 years age group had high risk for caries based on the bacterial sector [Figure 3]. In the present study, the distribution of susceptibility [Light blue sector] among different age groups was assessed. No significant association between the susceptibility sector among the age groups (Chi square analysis, $p=0.492$; $p>0.05$ statistically not significant). However high risk for caries based on susceptibility sector was found among 21-25 years [Figure 4]. In the present study, the distribution of diet [Dark blue sector] among different age groups was assessed. No significant association between the diet sector and the age groups (Chi square analysis, $p=0.622$; $p>0.05$ statistically not significant). However, high risk for caries based on the diet sector was found among 31-35 years [Figure 5].

On analysing the distribution of chance to avoid new caries [Green sector] among gender. No significant association between gender and chance to avoid new caries was found (Chi square analysis, $p=0.119$; $p>0.05$ statistically not significant). However the chance to avoid new caries (51-75%) was high among males (25.66%) [Figure 6]. On analysing the distribution of circumstances [Yellow sector] among gender. No significant association of gender and circumstances sector was found (Chi square analysis, $p=386$; $p>0.05$ statistically not significant). However, females (2.65%) had high risk for caries based on the circumstances [Figure 7].

On analysing the distribution of bacterial count [Red sector] among gender. No significant association between gender and the bacterial sector was found (Chi square analysis, $p=0.919$; $p>0.05$ statistically not significant). However, males (10.6%) had high risk for caries based on the bacterial sector [Figure 8]. On analysing the distribution of susceptibility [Light blue sector] among gender. No significant association between gender and the susceptibility sector was found (Chi square analysis, $p=0.358$; $p>0.05$ statistically not significant). However high risk for caries based on susceptibility sector was found among females (1.77%) [Figure 9]. On analysing the distribution of diet [Dark blue sector] among gender. No significant association between gender and the diet sector was found (Chi square analysis, $p=0.513$; $p>0.05$ statistically not significant). However, high risk for caries based on the diet sector was found among females (0.9%) [Figure 10].

DISCUSSION:

In our study, high caries risk was found among 31-35 years and low caries risk was found in 36-40 years age group. As age increases the risk for caries decreases. The high risk groups should be counselled for improving oral health which would improve their quality of life by preventing tooth loss due to dental caries. An epidemiological study conducted stated that 40% of participants were categorised as having low risk for caries and a number of those in the medium and high risk were almost equal [(Taqi, Razak and Ab-Murat, 2017)]. This study in consistency with our present study where prevalence of low risk for caries was 31.25% among the patients. Another study revealed that there was slight difference in caries risk among government and private schoolchildren, where government school children showed 48% risk for caries development, with 52% chance of avoiding caries in future, and private school children showed 51% risk for caries development, with 49% chance of avoiding caries in future, according to Cariogram [(Naik *et al.*, 2018)]. The Cariogram program generates an individualized interpretation and proposed measures which includes therapeutic strategies for prevention and risk reduction.

In our study, males and females had a higher prevalence of caries risk. Previous studies have shown a male predilection of higher caries risk [(Celik, Gokay and Ates, 2012; Sen *et al.*, 2018)]. Our findings are in contrast with the present study. The variation in the study could be due to geographic location, diet patterns and lifestyle. Salivary is the most important factor, when assessing the caries activity. Hyper salivation is common in patients with any disorders like disabled patients. Xerostomia is associated with patients who are under any disease or

under drugs. For high risk cases, it is important to follow up on actions taken and the caries risk evaluation should be repeated after 6 months. Also further research on different age groups and categories such as systemically compromised or disabled children would benefit improved health by using this model.

The present study lagged in assessing the caries risk among vulnerable age groups such as children (below 10 years) and elderly (above 60 years). As diet (dark blue sector) rich in free sugars influences the caries risk in children and systemic disease (yellow sector) with medication that produces xerostomia influences caries risk. Further prospective cohort studies are needed to find the caries risk among different age groups which will help in targeting the preventive programs. Our institution is passionate about high quality evidence based research and has excelled in various fields ((Pc, Marimuthu and Devadoss, 2018; Ramesh *et al.*, 2018; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Ramadurai *et al.*, 2019; Sridharan *et al.*, 2019; Vijayashree Priyadharsini, 2019; M. G. Mathew *et al.*, 2020)

CONCLUSION:

The study concludes that cariogram is a useful model to determine the caries risk assessment and to develop preventive measures among 15-40 years old adults. Males and females of age group 31-35 years have high risk for caries. As age increases the risk for caries decreases. It can be concluded that more than the agent and host factor, the environmental factors such as frequency and time of consumption of a cariogenic diet plays a vital role for caries risk. The high risk groups should be counselled for a diet to improve oral health which will improve their quality of life indeed by preventing tooth loss due to dental caries.

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CONFLICT OF INTEREST:

The authors declare that there is no conflict of interest

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Table 1

| Variables | Mean ± SD | | | | | p value |
|-----------|-------------|-------------|-------------|-------------|-------------|---------|
| | 15-20 years | 21-25 years | 26-30 years | 31-35 years | 36-40 years | |
| | | | | | | |

| | | | | | | |
|----------------------------|------------|------------|------------|------------|-----------|-------|
| Chance to avoid new caries | 51.2 ±35.8 | 46.4 ±24.9 | 56.5±25.27 | 47.6±23.9 | 57.8±27.1 | 0.366 |
| Circumstances (DMFT) | 5 ± 5.244 | 6.7 ±3.69 | 6.32±5.782 | 7.38±7.702 | 6.32±5.72 | 0.666 |
| Bacterial count | 12.2±8.78 | 13.9 ±7.14 | 12.2 ±7.50 | 14.6±7.153 | 12.6±8.45 | 0.271 |
| Susceptibility | 23.2±2.01 | 23.6 ±18.8 | 15.1±11.7 | 19.1±13.3 | 13.9±10.3 | 0.379 |
| Diet sector | 8.6 ±4.82 | 9.45±6.29 | 9.74±6.27 | 11.6±5.66 | 9.96±8.23 | 0.349 |

Table 1: The mean distribution and comparison of the cariogram sectors among different age groups. Mean chance to avoid new caries was high in the age group 36-40 years. Mean DMFT score was high in the age group 31-35 years. Mean bacterial count was high in the age group 31-35 years, mean susceptibility sector was high among 21-25 years, mean diet sector was high among 31-35 years. One- Way ANOVA analysis showed no significant difference in the mean new chance to avoid, circumstances, bacterial count, susceptibility and diet sector of cariogram among the age groups ($p>0.05$).

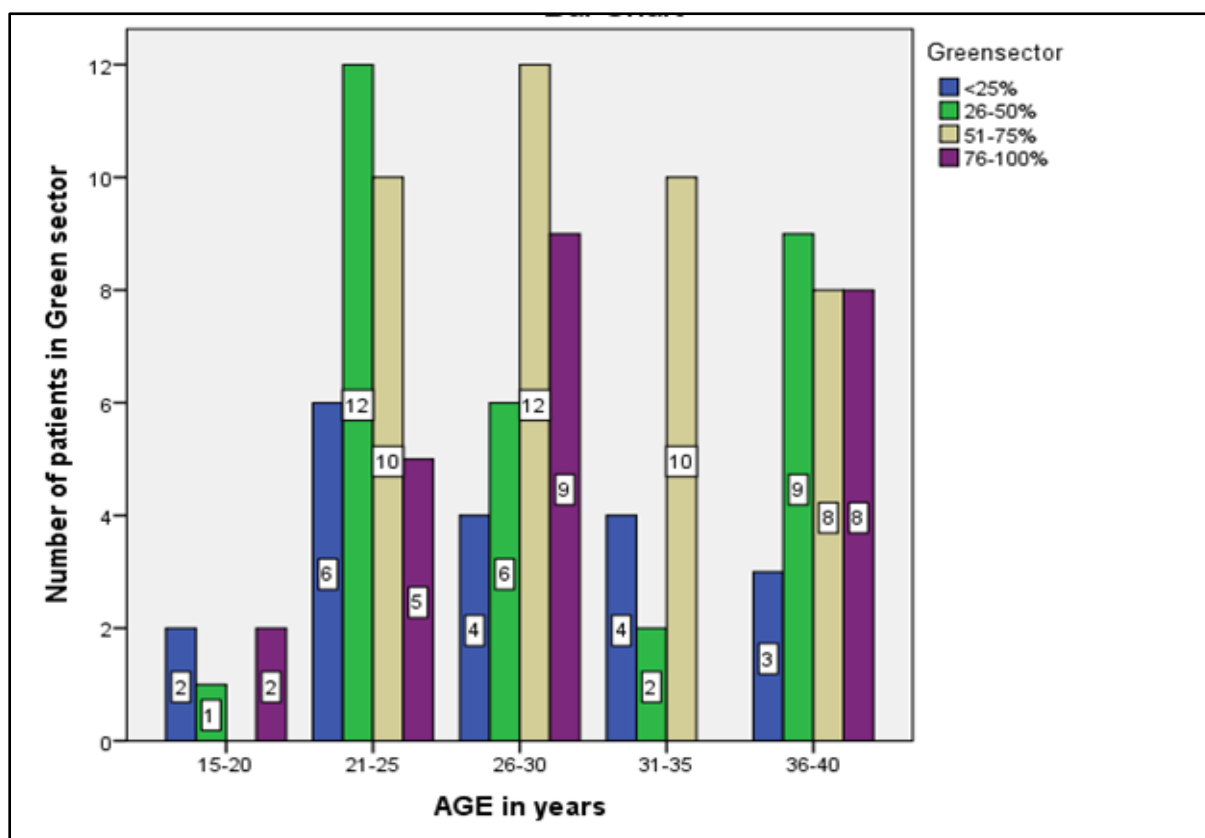


Fig.1: Bar chart shows the distribution of chance to avoid new caries [Green sector] among different age groups. X axis - age groups in years ; Y axis - number of patients in the green sector. No significant association between age and chance to avoid new caries was found (Chi square analysis, $p=0.761$; $p>0.05$ statistically not significant). However the chance to avoid new caries was high among 26-30 years (violet).

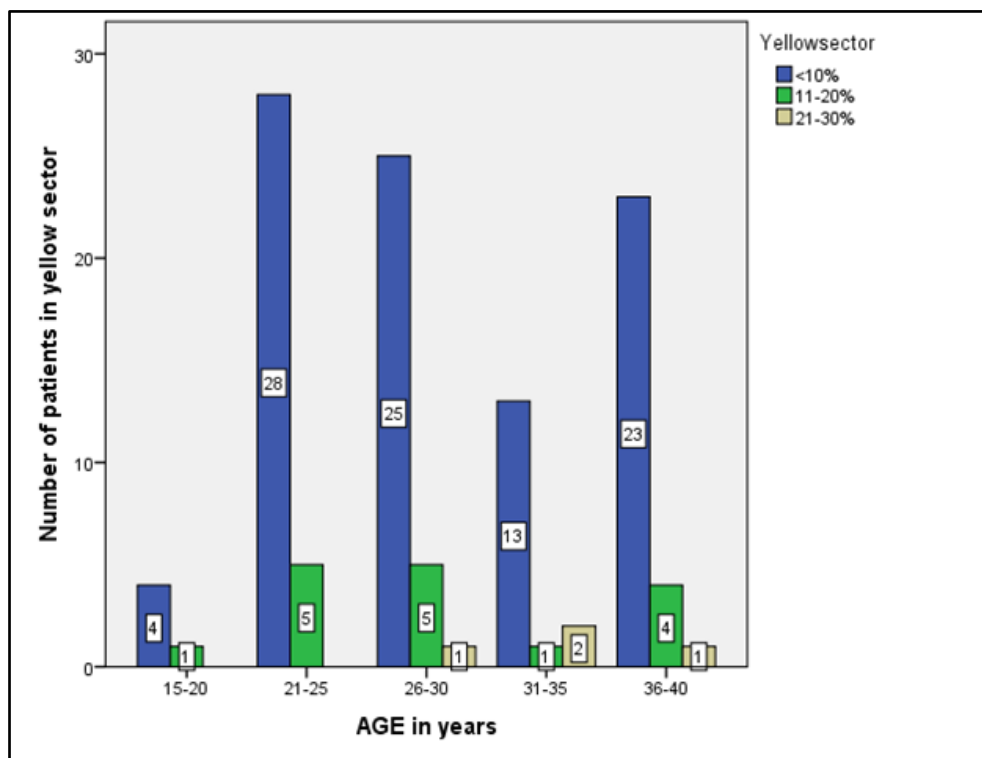


Fig.2: Bar chart shows the distribution of circumstances [Yellow sector] among different age groups. X axis - age groups in years; Y axis - number of patients in the yellow sector. No significant association of age and circumstances sector was found (Chi square analysis, $p=0.704$; $p>0.05$ statistically not significant). However, patients of 31-35 years had high circumstances risk for caries (grey 21-30%).

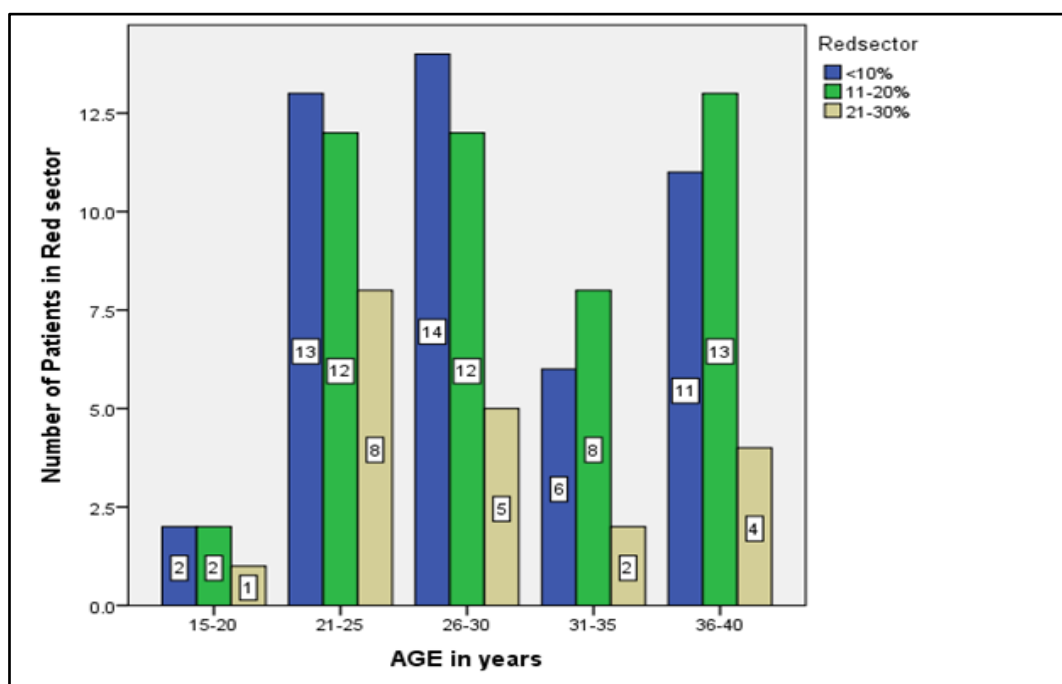


Fig.3: Bar chart shows the distribution of bacterial count [Red sector] among different age groups. X axis - age groups in years; Y axis - number of patients in the bacterial sector. No significant association between age and the bacterial sector was found (Chi square analysis, $p=0.308$; $p>0.05$ statistically not significant). However, the 21-25 years age group had bacterial risk for caries (grey, 21-30%).

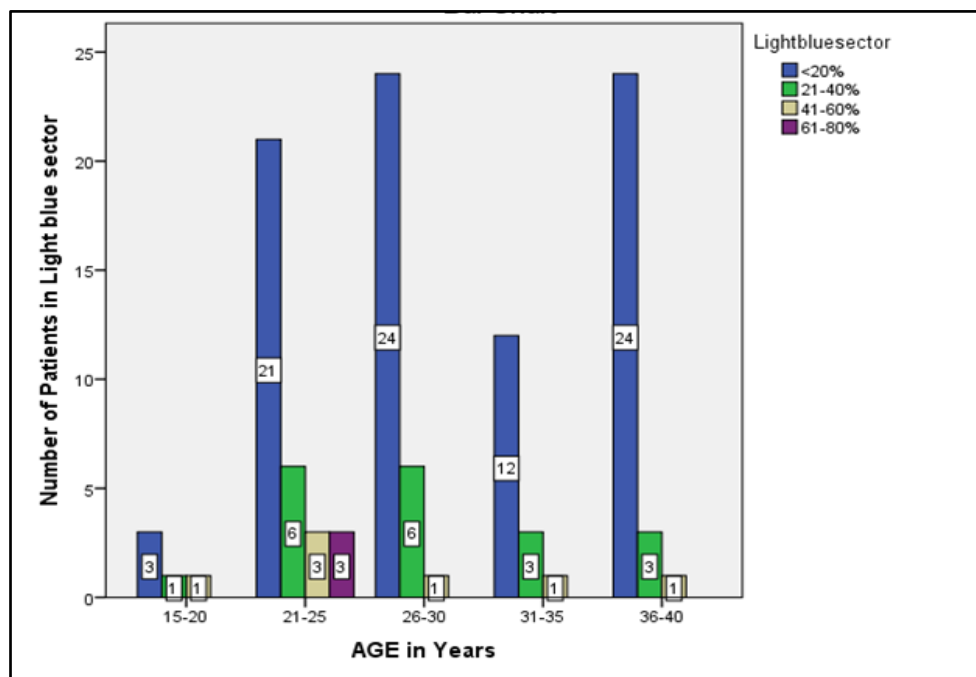


Fig.4: Bar chart shows the distribution of susceptibility [Light blue sector] among different age groups. X axis - age groups in years; Y axis - number of patients in susceptibility sector. No significant association between age and the susceptibility sector was found (Chi square analysis , $p=0.492$; $p>0.05$ statistically not significant). However risk for caries based on the susceptibility sector was found to be high among 21-25 years (violet 61-80%).

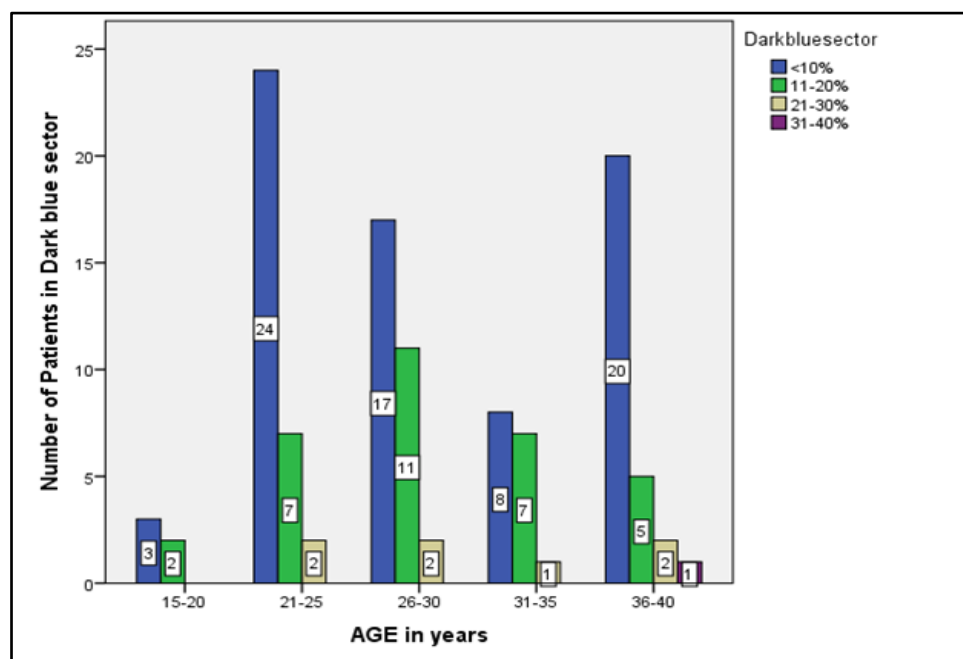


Fig.5 : Bar chart shows the mean distribution of diet [Dark blue sector] among different age groups. X axis - age groups in years; Y axis - number of patients in the bacterial sector. No significant association between age and the diet sector was found (Chi square analysis , $p=0.622$; $p>0.05$ statistically not significant). However, high dark blue sector risk for caries based on the diet frequency and content was found to be high among 36-40 years (violet 31-40%).

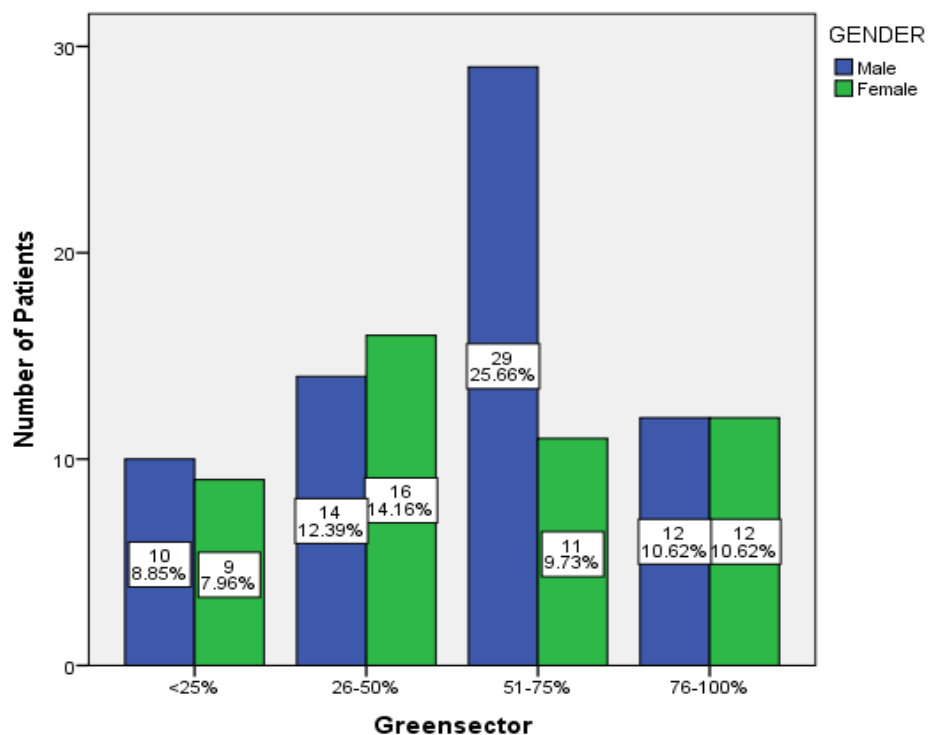


Fig.6: Bar chart shows the distribution of chance to avoid new caries [Green sector] among gender. X axis - percentages of green sector; Y axis - number of male and female patients. No significant association between gender and chance to avoid new caries was found (Chi square analysis , $p=0.119$; $p>0.05$ statistically not significant). However, males (25.66%) (blue) had a higher chance to avoid new caries 51-75%. Males had a high chance to avoid new caries compared to females.

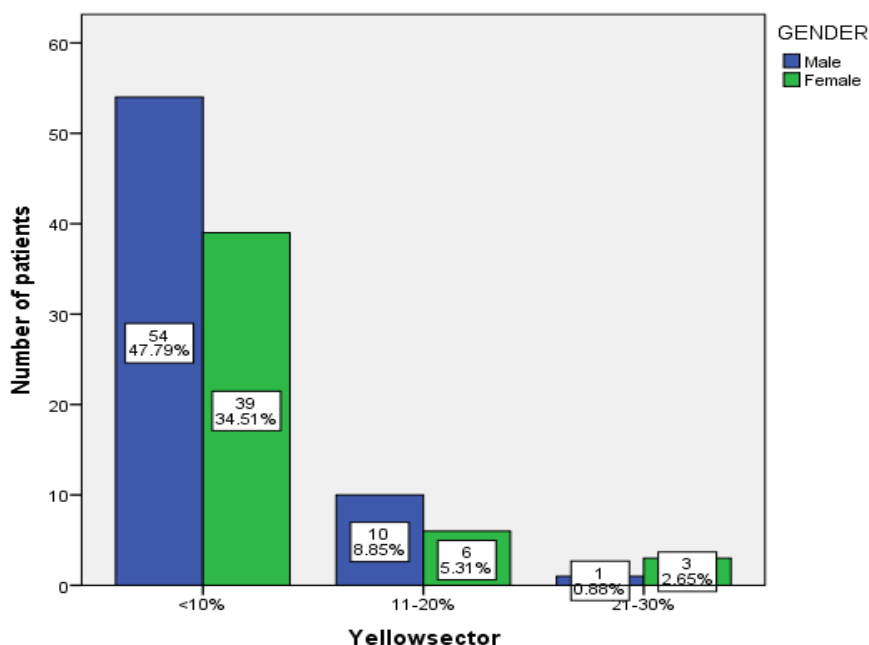


Fig.7: Bar chart shows the distribution of circumstances [Yellow sector] among gender. X axis - percentages of yellow sector; Y axis - number of male and female patients. No significant association of gender and circumstances sector was found (Chi square analysis, $p=0.386$; $p>0.05$ statistically not significant). However, females (2.65%) (green) had high the circumstances risk (21-30%) for caries.

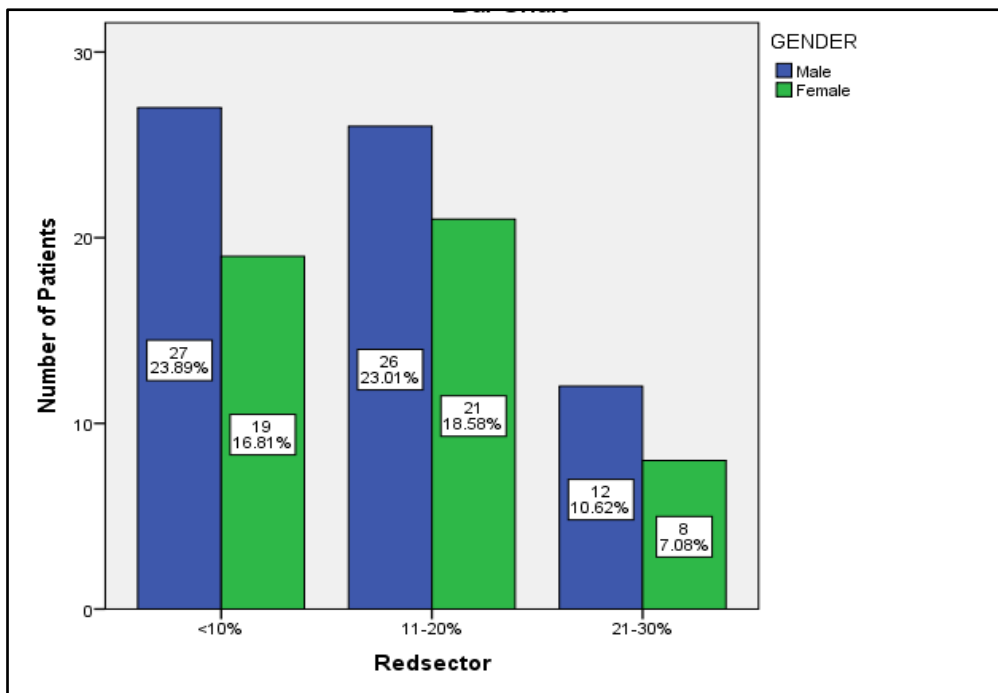


Fig.8: Bar chart shows the distribution of bacterial count [Red sector] among gender. X axis - percentage of red sector; Y axis - number of patients. No significant association between gender and the bacterial sector was found (Chi square analysis, $p=0.919$; $p>0.05$ statistically not significant). However, males (10.62%) (blue) had high red sector risk (21-30%) for caries than females.

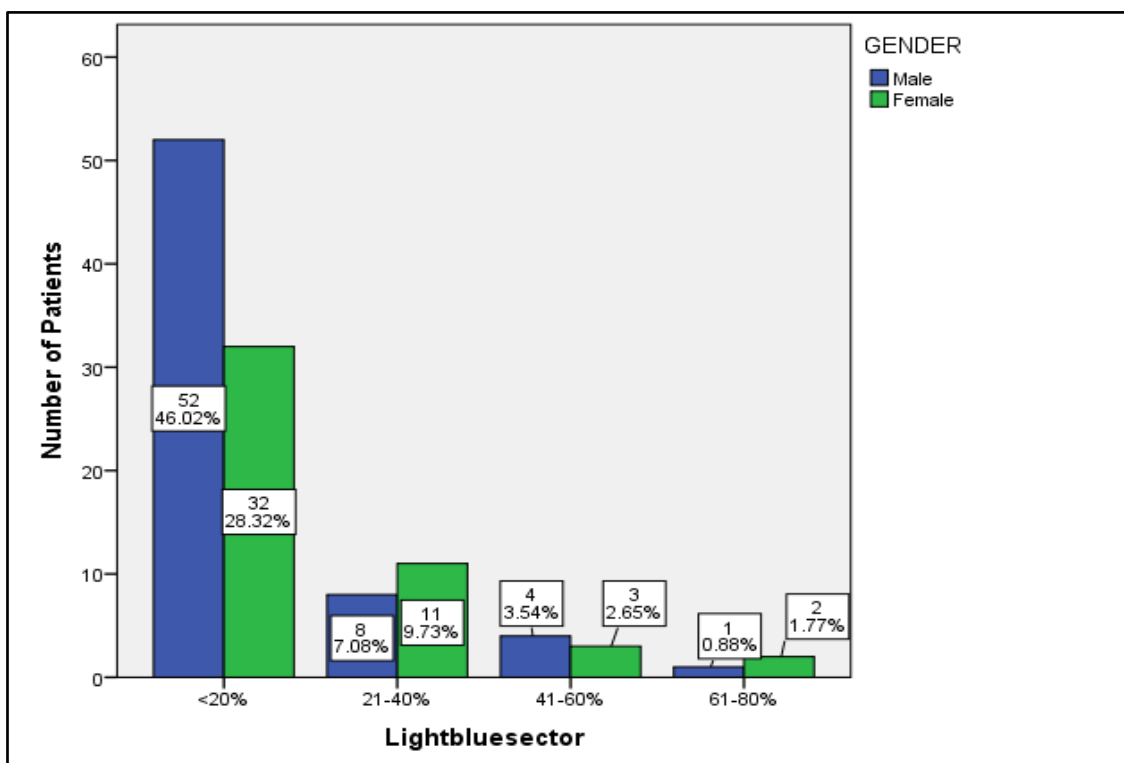


Fig.9: Bar chart shows the distribution of susceptibility [Light blue sector] among gender. X axis - percentage of light blue sector; Y axis - number of patients. No significant association between gender and the susceptibility sector was found (Chi square analysis, $p=0.358$; $p>0.05$ statistically not significant). However, females (1.77%) (green) had high light blue (61-80%) sector risk for caries.

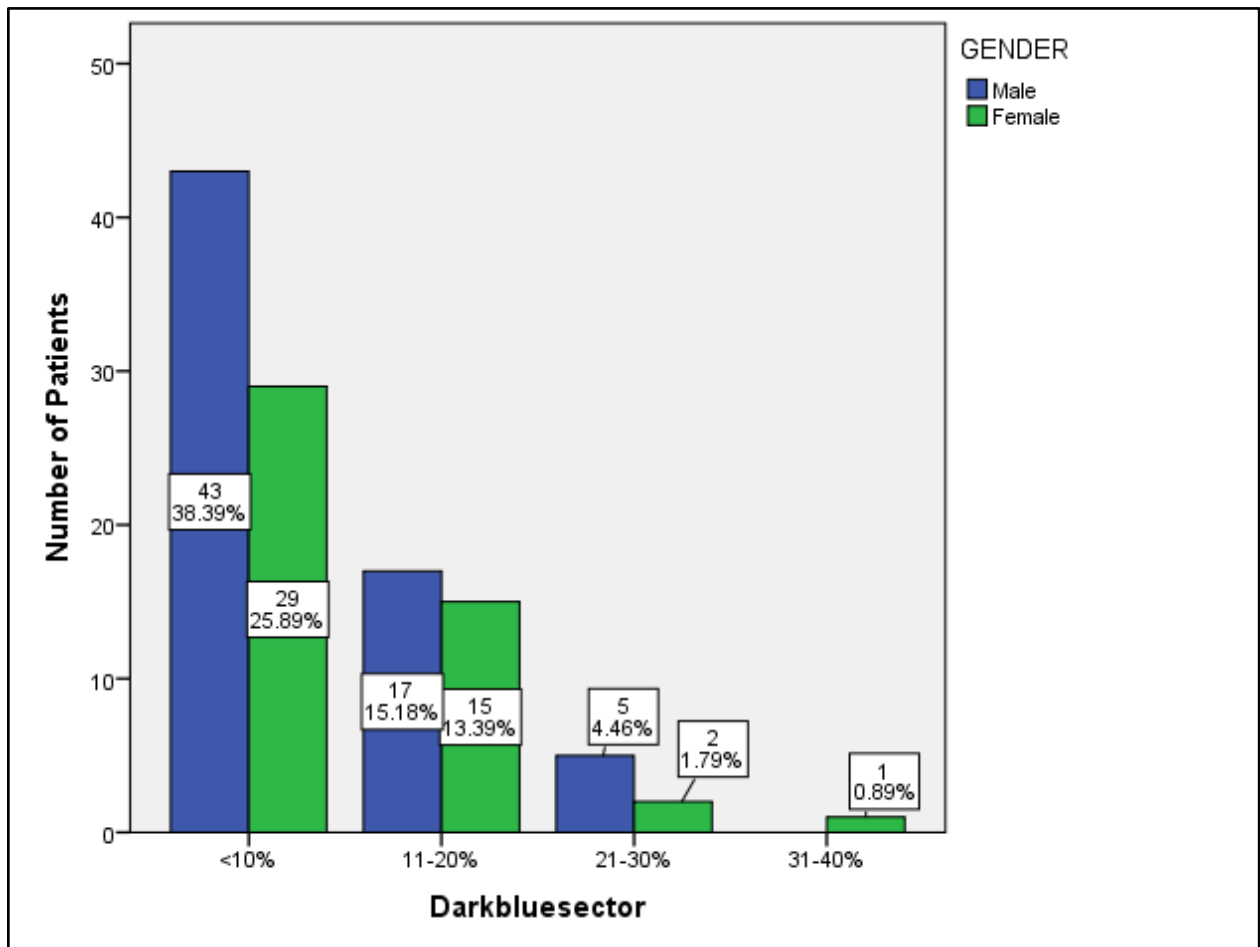


Fig.10 : Bar chart shows the distribution of diet [Dark blue sector] among gender. X axis - gender (males/females); Y axis - number of patients in the bacterial sector. No significant association between gender and the diet sector was found (Chi square analysis , $p=0.513$; $p>0.05$ statistically not significant). However, only females (0.9%) (green) had high (31-40%) dark blue sector risk for caries.