International Journal of Advanced Health Science and Technology
Homepage: ijahst.org
e-ISSN:2808-6422; p-ISSN:2829-3037
Vol. 4 No.4, pp. 157-162, August 2024

RESEARCH ARTICLE
OPEN ACCESS
Manuscript received June 11, 2024; revised June 17, 2024; accepted June 17, 2024; date of publication August 30, 2024
Digital Object Identifier (**DOI**): https://doi.org/10.35882/ijahst.v4i4.385
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How to cite: Bella Hidayatus Syafitri, Imam Sarwo Edi, Isnanto, and Ida Chairanna Mahirawatie, "The Relationship Between Brushing Teeth And Debris Index In Pregnant Women At The Buduran Health Center, Sidoarjo Regency", International Journal of Advanced Health Science and Technology, Vol. 4, No. 4, pp. 157 - 162, August, 2024.

The Relationship Between Brushing Teeth And Debris Index In Pregnant Women At The Buduran Health Center, Sidoarjo Regency

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ABSTRACT Poor oral hygiene during pregnancy poses significant health risks to both maternal and fetal well-being. Preliminary observations at the Buduran Health Center, Sidoarjo Regency, revealed that pregnant women exhibited elevated debris indices, indicating suboptimal oral hygiene practices. The accumulation of dental debris during pregnancy is particularly concerning as it can lead to periodontal disease, which has been associated with adverse pregnancy outcomes, including preterm birth and low birth weight. Despite the critical importance of maintaining oral health during pregnancy, limited research has examined the relationship between tooth brushing practices and debris accumulation in pregnant populations within the Indonesian healthcare context. This study aimed to investigate the relationship between tooth brushing techniques and debris index scores among pregnant women attending the Buduran Health Center, Sidoarjo Regency. A cross-sectional analytical study was conducted with 44 pregnant women selected from the Buduran Health Center, Sidoarjo Regency. Data collection utilized standardized examination sheets to measure debris indices and structured observation sheets to assess tooth brushing techniques. The debris index was evaluated using established clinical criteria, while brushing techniques were categorized based on frequency, duration, and methodology. Statistical analysis was performed using the Chi-Square test to determine the association between variables, with statistical significance set at $\alpha = 0.05$. The majority of participants (54.5%) demonstrated moderate tooth brushing techniques, while 56.8% exhibited moderate debris index scores. Chi-Square analysis revealed a statistically significant relationship between tooth brushing practices and debris index ($p = 0.023$, $p < 0.05$), indicating that brushing technique quality was significantly associated with oral debris accumulation. A significant correlation exists between tooth brushing practices and debris index among pregnant women at the Buduran Health Center. These findings underscore the importance of implementing comprehensive oral health education programs specifically tailored for pregnant women to improve brushing techniques and reduce debris accumulation, ultimately promoting better maternal and fetal health outcomes.

INDEX TERMS Oral Hygiene, Pregnancy, Debris Index, Tooth Brushing Technique, Maternal Health.

I. INTRODUCTION

Oral health deterioration during pregnancy represents a significant public health concern with far-reaching implications for both maternal and fetal well-being. The physiological and hormonal changes accompanying pregnancy create a unique environment that predisposes expectant mothers to increased oral health complications [1]. Contemporary research indicates that pregnant women demonstrate substantially compromised oral hygiene practices, with studies revealing that approximately 72.22% of pregnant women exhibit poor oral hygiene indices [2]. This alarming prevalence underscores the critical need for a comprehensive understanding and intervention strategies targeting oral health maintenance during pregnancy. The manifestation of poor oral hygiene in pregnant populations is particularly concerning given the established association between periodontal disease and adverse pregnancy outcomes, including preterm birth, low birth weight, and systemic maternal complications [3]. Furthermore, the elevated debris index observed in pregnant women at healthcare facilities, such as the 55.6% prevalence of poor debris indices documented at the Buduran Health Center, Sidoarjo Regency, demonstrates the urgent need for targeted interventions [4]. Current methodologies for assessing oral hygiene in pregnant populations predominantly utilize standardized clinical indices, with the Simplified Oral Hygiene Index (OHI-S) serving as the gold standard for debris and calculus assessment [5]. Advanced diagnostic approaches incorporate digital imaging systems and automated plaque detection algorithms to enhance measurement accuracy [6]. Contemporary research employs cross-sectional and longitudinal study designs to investigate

e-ISSN:2808-6422; p-ISSN:2829-3037
Vol. 4 No.4, pp. 157-162, August 2024

the relationship between oral hygiene practices and clinical outcomes [7].

Recent technological innovations have introduced smartphone-based applications and telemedicine platforms for remote oral health monitoring, enabling continuous assessment of brushing effectiveness and debris accumulation patterns [8]. Machine learning algorithms have been integrated into oral health assessment protocols, facilitating predictive modeling of periodontal disease progression during pregnancy [9]. Additionally, biomarker analysis techniques, including salivary diagnostics, have emerged as non-invasive methods for evaluating oral health status and inflammation markers [10]. Despite extensive research documenting the relationship between pregnancy and oral health deterioration, significant knowledge gaps persist regarding the specific mechanisms underlying brushing technique effectiveness and debris accumulation patterns in pregnant populations. Limited studies have examined the correlation between standardized brushing protocols and quantitative debris index measurements in Indonesian healthcare settings [11]. Furthermore, the majority of existing research focuses on Western populations, with insufficient representation of Southeast Asian maternal cohorts [12]. The absence of culturally-specific oral health education programs tailored to Indonesian pregnant women represents a critical gap in current intervention strategies [13]. Additionally, the relationship between socioeconomic factors, educational background, and oral hygiene practices among pregnant women in developing healthcare systems remains underexplored [14]. The lack of standardized protocols for evaluating brushing technique effectiveness in clinical settings further compounds these research limitations [15].

This study aims to investigate the relationship between tooth brushing techniques and debris index scores among pregnant women attending the Buduran Health Center, Sidoarjo Regency, while establishing evidence-based recommendations for improving oral hygiene practices during pregnancy. This research contributes to the existing knowledge base through several key innovations:

1. Quantitative Assessment Framework: Development of a comprehensive evaluation system that correlates standardized brushing techniques with objective debris index measurements, providing healthcare practitioners with evidence-based assessment tools for pregnant women's oral health monitoring.
2. Cultural Context Integration: Investigation of oral hygiene practices within the Indonesian healthcare context, addressing the significant gap in culturally-specific research and providing insights applicable to Southeast Asian maternal populations with similar socioeconomic and cultural characteristics.
3. Clinical Decision Support: Establishment of evidence-based guidelines for healthcare providers to implement targeted oral health interventions during prenatal care, enhancing the quality of maternal healthcare services and reducing pregnancy-related oral health complications.

This paper is organized into five main sections. The subsequent sections are organized as follows: Section I reviews related works on digital oral health interventions; Section II details the system design and methodology; Section III presents the evaluation results; Section IV discusses the findings and potential implications; finally, Section V concludes with future directions.

II. METHOD

A. STUDY DESIGN AND POPULATION SAMPLING

This investigation employed a cross-sectional analytical research design to examine the relationship between tooth brushing techniques and debris index measurements among pregnant women. The study was conducted at the Buduran Health Center, Sidoarjo Regency, East Java, Indonesia, between January and March 2024. The selected healthcare facility serves as a primary care center providing comprehensive maternal health services, including dental care, to the local population. The cross-sectional design was selected to provide a snapshot assessment of oral hygiene practices and debris accumulation at a single time point, enabling efficient data collection while minimizing participant burden during pregnancy. The target population comprised pregnant women attending the Dental Polyclinic at the Buduran Health Center, Sidoarjo Regency. Inclusion criteria encompassed pregnant women across all trimesters who voluntarily sought dental care services during the study period. Exclusion criteria included pregnant women with severe systemic conditions that could interfere with oral examination procedures, those unable to provide informed consent, and individuals with cognitive impairments that might affect their ability to demonstrate brushing techniques accurately. Sample size determination followed established statistical principles for cross-sectional studies investigating correlational relationships. A minimum sample size of 30 participants was calculated based on anticipated effect sizes and statistical power requirements. The final sample comprised 44 pregnant women, exceeding the minimum threshold to ensure adequate statistical power for detecting clinically meaningful associations between variables. A non-probability sampling approach utilizing an accidental sampling technique was implemented for participant recruitment. This convenience sampling method involved the systematic enrollment of eligible pregnant women who presented to the dental clinic during the designated study period.

B. DATA COLLECTION PROCEDURES

Before initiating data collection, rigorous informed consent protocols were established following established ethical research guidelines. Participants received thorough briefings covering study aims, methodologies, potential risks and benefits, and their unconditional right to discontinue participation without compromising their medical care access. All participants provided written authorization before commencing any evaluation activities. Data collection occurred through structured clinical interviews conducted by trained research personnel in standardized healthcare environments. Each session followed predetermined protocols to ensure consistency across all participants. Demographic information, medical histories, and relevant clinical assessments were systematically documented using validated instruments. Quality assurance measures included

e-ISSN:2808-6422; p-ISSN:2829-3037
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regular calibration sessions among research staff to maintain inter-rater reliability and adherence to established procedures.

Debris index evaluation followed standardized clinical protocols utilizing the Simplified Oral Hygiene Index (OHI-S) methodology. The assessment procedure consisted of three sequential steps: First, disclosing solution gel was systematically applied to predetermined index teeth surfaces (buccal surfaces of maxillary first molars, labial surfaces of maxillary right central incisor, and lingual surfaces of mandibular first molars) using standardized application techniques within the dental unit environment. Second, visual assessment of debris accumulation was conducted under standardized lighting conditions using dental mirrors and explorers. Each tooth surface was evaluated according to established scoring criteria: 0 = no debris, 1 = debris covering not more than one-third of the surface, 2 = debris covering more than one-third but not more than two-thirds of the surface, and 3 = debris covering more than two-thirds of the surface. Third, assessment results were systematically documented on standardized debris index examination forms, ensuring consistent data capture across all participants.

Brushing technique assessment employed direct observation methodology using structured evaluation protocols. The evaluation process incorporated three components: Participants were instructed to demonstrate their typical tooth brushing technique using standardized toothbrushes and fluoride toothpaste at designated sink facilities within the dental clinic. This naturalistic approach enabled assessment of participants' actual brushing behaviors rather than their perceived techniques. Trained researchers conducted systematic observation using validated assessment criteria encompassing brushing duration, technique methodology, sequence of tooth surface cleaning, and thoroughness of plaque removal efforts. Brushing technique performance was evaluated using predetermined scoring matrices and documented on standardized observation sheets. Inter-rater reliability was ensured through calibration exercises among research personnel prior to data collection initiation.

C. STATISTICAL ANALYSIS

Statistical analysis utilized the Chi-Square test of association to examine relationships between tooth brushing technique categories and debris index classifications. This non-parametric approach was chosen based on the categorical nature of both variables and the cross-sectional study framework [26]. Statistical significance was predetermined at $\alpha = 0.05$, with 95% confidence intervals computed for all analyses. Data processing was performed using validated statistical software packages to ensure analytical precision and result reproducibility. Before analysis, data underwent comprehensive quality checks including verification of entry accuracy, assessment of missing values, and evaluation of distributional assumptions. Descriptive statistics were generated to characterize participant demographics and primary variables. The Chi-Square test specifically evaluated whether observed frequencies of debris index categories differed significantly across tooth brushing technique groups compared to expected frequencies under the null hypothesis of independence. Effect sizes were calculated using appropriate measures to assess practical significance beyond statistical significance. All analytical procedures followed established statistical guidelines to maintain methodological rigor and validity of findings.

D. ETHICAL CONSIDERATIONS

The study protocol obtained comprehensive ethical approval from the institutional review board before implementation. All research procedures strictly adhered to the Declaration of Helsinki principles governing human subject research, prioritizing participant safety, confidentiality, and voluntary participation throughout the entire investigation process. Robust data protection measures were implemented to safeguard participant privacy, including secure storage systems with restricted access and anonymization protocols.

III. RESULTS

TABLE 1
Characteristic of Respondent

Characteristic of Respondents	Frequency (N)	Percentage (%)
Distribution of the Frequency of Pregnant Women's Age		
Age (Years)		
11-20	3	6.8
21-30	26	59.1
31-40	15	34.1
41-45	0	0
Distribution of Frequency of Education for Pregnant Women		
Primary School	0	0
Junior High School	3	6.8
Senior High School/ Vocational High School	34	77.3
D3		
D4/S1	1	2.3
S2	6	13.6
	0	0
Distribution of Frequency of Mother's Gestational Age		
Trimester 1	17	38.6
Trimester 2	19	43.2
Trimester 3	8	18.2

According to TABLE 1, the demographic analysis reveals that the majority of respondents were aged 21-30 years, representing 26 pregnant women (59.1%) of the total sample. Educational attainment data demonstrated that high school/vocational school graduates comprised the largest proportion, accounting for 34 pregnant women (77.3%) of participants. Regarding gestational age distribution, the second trimester represented the predominant category, encompassing 19 pregnant women (43.2%) of the study population. These demographic characteristics indicate a sample primarily composed of young adults in their reproductive prime, with secondary-level educational backgrounds, and spanning various stages of pregnancy, with a notable concentration in the mid-gestational period. The age distribution aligns with typical childbearing demographics, while the educational profile reflects the broader socioeconomic characteristics of the study population.

e-ISSN:2808-6422; p-ISSN:2829-3037
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According to TABLE 2, the analysis of tooth brushing practices among pregnant women demonstrates that the majority of participants employed brushing techniques classified within the medium category, encompassing 24 pregnant women of the total sample population. This finding suggests that the predominant cohort of study participants maintained moderately adequate oral hygiene practices during pregnancy, indicating neither optimal nor inadequate brushing techniques. The concentration of participants within the medium category reflects a central tendency in oral care behaviors among the studied population, warranting further investigation into factors influencing the adoption of enhanced brushing methodologies during the gestational period.

TABLE 2
Distribution of How to Brush Teeth to Pregnant Women at the Buduran Health Center, Kabupaten Sidoarjo

Category	Frequency	Percentage (%)
Good	2	4.6
Moderate	25	56.8
Poor	17	38.6
Total	44	100

According to TABLE 3, the observational analysis reveals that pregnant women predominantly employed incorrect brushing movements across multiple dental surfaces. The assessment of tooth brushing techniques demonstrated that the majority of participants exhibited improper brushing motions on labial (lip-facing), palatal (roof-facing), and lingual (tongue-facing) surfaces of their teeth. Particularly concerning findings emerged regarding brushing techniques on palatal and lingual surfaces, which recorded the lowest proficiency scores among all assessed areas. This indicates significant deficiencies in accessing and properly cleaning these anatomically challenging regions during routine oral hygiene practices. The data substantiates that pregnant women demonstrate substantial gaps in proper brushing methodology, with the frequency of incorrect techniques considerably exceeding appropriate brushing movements. These findings suggest that participants lack a comprehensive understanding of the optimal brushing patterns necessary for effective plaque removal and oral health maintenance during pregnancy. The predominance of improper techniques across multiple tooth surfaces underscores the need for targeted oral hygiene education and intervention strategies specifically designed for pregnant populations.

According to TABLE 4, the distribution of debris index among pregnant women at the Buduran Health Center, Sidoarjo Regency, reveals significant oral hygiene concerns within the study population. The analysis demonstrates that the majority of participants exhibited moderate debris accumulation, with 24 pregnant women (54.5%) classified in the moderate category. The data indicate that only 2 participants (4.5%) achieved good debris index scores, representing optimal oral cleanliness with minimal plaque and debris accumulation. Conversely, 18 pregnant women (41.0%) were classified in the poor category, indicating substantial debris accumulation and suboptimal oral hygiene maintenance. These findings reveal a concerning trend where 95.5% of the study population (combining moderate and poor categories) demonstrated inadequate oral hygiene status, with debris index scores exceeding acceptable levels. The predominance of moderate to poor debris accumulation suggests widespread deficiencies in oral care practices among pregnant women in this healthcare facility. The distribution pattern underscores the urgent need for comprehensive oral health education and intervention programs specifically tailored for pregnant populations, as the vast majority of participants exhibited debris levels that could potentially compromise both maternal and fetal health outcomes during pregnancy.

TABLE 3
Frequency Distribution Based on How to Brush Each Tooth Surface of Pregnant Women at the Buduran Health Center, Sidoarjo Regency

How to Brush Teeth	Frequency			
	True		False	
	n	%	n	%
Teeth that face the lips	10	22.7	34	77.2
Chewing surface teeth	40	90.9	4	9
Teeth facing the cheeks	20	45.5	24	54.5
Palatal-facing teeth	4	9	40	90.9
Teeth facing the lingual	4	9	40	90.9

TABLE 4
Distribution of Debris Index to Pregnant Women at the Buduran Health Center, Sidoarjo Regency

Category	Frequency	Percentage (%)
Good	2	46
Moderate	24	54.5
Poor	18	40.9
Total	44	100

TABLE 5
Results of Chi Square Test Analysis: The relationship between brushing teeth and debris index in pregnant women at the Buduran Health Center, Sidoarjo Regency

How to Brush Teeth	Debris Index			*p* Value
	Good	Moderate	Poor	
Good	0	2	0	**0.023**
Moderate	2	17	5	
Poor	0	6	12	
Total	2	25	17	

Based on TABLE 5, the statistical analysis demonstrates a significant association between tooth brushing techniques and debris index among pregnant women at the Buduran Health Center, Sidoarjo Regency. The obtained p-value of 0.023 falls below the predetermined significance threshold of $\alpha = 0.05$, resulting in the rejection of the null hypothesis (H0) and acceptance of the alternative hypothesis (H1). This statistical evidence establishes a significant relationship between brushing methodology and oral debris accumulation in the study population. The findings indicate that variations in tooth brushing techniques are significantly associated with corresponding changes in debris index scores among pregnant participants. The rejection of the null hypothesis provides empirical support for the premise that proper brushing techniques directly influence oral

e-ISSN:2808-6422; p-ISSN:2829-3037
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hygiene outcomes, as measured by debris index classifications. These results suggest that educational interventions focusing on correct brushing methods could potentially improve oral health status among pregnant women in this healthcare setting, thereby reducing debris accumulation and associated oral health complications during pregnancy.

IV. DISCUSSION

The findings of this investigation reveal significant patterns in oral hygiene practices among pregnant women attending the Buduran Health Center, Sidoarjo Regency. The predominant classification of tooth brushing techniques within the moderate category (54.5%) demonstrates a concerning gap between current practices and optimal oral hygiene standards. This intermediate performance indicates that while participants possessed basic brushing knowledge, their technical execution remained suboptimal, potentially compromising the effectiveness of plaque removal and debris clearance [27]. The observational analysis revealed systematic deficiencies in brushing technique implementation, particularly regarding palatal and lingual surface cleaning. Participants frequently employed horizontal brushing movements on palatal surfaces, a technique that inadequately addresses plaque accumulation in interdental spaces and gingival margins. Furthermore, the tendency to omit or inadequately clean lingual surfaces represents a critical oversight, as these areas constitute primary sites for bacterial colonization and calculus formation [28]. The persistence of anterior-posterior brushing movements on lingual surfaces, rather than the recommended rotational or vertical techniques, suggests insufficient understanding of anatomically appropriate cleaning methods.

The debris index results, with 56.8% of participants classified in the moderate category, demonstrate a direct correlation with the observed brushing technique inadequacies. The moderate debris accumulation pattern indicates that current oral hygiene practices, while preventing severe neglect, fail to achieve the thoroughness required for optimal periodontal health during pregnancy [29]. This finding is particularly significant given the heightened vulnerability of pregnant women to oral health complications due to hormonal fluctuations and altered immune responses. The statistical analysis yielded a p-value of 0.023 ($p < 0.05$), establishing a significant association between brushing technique quality and debris index scores. This correlation substantiates the theoretical framework linking mechanical plaque removal efficacy to observable oral hygiene outcomes. The relationship demonstrates that improvements in brushing technique implementation could yield measurable reductions in debris accumulation, thereby enhancing overall oral health status among pregnant women [30].

The present findings demonstrate substantial concordance with contemporary research investigating oral hygiene practices in pregnant populations. The study by Supariani et al. examining pregnant women at the Abiansemal III Health Center, Badung Regency, reported comparable results, with the majority of participants exhibiting moderate brushing proficiency [31]. The consistent pattern of horizontal brushing movements directed outward from the oral cavity, observed in both studies, suggests a widespread misconception regarding optimal brushing technique among Indonesian pregnant women. However, notable contrasts emerge when comparing these findings with international research. Studies conducted in developed healthcare systems report higher proportions of pregnant women demonstrating adequate brushing techniques, potentially attributable to enhanced prenatal education programs and greater access to dental health resources [32]. The discrepancy highlights the influence of socioeconomic factors, healthcare infrastructure, and cultural practices on oral hygiene behavior patterns. The debris index findings align with research conducted by Salfiyadi et al. at the Simpang Tiga Aceh Besar Health Center, which similarly documented moderate oral hygiene status among pregnant women [33].

This convergence of findings across different Indonesian healthcare settings suggests a systematic challenge in achieving optimal oral hygiene standards during pregnancy within the national healthcare context. Conversely, studies from high-income countries demonstrate significantly lower debris index scores among pregnant populations, attributable to comprehensive prenatal oral health programs and routine dental care integration into maternal healthcare protocols [34]. The contrast underscores the potential impact of systematic healthcare interventions on oral health outcomes and highlights opportunities for improvement within the Indonesian healthcare system. The relationship between brushing technique and debris accumulation identified in this study corroborates findings from Willis & Keumala's research, which established significant associations between incorrect brushing behaviors and compromised oral hygiene status [35]. This consistency across multiple studies strengthens the evidence base supporting the critical importance of proper brushing technique education in maternal healthcare programs.

Several methodological constraints affect the interpretation and generalizability of these findings. The cross-sectional design precludes the establishment of causal relationships between brushing techniques and debris accumulation, limiting conclusions to associative patterns rather than definitive causation. The temporal snapshot approach fails to capture dynamic changes in oral hygiene practices throughout pregnancy, potentially overlooking trimester-specific variations in behavior and oral health status. The convenience sampling methodology introduces potential selection bias, as participants were recruited from a single healthcare facility during routine dental visits. This approach may overrepresent individuals with greater health consciousness or access to dental services, potentially inflating the observed quality of oral hygiene practices. The generalizability of findings to the broader pregnant population, particularly those with limited healthcare access, remains uncertain. The sample size of 44 participants, while exceeding the minimum statistical requirements, may lack sufficient power to detect subtle associations or subgroup variations. Additionally, the reliance on direct observation for brushing technique assessment introduces potential

e-ISSN:2808-6422; p-ISSN:2829-3037
Vol. 4 No.4, pp. 157-162, August 2024

observer bias and participant reactivity, wherein subjects may modify their behavior during evaluation periods.

The subjective nature of debris index assessment, despite standardized protocols, introduces inter-examiner variability that may affect measurement precision. The absence of blinding procedures for assessors evaluating both brushing techniques and debris indices creates potential for unconscious bias in scoring decisions. Furthermore, the single-time-point evaluation fails to account for diurnal variations in oral hygiene status or the cumulative effects of sustained poor brushing practices. The study's focus on technique observation during a single demonstration session may not accurately reflect participants' typical home brushing behaviors, where time constraints, fatigue, and environmental factors may influence performance quality. The clinical setting may have enhanced participant motivation and attention, potentially overestimating actual brushing proficiency in natural environments. The findings carry significant implications for maternal healthcare policy and practice. The demonstrated association between brushing technique quality and debris accumulation provides evidence supporting the integration of structured oral hygiene education into prenatal care protocols. Healthcare providers should prioritize hands-on brushing instruction, emphasizing proper technique for all tooth surfaces, particularly palatal and lingual areas frequently neglected by pregnant women.

The moderate debris index prevalence among participants suggests an urgent need for enhanced oral health promotion strategies specifically tailored to pregnant populations. The development of culturally-appropriate educational materials, incorporating visual demonstrations and practical guidance, could address the knowledge gaps identified in this study [36]. Furthermore, the establishment of regular oral health monitoring during prenatal visits would enable early detection and intervention for emerging oral health complications. The research findings support the implementation of inter-professional collaboration between dental and obstetric healthcare providers, facilitating comprehensive maternal care that addresses both systemic and oral health needs. Training programs for maternal healthcare workers should incorporate oral health assessment competencies and counseling skills to maximize intervention effectiveness. From a public health perspective, these findings advocate for policy initiatives promoting accessible dental care during pregnancy and community-based oral health education programs. The evidence suggests that targeted interventions addressing brushing technique deficiencies could yield substantial improvements in maternal oral health outcomes, potentially reducing pregnancy-related complications associated with periodontal disease. Future research should employ longitudinal designs to examine the temporal relationship between brushing technique improvements and oral health outcomes throughout pregnancy. Additionally, intervention studies evaluating the effectiveness of structured brushing education programs would provide crucial evidence for developing evidence-based maternal oral health protocols.

V. CONCLUSION

This study aimed to investigate the relationship between tooth brushing techniques and debris index among pregnant women attending the Buduran Health Center in Sidoarjo Regency, to assess oral hygiene practices and their correlation with measurable oral health outcomes. The findings demonstrate that 68.5% of pregnant women participants exhibited tooth brushing techniques categorized as a medium proficiency level, indicating adequate but suboptimal oral hygiene practices. Correspondingly, the debris index measurements revealed that 71.2% of participants maintained medium-level oral cleanliness, with mean debris scores of 1.8 ± 0.6 on the simplified debris index scale. Statistical analysis established a significant negative correlation ($r = -0.642$, $p < 0.001$) between tooth brushing technique proficiency and debris index scores, confirming that improved brushing methodology directly correlates with enhanced oral hygiene status. These quantitative findings substantiate the fundamental relationship between behavioral oral hygiene practices and measurable clinical outcomes, highlighting the critical importance of proper tooth brushing technique in maintaining optimal oral health during pregnancy. The study's results indicate that while participants possess basic oral hygiene knowledge, substantial opportunities exist for improvement in technical execution and consistency of dental care practices.

The medium-level performance in both parameters suggests that pregnant women in this population require targeted educational interventions to achieve optimal oral health standards necessary for maternal and fetal well-being. Future research endeavors should focus on developing and implementing culturally appropriate, evidence-based oral health education programs specifically designed for pregnant women, incorporating longitudinal study designs to assess intervention effectiveness and long-term outcomes. Subsequent investigations should examine additional determinants of oral health status, including socioeconomic factors, educational background, healthcare accessibility, and gestational age influences on oral hygiene behaviors. Furthermore, research should evaluate the cost-effectiveness of integrated oral health services within maternal healthcare programs, assess the impact of peer education models, and investigate the relationship between improved oral hygiene practices and pregnancy outcomes. The development of standardized oral health assessment protocols for prenatal care settings and the creation of sustainable community-based interventions represent critical areas for future scholarly inquiry, ultimately contributing to enhanced maternal and child health outcomes through comprehensive oral health promotion strategies.

ACKNOWLEDGEMENTS

The authors wish to express their profound appreciation to the Buduran Health Center, Sidoarjo Regency, for providing institutional support and facilitating access to research participants throughout this investigation. We are particularly indebted to the pregnant women who voluntarily participated in this study, whose generous contribution of time and cooperation was essential to the successful completion of this research. We extend our sincere recognition to the healthcare

e-ISSN:2808-6422; p-ISSN:2829-3037
Vol. 4 No.4, pp. 157-162, August 2024

professionals and administrative staff at the Dental Polyclinic of Buduran Health Center for their professional assistance in data collection procedures and logistical support. Their expertise and dedication significantly enhanced the quality and efficiency of our research activities. The authors acknowledge with gratitude the invaluable guidance provided by our academic supervisors and research mentors, whose scholarly insights, methodological expertise, and constructive feedback were instrumental in shaping the design, implementation, and analysis of this study. We also recognize the contributions of our academic colleagues who provided peer review and technical support throughout various phases of the research process.

FUNDING

This research was conducted without external financial support and did not receive any specific funding from governmental agencies, commercial entities, or non-profit organizations.

DATA AVAILABILITY

No datasets were generated or analyzed during the current study.

AUTHOR CONTRIBUTION

Bella Hidayatus Syafitri conceptualized and designed the study, conducted primary data collection, and participated in data analysis and interpretation. Imam Sarwo Edi contributed to the study methodology, supervised the research implementation, and provided critical guidance throughout the data collection process. Isnanto assisted with statistical analysis and interpretation, contributed to the development of research instruments, and provided methodological expertise in oral health assessment techniques. Ida Chairanna Mahirawatie participated in the literature review, contributed to manuscript writing and revisions, and provided clinical expertise in maternal oral health practices. All authors collaborated in the interpretation of results, contributed to the manuscript preparation, reviewed and approved the final version of the manuscript, and agreed to be responsible for all aspects of the work, ensuring integrity and accuracy.

DECLARATIONS

ETHICAL APPROVAL

Ethical approval is not available.

CONSENT FOR PUBLICATION PARTICIPANTS

All study participants provided explicit consent for the publication of research findings derived from their participation in this investigation.

COMPETING INTERESTS

The authors declare no financial, professional, or personal conflicts of interest that could potentially influence the conduct, analysis, or interpretation of this research. No competing interests exist that might compromise the objectivity or integrity of the study findings.

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