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# Inchair Prediabetic Screening and Its Correlation with Periodontal Disease -A Findrisc Based Cross-Sectional Study

**Jayasree Karunanidhi[1], TamilSelvan Kumar[2], Prathana manoharan[3], Selvalakshmi Saravanan[4], Saradha Ramakrishna[5] and Rohan Vasanth Raj[6]**

[1]CRRI, Vinayaka Mission's Sankarachariyar Dental College, Vinayaka Mission's Research Foundation (deemed to be university under section 3 of the UGC Act 1956), Sankari Main Rd, Ariyanur, Salem, Tamil Nadu 636308.

[2]Associate Professor, Department of Periodontology, Vinayaka Mission's Sankarachariyar Dental College, Vinayaka Mission's Research Foundation (deemed to be university under section 3 of the UGC Act 1956), Sankari Main Rd, Ariyanur, Salem, Tamil Nadu 636308.

[3]Assistant Professor, Department of Public Health Dentistry, Vinayaka Mission's Sankarachariyar Dental College, Vinayaka Mission's Research Foundation (deemed to be university under section 3 of the UGC Act 1956), Sankari Main Rd, Ariyanur, Salem, Tamil Nadu 636308.

[4]Assistant Professor, Department of Periodontology, Vinayaka Mission's Sankarachariyar Dental College, Vinayaka Mission's Research Foundation (deemed to be university under section 3 of the UGC Act 1956), Sankari Main Rd, Ariyanur, Salem, Tamil Nadu 636308.

[5]Assistant Professor, Department of Periodontology, Vinayaka Mission's Sankarachariyar Dental College, Vinayaka Mission's Research Foundation (deemed to be university under section 3 of the UGC Act 1956), Sankari Main Rd, Ariyanur, Salem, Tamil Nadu 636308.

[6]Assistant Professor, Department of Periodontology, Vinayaka Mission's Sankarachariyar Dental College, Vinayaka Mission's Research Foundation (deemed to be university under section 3 of the UGC Act 1956), Sankari Main Rd, Ariyanur, Salem, Tamil Nadu 636308.

**Corresponding Author:**

**TamilSelvan Kumar,** Associate Professor, Department of Periodontology, Vinayaka Mission's Sankarachariyar Dental College, Vinayaka Mission's Research Foundation (deemed to be university under section 3 of the UGC Act 1956), Sankari Main Rd, Ariyanur, Salem, Tamil Nadu 636308.

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**KEYWORDS**

Diabetes mellitus, Periodontitis, FINDRISC

**ABSTRACT:**

Background:FINDRISC is an efficient tool used to assess the likelihood of developing diabetes mellitus in undiagnosed population. The overall prevalence of undiagnosed diabetes was nearly half a billion people worldwide in the year 2021, so we are expecting more undiagnosed diabetes cases in the year 2024.The significance of FINDRISC lies in its ability to identify individuals at high risk of developing diabetes, allowing for early intervention.

Aim: The aim of the study was to identify undiagnosed diabetic and prediabetic diabetic patients among periodontitis subjects.

Materials and Methods:Patient attending the out patient department of Vinayaka Mission's Sankarachariyar Dental College, Vinayaka Mission's Research Foundation (deemed to be university under section 3 of the UGC Act 1956), between February 15 , 2024 and June 30 , 2024 for

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periodontal examination were considered. Only patients with stage 1,2,3,4 periodontitis were included. Individuals with positive FINDRISC scores (45 FINDRISC+) were referred for diabetological examination.

Results:A significant association of FINDRISC scoring was found with each stage of periodontitis. Stages 1 and 2 had the majority of slightly elevated FINDRISC scoring.In stage 1 periodontitis bleeding gums were significantly associated and in stage 2 had parents history of systemic diseases related. Other than these, all other parameters were not significantly associated with the FINDRISC score in each stage.

Conclusion: Only 15% of the patients in the current study were diabetic among 45 FINDRISC positive patients. FINDRISC questionairre in detecting diabetes mellitus was not significant among salem population in this current study.

**Introduction**

Diabetes mellitus (DM) encompasses a cluster of metabolic disorders marked by elevated blood glucose levels. Individuals afflicted with diabetes face heightened susceptibility to a range of severe, potentially life-threatening health complications. These complications not only escalate medical expenses but also diminish the quality of life and augment mortality rates[1]. Elevated blood glucose levels over time leads to widespread vascular damage, impacting vital organs such as the heart, eyes, kidneys, and nerves. This vascular damage precipitates a multitude of complications, ranging from cardiovascular issues to diabetic retinopathy, nephropathy, and neuropathy [2]. Over decades, there has been a notable rise in the global prevalence of diabetes and impaired glucose tolerance among adults[3-5].

The surge in diabetes prevalence across many countries and regions has been accelerated by rapid urbanization and the significant shift towards sedentary lifestyles[6]. In 1980, the World Health Organization (WHO) estimated that approximately 108 million individuals were living with diabetes. By 2014, this figure had quadrupled according to WHO estimates [7]. Indian Diabetes Federation (IDF) estimated the global prevalence was 415 million in 2015 [8].

Screening for DM in dental settings shows promise in identifying previously undiagnosed (pre-)DM. There are two distinct procedures available: invasive blood collection in the dental office for HbA1c measurement and a non-invasive questionnaire-based screening, followed by referring at-risk patients to general physicians or diabetologists. Additionally, research has explored the use of gingival crevicular blood as an alternative screening method for diabetologically conspicuous patients[7,10]. Among the methods available to identify previously undiagnosed (pre-)DM in a dental setting, the questionnaire-based screening method offers several advantages over blood analysis.

Dentists typically lack the authority to diagnose DM, necessitating a secondary invasive blood analysis by general physicians or diabetologists [8]. Considering cost-effectiveness, DM screening in dental care settings proves to be a cost-effective measure [8]. Patients may reject an invasive blood collection at the dental office, but their willingness to participate in non-invasive measures is often high [9]. In summary, implementing a screening method for DM in dental practice appears justified. A questionnaire-based screening in patients with severe periodontitis followed by referral to a general physician may prove to be a strategy with high sensitivity and specificity [8]. The aim of the current study is to validate the FINDRISC questionnaire to detect previously undiagnosed DM patients among periodontitis patients in dental chair.

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## 2 . Materials and methods

### 2.1 Patient

Patient attending the out patient department of Vinayaka Mission's Sankarachariyar Dental College, Vinayaka Mission's Research Foundation (deemed to be university under section 3 of the UGC Act 1956), between February 15, 2024 and June 30, 2024 for periodontal examination were considered. Only patients with stage 1,2,3,4 periodontitis who were examined under a special periodontal consultation, were included in the cross-sectional assessment. During the special periodontal consultation, all patients received general enlightenment on the use of their data for research questions.

After checking the inclusion and exclusion criteria for the cross-sectional assessment and analyses of the data, patient who fit into the following inclusion criteria received detailed information and an informed consent were obtained from them. The following inclusion criteria were defined: age of ≥ 30 years, stage 1,2,3,4 periodontitis, complete periodontal examination within the observation period; complete answering of DM screening questionnaire (figure 1) and willing to provide written informed consent for the cross-sectional data collection and analysis

The following exclusion criteria were considered: missing periodontal findings, missing data of DM screening; immunosuppressive medication, known type 1 DM and pregnancy. Data for all patients who met the inclusion criteria were collected. General data, the results of DM screening, the results of HbA1C, and periodontal findings were collected and analysed. All the procedures, including periodontal examination and DM screening, were part of the routine process in the dental practice.

Finnish Diabetes Association

**TYPE 2 DIABETES RISK ASSESSMENT FORM**

Circle the right alternative and add up your points.

**1. Age**
0 p. Under 45 years
2 p. 45–54 years
3 p. 55–64 years
4 p. Over 64 years

**2. Body-mass index**
(See reverse of form)
0 p. Lower than 25 kg/m²
1 p. 25–30 kg/m²
3 p. Higher than 30 kg/m²

**3. Waist circumference measured below the ribs (usually at the level of the navel)**

| | MEN | WOMEN |
|---|---|---|
| 0 p. | Less than 94 cm | Less than 80 cm |
| 3 p. | 94–102 cm | 80–88 cm |
| 4 p. | More than 102 cm | More than 88 cm |

**4. Do you usually have daily at least 30 minutes of physical activity at work and/or during leisure time (including normal daily activity)?**
0 p. Yes
2 p. No

**5. How often do you eat vegetables, fruit or berries?**
0 p. Every day
1 p. Not every day

**6. Have you ever taken medication for high blood pressure on regular basis?**
0 p. No
2 p. Yes

**7. Have you ever been found to have high blood glucose (eg in a health examination, during an illness, during pregnancy)?**
0 p. No
5 p. Yes

**8. Have any of the members of your immediate family or other relatives been diagnosed with diabetes (type 1 or type 2)?**
0 p. No
3 p. Yes: grandparent, aunt, uncle or first cousin (but no own parent, brother, sister or child)
5 p. Yes: parent, brother, sister or own child

**Total Risk Score**
The risk of developing type 2 diabetes within 10 years is

| | |
|---|---|
| Lower than 7 | Low: estimated 1 in 100 will develop disease |
| 7–11 | Slightly elevated: estimated 1 in 25 will develop disease |
| 12–14 | Moderate: estimated 1 in 6 will develop disease |
| 15–20 | High: estimated 1 in 3 will develop disease |
| Higher than 20 | Very high: estimated 1 in 2 will develop disease |

Please turn over

Test designed by Professor Jaakko Tuomilehto, Department of Public Health, University of Helsinki, and Jaana Lindström, MFS, National Public Health Institute.

Figure 1: FINDRISC questionnaire form

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**Statistical analysis**

Data was collected using Microsoft Excel spreadsheet and analyzed using SPSS software version 26. Data was found to be normally distributed after using Shapiro – wilk test, descriptive data was presented as mean and standard deviation. Association was performed using chi-square test. Significance was kept as less than 0.05.

**3 Results**

**3.1** patients

A total of 165 patients reported to the out patient department of oral medicine in Vinayaka mission's sankarachariyar dental college, Vinayaka Mission's Research Foundation(deemed to be university under section 3 of UGC Act 1956), were evaluated in this observational study. 110 patients were included after considering the inclusion and exclusion criteria. All the patients provided written informed consent for the current study.

A significant association of FINDRISC scoring was found with each stage of periodontitis. Stages 1 and 2 had the majority of slightly elevated FINDRISC scoring. Stage 3 and 4 majorities had moderate FINDRISC scoring as shown in table 1.

Table 1: Association of FINDRISC scoring with each stages of periodontitis (chi-square test)

| | | **STAGES** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Stage 1 | | Stage 2 | | Stage 3 | | Stage 4 | | |
| | | Count | N % | Count | N % | Count | N % | Count | N % | |
| **Findrisc** | **Low** | 4 | 16.7% | 4 | 10.5% | 3 | 8.6% | 4 | 30.8% | 0.013* |
| | **Slightly elevated** | 16 | 66.7% | 20 | 52.6% | 11 | 31.4% | 3 | 23.1% | |
| | **Moderate** | 4 | 16.7% | 11 | 28.9% | 12 | 34.3% | 5 | 38.5% | |
| | **High** | 0 | 0.0% | 3 | 7.9% | 9 | 25.7% | 1 | 7.7% | |

*significance <0.05

Table 2: Association of gingival questionnaires with each stage of periodontitis (chi-square test)

| | stages | | | | |
|---|---|---|---|---|---|
| | stage 1 | stage 2 | stage 3 | stage 4 | |

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| | | Count | Column N % | Count | Column N % | Count | Column N % | Count | Column N % | |
|---|---|---|---|---|---|---|---|---|---|---|
| bleeding gums (2) | yes | 22 | 91.7% | 38 | 100.0% | 34 | 97.1% | 11 | 84.6% | 0.083 |
| | no | 2 | 8.3% | 0 | 0.0% | 1 | 2.9% | 2 | 15.4% | |
| retracted gums(2) | yes | 21 | 87.5% | 37 | 97.4% | 35 | 100.0% | 11 | 84.6% | 0.044 |
| | no | 3 | 12.5% | 1 | 2.6% | 0 | 0.0% | 2 | 15.4% | |
| teeth move (2) | yes | 8 | 33.3% | 32 | 84.2% | 35 | 100.0% | 13 | 100.0% | 0.00 |
| | no | 16 | 66.7% | 6 | 15.8% | 0 | 0.0% | 0 | 0.0% | |
| lost teeth recently (2) | yes | 1 | 4.2% | 12 | 31.6% | 31 | 88.6% | 11 | 84.6% | |
| | no | 23 | 95.8% | 26 | 68.4% | 4 | 11.4% | 2 | 15.4% | 0.00 |
| brushing (3) | once | 14 | 58.3% | 33 | 86.8% | 31 | 88.6% | 12 | 92.3% | |
| | twice | 10 | 41.7% | 5 | 13.2% | 4 | 11.4% | 1 | 7.7% | 0.009 |
| stress(3) | some | 14 | 58.3% | 30 | 78.9% | 25 | 71.4% | 9 | 69.2% | |
| | no | 8 | 33.3% | 6 | 15.8% | 3 | 8.6% | 3 | 23.1% | 0.124 |
| | a lot | 2 | 8.3% | 2 | 5.3% | 7 | 20.0% | 1 | 7.7% | |
| over weight (2) | yes | 0 | 0.0% | 3 | 7.9% | 4 | 11.4% | 0 | 0.0% | 0.244 |
| | no | 24 | 100.0% | 35 | 92.1% | 31 | 88.6% | 13 | 100.0% | |
| smoke (3) | ex smoker | 1 | 4.2% | 1 | 2.6% | 2 | 5.7% | 2 | 15.4% | 0.368 |
| | no | 23 | 95.8% | 37 | 97.4% | 33 | 94.3% | 11 | 84.6% | |
| parents(2) | yes | 19 | 79.2% | 31 | 81.6% | 22 | 62.9% | 7 | 53.8% | 0.117 |

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|  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|
|  | no | 5 | 20.8% | 7 | 18.4% | 13 | 37.1% | 6 | 46.2% |  |

Association of gingival questionnaires with each stage of periodontitis is shown in table 2. In stage 1 periodontitis bleeding gums were significantly associated and in stage 2 had parent's history of systemic diseases related. Other than these, all other parameters are not significantly associated with the FINDRISC score in each stage as shown in table 3. Association of FINDRISC + ve with HBA1C values in correlation stage 3 and stage 4 periodontitis is explanined in table 4.

Table 3: Association of FINDRISC scoring with gingival questionnaire among each stages of periodontitis (chi-square test)

| **Stages** | **FINDRISC scoring** | **P value of bleeding gums** | **P value of retracted teeth** | **P value of teeth mobility** | **P value of lost teeth** | **P value of brushing** | **P value of stress** | **P value of over-weight** | **P value of smoke** | **P value of parents** |
|---|---|---|---|---|---|---|---|---|---|---|
| Stage 1 | Low | 0.004* | 0.565 | 0.720 | 0.074 | 0.741 | 0.355 | - | 0.074 | 0.532 |
|  | Slightly elevated |  |  |  |  |  |  |  |  |  |
|  | Moderate |  |  |  |  |  |  |  |  |  |
|  | High |  |  |  |  |  |  |  |  |  |
|  | Very high |  |  |  |  |  |  |  |  |  |
| Stage 2 | Low | - | 0.820 | 0.693 | 0.115 | 0.564 | 0.338 | 0.111 | 0.472 | 0.049* |
|  | Slightly elevated |  |  |  |  |  |  |  |  |  |
|  | Moderate |  |  |  |  |  |  |  |  |  |
|  | High |  |  |  |  |  |  |  |  |  |
|  | Very high |  |  |  |  |  |  |  |  |  |
| Stage 3 | Low | 0.523 | - | - | 0.363 | 0.802 | 0.566 | 0.103 | 0.653 | 0.709 |
|  | Slightly elevated |  |  |  |  |  |  |  |  |  |
|  | Moderate |  |  |  |  |  |  |  |  |  |
|  | High |  |  |  |  |  |  |  |  |  |
|  | Very high |  |  |  |  |  |  |  |  |  |

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| Stage 4 | Low | 0.150 | 0.150 | - | 0.286 | 0.307 | 0.102 | - | 0.630 | 0.253 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Slightly elevated | | | | | | | | | |
| | Moderate | | | | | | | | | |
| | High | | | | | | | | | |
| | Very high | | | | | | | | | |

*significance <0.05

Table 4: Association of FINDRISC + ve with HBA1C values in correlation stage 3 and stage 4 periodontitis .

| | Moderate | | High | |
|---|---|---|---|---|
| | Stage 3 | Stage 4 | Stage 3 | Stage 4 |
| HBA1C ≥5.7 | 8 | 2 | 1 | 0 |
| HBA1C <5.7 | 4 | 3 | 8 | 0 |

**3.2 DM screening and diabetological findings**

Nearly one third of the patients were FINDRISC (+ve), based on the cutoff of 12 points (41%, n =45) as shown in table 1. Patients were referred to the general practioner for DM screening. Out of 45 patient, 16 patients were found to be FINDRISC positive and also have HBA1C of ≥5.7%. These 16 patients were found to be previously unknown diabetic, which represents 15% of the total study population.

## 4. DISCUSSION

In the current study, diabetes patients were excuded to validate the reliability of FINDRISC questionnaire in the dental chair to identify previously undiagnosed DM among stage III and IV periodontitis. Currently it is estimated that nearly half of the people living with DM worldwide are undiagnosed (44.7%).A study done by Schmalz G et al., reported that63.2% of the study population in Germany had an HbA1C of ≥5.7%. In our Current study, only 15% of the selected population were diagnosed with conspicuous diabetic condition, through FINDRISC questionnaire [11].

A recent Greek study discovered that 25% of patients with (mainly mild) chronic periodontitis had unexplained hyperglycemia when chair side HbA1c testing was performed [12]. Although this percentage is greater than in the current study, the investigation demonstrated a relationship between HbA1c and waist circumference and included over 80% of obese patients [12]. Generally speaking, every outcome that is now accessible supports the value of DM screening in a dental practice [12]. Because a comment on the patient's hyperglycemia is independent of patient compliance (simple answers, going to the doctor), blood testing in dentistry settings may therefore have a higher sensitivity. In light of this, a systematic study determined the effectiveness of point-of-care testing [13]. This type of screening, however, has a number of drawbacks. It seems challenging for dental personnel to properly collect and analyze blood, which could lead to a lot of false-positive results [14].

Furthermore, DM cannot be diagnosed or treated by dentists, necessitating a second visit with general practitioners. In addition, it's unclear how much dentists are paid. Consequently, it appears most

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practical to use a questionnaire-based screening to identify high-risk individuals and assign them to a general practitioner. It appears that there is a search to identify and as practitioners to limit the frequency of false-positive results of DM screening in dental practice, several parameters were considered in the current study.

The focus on the exclusive screening of patients with severe periodontitis (Stages III and IV) allowed 15% of participants to be correctly identified. In our study the decreased impact of FINDRISC may be due to many factors. There was no correlation between DM and periodontal parameters in one study that was available and looked at patients with mild periodontitis [12]. Still, it makes sense to look at people who have periodontal disease. Similarly, results from the Japanese Ehime Dental Diabetes Study verified that people with severe periodontal disease had the highest percentage of hyperglycemia [15].

Winning et al. utilized a prospective cohort analysis to demonstrate a hazard ratio of 1.69 for males with moderate-to-severe periodontitis for the development of a DM, hence supporting the recommendation of DM screening in periodontally infected patients [16]. DM risk also increases with age [17]. Therefore, age is also reflected as a question in the applied FINDRISC questionnaire. In elderly people with diabetes, periodontal abscesses may be a clinical indicator of undetected DM, according to a large-scale cross-sectional investigation [18].

Given that all patients underwent clinical and radiographic evaluations, as well as conservative or surgical therapy, prior to receiving a periodontal status and DM screening, endo-periodontal lesions may have been almost entirely excluded from our study. According to this self-report, 53.5% of adults in Germany are overweight, men more often than women [19]. The obesity prevalence for both sexes is 19.0%.The prevalence of obesity in tamilnadu was 24.6 percent, respectively [20].

The prevalence of diabetes among the tribal population was 7.4% [21]. The corresponding age and sex standardized prevalence of diabetes were 9.7% in 2009 and 9.9% in 2010, respectively [22].

**CONCLUSION**:

In the current study FINDRISC questionnaire identified previously undiagnosed diabetes mellitus in the patients with stage III and IV periodontitis among salem population. However, the results that we obtained was not significant in our study which can be due to various factors. Therefore, further validation of diabetic screening questionnaire is to be done to detect the undiagnosed diabetes mellitus among the periodontitis patients in salem population.

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