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Prevalence and determinants of dental anxiety among adults in Benin: an analytical cross-sectional study at a health center in Parakou, 2025.

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Abstract

Background:

Dental anxiety is an often-underestimated public health problem that may lead to avoidance of dental care and oral health complications. This study aimed to assess the prevalence, determinants, and physiological manifestations of dental anxiety among adults.

Methods:

A descriptive cross-sectional study was conducted among 120 adults. Dental anxiety was assessed using the Dental Fear Survey (DFS) and complemented by changes in heart rate before and after dental procedures (ΔHR = HR during – HR before) as a physiological indicator. Bivariate and multivariate analyses were performed to identify associated factors.

Results:

The mean age was 32.68 ± 13.19 years, with 58% females. Most patients (61.67%) had a tertiary education. The mean DFS score was 33.91 ± 9.39; 81% of participants exhibited very low anxiety, and 19% had moderate anxiety. Main anxiety triggers were pain (30%) and local anesthetic injection (17.5%). In the adjusted model, female sex and higher educational level emerged as independent determinants of dental anxiety. Physiologically, heart rate increased most during dental extractions, confirming their anxiogenic nature. The multivariate model explained 24% of the change in heart rate, primarily driven by procedure type and sex.

Conclusion:

Dental anxiety in this population was generally low but present in a meaningful proportion of patients. Female sex, higher educational level, and the invasive nature of dental procedures were key determinants. To improve patients' experiences, dental services should use a combination of clear and empathetic communication, pain control, and behavioral strategies to reduce anxiety and its impact on dental care.

Keywords: dental anxiety; Dental Fear Survey; prevalence; associated factors; heart rate.
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Introduction

The World Health Organization (WHO) defines anxiety as a diffuse feeling of imminent danger that is accompanied by emotional discomfort and psychological agitation [1]. Currently, anxiety is a significant threat to the global population's well-being [2]. Dental anxiety refers to a specific fear associated with dental care and procedures. This response to anticipated dental procedures involves cognitive, emotional, and physiological components [3]. It manifests as intense apprehension, which may interfere with treatment adherence and promote avoidance behaviors [4,5]. From a public health perspective, dental anxiety is a major concern due to its negative impact on oral healthcare service use and oral health deterioration [6,7]. Notably, a recent meta-analysis estimated the global adult dental anxiety prevalence at 13.8%, while 2.6% of adults present severe forms [8]. However, this prevalence varies across regions and sociocultural contexts.

In sub-Saharan Africa, available data show substantial heterogeneity. For example, in Nigeria, prevalence rates range from 7.4% to over 60%. These differences were accounted for by the study design and clinical setting [9–

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11]. Similarly, in Cameroon, a hospital-based study reported a prevalence of 59.56% among adults [12]. However, no published data were available from Benin, highlighting a lack of national epidemiological evidence.

Numerous factors related to dental anxiety appear in the literature. For example, demographic variables, particularly female sex and younger age, are significant determinants [13–16]. In addition, negative dental experiences, perceived pain, invasive procedures, and psychological characteristics also play major roles [17–20]. However, the relationship between education level and dental anxiety remains controversial. Some studies report higher anxiety in individuals with lower educational attainment, while others observe the opposite association [21–23].

Given the absence of Beninese data, this study aimed to estimate the prevalence of dental anxiety among adults and to identify associated factors. To achieve this, we used a combined approach: integrating a standardized psychometric assessment (Dental Fear Survey) with an objective physiological indicator based on heart rate variability.

In this context, characterized by the absence of Beninese data, the present study aimed to estimate the prevalence of dental anxiety among adults and to identify associated factors, using a combined approach that integrates a standardized psychometric assessment (Dental Fear Survey) and an objective physiological indicator based on heart rate variation.

Materials and Methods

Study design

This was a quantitative cross-sectional descriptive and analytical study design.

Study setting

The study took place at the dental clinic of the Medical and Social Center of the Parakou Garrison. Parakou, the main city in northern Benin, is home to this primary healthcare facility, which includes a maternity unit, general medicine, medical imaging, a biomedical laboratory, and a dental department. The dental department has a dental chair and an intraoral radiography system (RVG or radiovisiography), which uses digital sensors to capture detailed images inside the mouth. This device supports dental radiological investigations that guide therapeutic decisions. The department primarily offers general dental care, including consultations, fillings, extractions, and minor oral surgeries. Services offered focus on adults, although some pediatric patients are treated. Data collection was conducted between July and October 2025. Data analysis and interpretation of the results were performed in November 2025.

Study population

The study included adult patients aged 18 and over who attended the dental clinic during the study period and provided written informed consent. Exclusion criteria were use of anxiolytic medication, known cardiac disease, or severe psychiatric disorders.

Sampling and sample size

Participants were recruited consecutively using non-probability sampling. National prevalence data were unavailable. Therefore, the minimum sample size was calculated using a Nigerian study with a 7.43% prevalence. At 95% confidence and 5% precision, the required sample size was 106. This was increased to 117 to account for possible non-response. Ultimately, 120 patients were included in the analysis.

Data collection

Dental anxiety was assessed using the validated Dental Fear Survey (DFS) by Kleinknecht et al., administered before the dental visit. The DFS covers three areas: avoidance of treatment, fear of dental stimuli (e.g., needles, drills), and physical symptoms such as sweating or a rapid heartbeat. Total scores range from 20 to 100; higher scores indicate greater anxiety.

Heart rate was measured using a Polar H10 chest-worn sensor before and during the dental procedure. The change (ΔHR = HR during − HR before) was calculated for each participant to assess physiological reactivity to dental anxiety.

Statistical analysis

Data were analyzed using R Studio version 4.4.3. Descriptive statistics were summarized for continuous variables as mean ± standard deviation. Frequencies and percentages were used to describe categorical variables. Bivariate analyses examined associations between DFS scores, changes in heart rate, and individual characteristics. Multivariate regression models identified factors independently associated with dental anxiety and physiological heart rate response. Statistical significance was set at $p < 0.05$.

Bias

Potential sources of bias were minimized through the use of predefined inclusion and exclusion criteria, standardized data collection procedures, and a validated questionnaire. Physiological measurements, including heart rate, were performed using the same protocol for all participants. Data quality was ensured through systematic consistency and

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validity checks before statistical analysis. No missing data were recorded. Multivariate analyses were conducted to account for potential confounding factors.

Ethical considerations and informed consent

Ethical approval for this study was obtained from the Ethics and Quality Assurance Committee of the "Université des Montagnes (CEAQ-UdM)", under authorization number 2025/218/UdM/PR/CEAQ, issued on June 26, 2025. Written informed consent was obtained from all participants before their inclusion in the study. Participation was voluntary, and the confidentiality of participants' information was ensured throughout the study. Data analysis was conducted using an anonymized database, from which all personal identifiers had been removed.

Results

Participant flow

During the study period, approximately 143 patients attended the dental clinic of the Medical and Social Center of the Parakou Garrison and were screened for eligibility. Eight patients were not eligible because they were younger than 18 years. Among the remaining 135 eligible adults, 15 did not provide informed consent and were therefore not included. Finally, 120 adult patients met the inclusion criteria, provided written informed consent, and were enrolled in the study. No participant withdrew after enrollment, and complete data were obtained for all included participants. Consequently, all 120 enrolled adults were included in the final analysis.

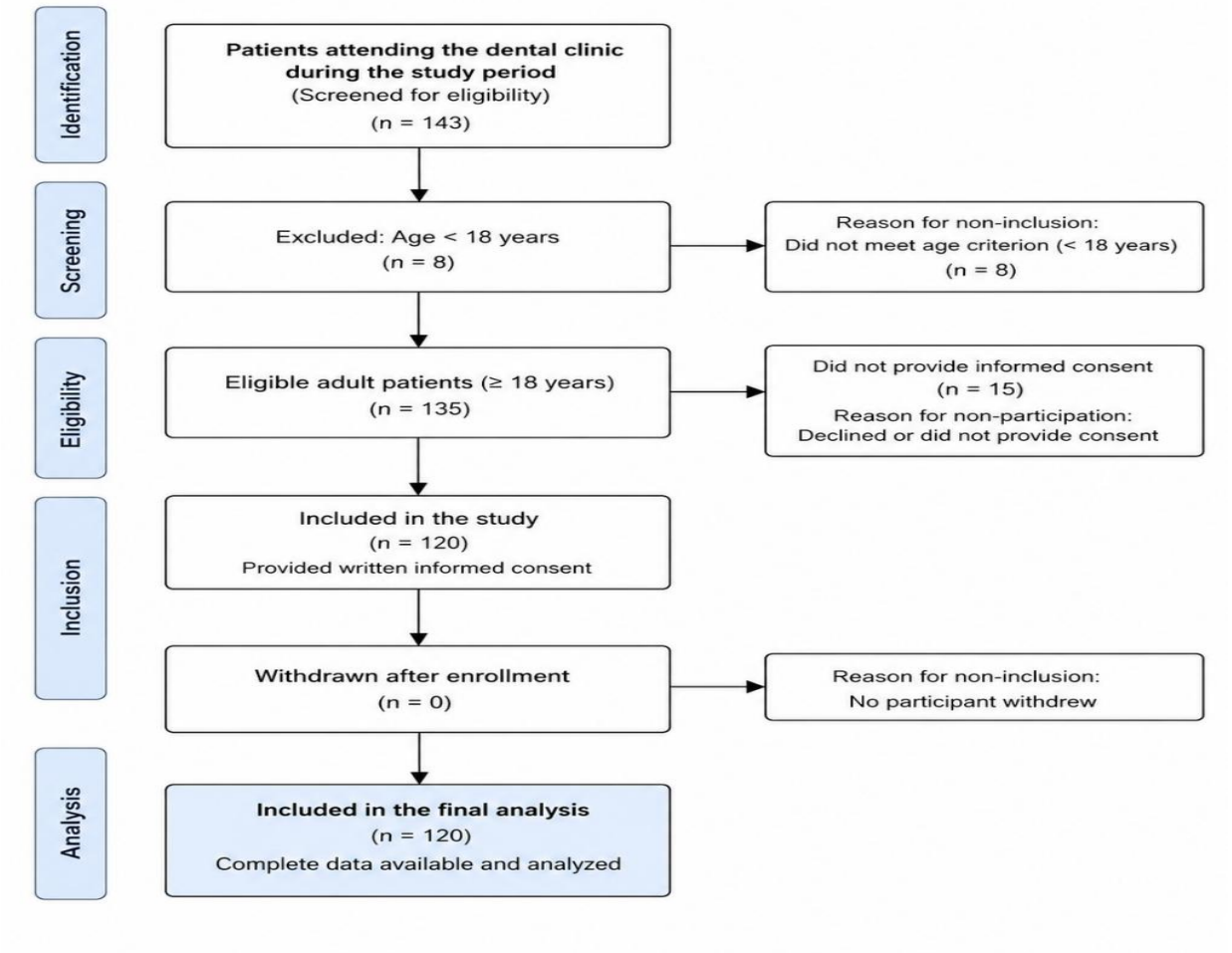

Figure 1. Flow diagram of participant recruitment, inclusion, and analysis.

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A total of 120 adult patients were included in the study. The mean age was 32.68 ± 13.19 years, with a range of 18 to 80 years. Participants aged 18–30 years were the most represented age group. Females accounted for 58% of the study population, yielding a sex ratio of 0.72. The majority of participants had attained tertiary education (at the university level) (Table 1)

Table 1. Sociodemographic characteristics of the study population.

Variable	n	%
Sex		
Male	50	42
Female	70	58
Age group (years)		
18–30	64	53
31–50	44	37
≥51	12	10
Educational level		
Primary	15	12.5
Secondary	31	25.83
Higher	74	61.67

Regarding dental history, most participants reported having previously visited a dentist. The most frequently reported factors contributing to dental anxiety were pain associated with dental procedures (30%) and local anesthetic injection (17.5%). (Table 2).

Assessment of dental anxiety using the DFS yielded a mean score of 33.91 ± 9.39. Overall, 81% of participants presented with low dental anxiety, while 19% had moderate anxiety. No cases of severe dental anxiety were identified. (Figure 2)

Table 2. Distribution of the study population according to previous dental visit and factors associated with the occurrence of dental anxiety.

Variable	Number (n)	Frequency (%)
previous dental visit		
Yes	70	58
No	50	42
Factors implicated in the occurrence of dental anxiety		
Noise of rotary instruments	6	5.00
Pain caused by the procedure	36	30.00
Negative experiences	5	4.17
Dentist's judgment of oral hygiene	3	2.50
Fear of contracting a pathogen during treatment	13	10.83
Local anesthetic injection	21	17.50
Reclined position in the dental chair	2	1.67
None	34	28.33

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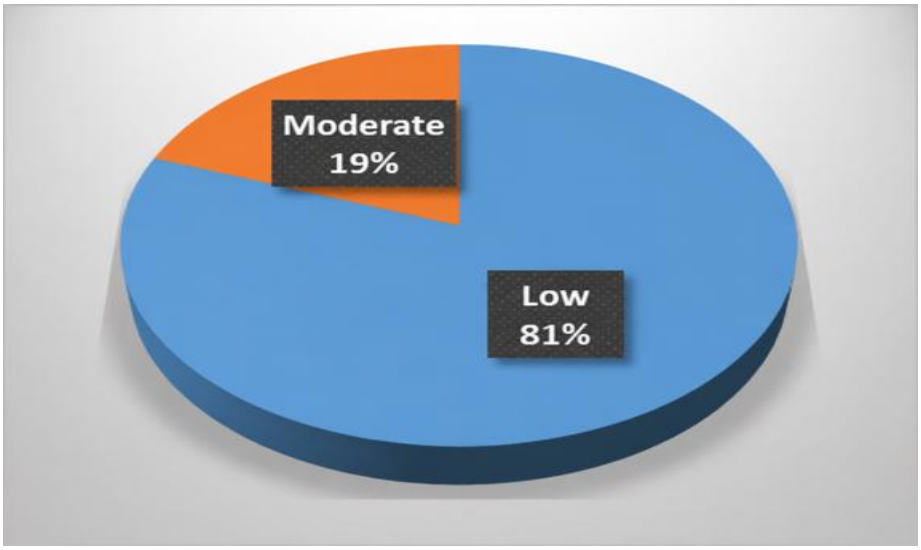

Figure 2. Distribution of patients by level of dental anxiety.

Multivariate analysis showed that female sex and higher educational level were independently associated with self-reported dental anxiety (Table 3).

Table 3. Multivariate linear regression between DFS score and individual factors.

Variable	Coefficient	95% Confidence Interval	*p*-value
Age	−0.081	−0.228 to	0.2759
Sex (Male/Female)	−5.097	−8.470 to	0.0034
Education level (Secondary/Primary)	2.144	−3.594 to	0.4607
Education level (Higher/Primary)	5.424	0.003 to	0.0499
Previous dental visit (Yes/No)	3.257	−0.207 to	0.0651

Coefficient of determination $r^2 = 0.17$; overall model p-value = 0.0006

From a physiological perspective, analysis of heart rate changes (ΔHR) showed a more pronounced increase during dental extractions compared with other types of dental procedures, confirming the highly anxiogenic nature of invasive procedures (Table 4). The multivariate model explained approximately 24% of the variability in ΔHR, mainly attributable to the type of dental procedure and sex (Table 5).

Table 4. Mean heart rate difference (ΔHR) by type of dental care.

Type of dental care	Sample size (n)	Mean heart rate difference (ΔHR = HR during − HR before)
Consultation	27	−0.0741
Scaling	47	0.1064
Dental extraction	34	6.6765
Dentinogenic treatment	12	0.25

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Table 5. Multivariate linear regression between heart rate difference (ΔHR), type of dental procedure, and individual factors.

Variable	Coefficient	95% Confidence Interval	*p*-value
Type of care (Scaling/Consultation)	0.163	−3.234 to	0.9245
Type of care (Dental extraction/Consultation)	7.524	3.942 to	<0.001
Type of care (Conservative dental treatment/Consultation)	1.026	−3.834 to	0.6766
Age	−0.010	−0.128 to	0.8665
Sex (Male/Female)	−3.387	−6.059 to	0.0134
Previous dental visit (Yes/No)	0.922	−1.863 to	0.5131
Education level (Secondary/Primary)	−1.397	−6.032 to	0.5516
Education level (Higher/Primary)	2.151	−2.172 to	0.3263

Coefficient of determination $r^2 = 0.24$; overall model *p*-value = 0.0001

Discussion

To our knowledge, this is the first study conducted in Benin to investigate dental anxiety among adult dental patients. The study population was predominantly young, with a mean age of 32.68 ± 13.19 years, and showed a female predominance. This profile is comparable to that reported in several previous studies [24, 25, 10]. However, other studies have reported a predominance of male participants [26, 11], suggesting that there is no consistent relationship between sex and dental care utilization patterns. The high proportion of participants with university-level education (61.67%) is consistent with findings from studies conducted in other settings, particularly in India [21], and likely reflects studies conducted in selected dental care facilities, which are influenced by socio-economic and cultural determinants.

Dental anxiety assessed using the Dental Fear Survey (DFS) was overall low in this study, with a mean score of 33.91 ± 9.39 and a predominance of very low anxiety levels. Nevertheless, nearly one-fifth of participants (19%) presented moderate dental anxiety, a proportion comparable to that reported in Nigeria (20.5%) [10], although no cases of severe anxiety were observed in the present study. In contrast, considerably higher levels of dental anxiety have been reported in China, where more than 80% of participants exhibited moderate to high anxiety [24], highlighting the influence of socio-cultural context on the expression of dental anxiety.

Pain and local anesthetic injection emerged as the main anxiety-triggering factors, corroborating previous studies in agreement with previous literature. Indeed, Astramskaitė et al. emphasized the central role of pain-related experiences or expectations in the development of dental anxiety ($p < 0.05$) [19]. These findings emphasize the critical importance of pain perception in shaping patients' emotional responses to dental care. Multivariate analysis identified female sex and higher educational level as independent determinants of self-reported dental anxiety after adjustment for other covariates. Higher anxiety levels among women have been consistently documented in the literature [15, 16, 27] and may be explained by greater emotional expressiveness, lower pain tolerance, or greater acceptance of fear-related feelings. The seemingly paradoxical association between higher educational attainment and increased dental anxiety may reflect heightened risk perception of dental procedures or result from the overrepresentation of highly educated individuals in the study sample.

From a physiological standpoint, the significant increase in heart rate observed during dental extractions confirms the highly anxiogenic nature of this invasive procedure, as highlighted in previous studies [15, 16, 27]. The multivariate model, which explained approximately 24% of the variability in heart rate change, underscores the predominant influence of dental procedure type and sex on the physiological stress response. These physiological findings complement the self-reported anxiety data. These results support the need for individualized management of dental anxiety, taking into account the patients' sociodemographic characteristics and the nature of the procedures to be performed. The findings of this pilot study should be interpreted as context-specific evidence from a clinical dental care setting in Parakou (Benin Republic). They may be most applicable to adult patients attending similar urban or semi-urban primary dental care facilities in Benin and comparable sub-Saharan African contexts. Rather than providing nationally representative estimates, the study offers preliminary insights into the patterns and determinants of dental anxiety in a setting where evidence remains scarce. These findings may therefore inform local clinical practice and guide the design of larger studies with broader external validity.

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Conclusion

This cross-sectional study conducted among 120 adult patients at the Medical and Social Center of Parakou indicates that dental anxiety is generally low but remains clinically significant in a non-negligible proportion of patients, particularly in its moderate form. Female sex and higher educational level emerged as independent determinants of self-reported dental anxiety, while the invasive nature of dental procedures—especially dental extractions—was associated with a marked physiological anxiety response, evidenced by increased heart rate.

The integration of a physiological indicator confirmed the concordance between self-reported anxiety and cardiovascular reactivity, reinforcing the relevance of combining psychometric and physiological approaches in the assessment of dental anxiety. These findings emphasize the need for individualized management strategies based on enhanced dentist–patient communication, effective pain control, and the adoption of appropriate behavioral interventions to reduce the impact of anxiety on dental care experience and healthcare utilization. To improve patients' experiences, dental services should use a combination of clear and empathetic communication, pain management, and behavioral strategies to reduce anxiety and its impact on dental care.

As the first study of its kind in Benin, this work provides essential methodological and epidemiological evidence to support the development of targeted clinical interventions and to guide future large-scale research integrated into public health strategies for oral health promotion.

Limitations

This study has certain limitations, including potential selection bias due to voluntary attendance at the dental clinic, which may have led to an underestimation of the true prevalence of dental anxiety, as well as limited representativeness given the high proportion of participants with higher education.

Funding

The study wasn't funded

Conflict of Interest

The authors declare no conflicts of interest

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