IOSR Journal of Nursing and Health Science (IOSR-JNHS)
e-ISSN: 2320–1959.p- ISSN: 2320–1940 Volume 13, Issue 3 Ser.5 (May. – June. 2024), PP 12-18
www.iosrjournals.org

Evaluation Of The Correlation Between Self-Reported And Clinical Measurement Of Bleeding On Probing (BOP) In Some Communities In Lagos

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Abstract
Background: *Gingivitis, a gum inflammation caused by plaque buildup, is a major public health concern around the world which can lead to severe periodontal destruction with tooth loss and other systemic health complications if left untreated. Bleeding on probing (BOP) after gentle probing is a widely acknowledged clinical indicator for evaluating gingival inflammation and periodontal health.*
Self-reported measures of oral health, such as bleeding on brushing (BOB) are often used in epidemiological studies and public health surveys due to their cost-effectiveness and ease of administration. These measures rely on individuals' perceptions and recollections of their oral health status, which can be influenced by their knowledge, awareness, and cultural beliefs.
Previous studies that have explored the correlation between self-reported and clinically measured BOP, reported mixed findings. Hence, this research aimed to evaluate the correlation between self-reported (BOB) and clinical measurements of Bleeding on Probing (BOP) in some communities in Lagos.
Materials and Methods: *In this cross-sectional study, 236 consented individuals above 18year old were recruited into the study during medical outreaches in two communities in Lagos. A structured, interviewer-administered questionnaire was used to obtain the sociodemographic and other relevant data, including their oral hygiene practices after which all received an intraoral examination under natural light with sterile mirrors and the CPI periodontal probes. Oral hygiene and gingival health status were assessed using Simplified Oral Hygiene Index and Bleeding on Probing–BOP index respectively.*
Results: *67.5% of those who had Gingivitis (BOP ≥ 10%) correctly self-reported gingival bleeding, while 45.3% of those that had healthy gingiva correctly self-reported it. The association was statistically significant (0.001). There was a significant relationship between self-reported gingival bleeding and clinically assessed gingival bleeding (BOP)P value = 0.005. There was also a weak significant positive correlation of 0.23.*
Conclusion: *The association between self-reported gingival bleeding (BOB) and clinically assessed gingival bleeding (BOP) was significant and demonstrated a weak positive correlation.*
Keywords: *Bleeding on probing (BOP), Self-reported gingival bleeding, Bleeding on brushing (BOB), Gingivitis, Gingival bleeding, Periodontal health.*

Date of submission: 20-06-2024 Date of acceptance: 30-06-2024

I. Introduction

Gingivitis, marked by the inflammation of the gingiva due to plaque buildup, is a major public health issue worldwide, impacting individuals across all age groups and backgrounds[1], and if not appropriately managed, can progress to more severe periodontal destruction, eventually leading to tooth loss and systemic health complications[2]. Bleeding on Probing (BOP), observed as bleeding from the gingival sulcus when gently probed with a periodontal probe, is as an objective measure of gingival inflammation and is widely accepted as a reliable indicator of periodontal disease activity[3]. Early detection and intervention are essential in the management of gingivitis, with bleeding on probing (BOP) serving as a critical clinical parameter in periodontal assessment. BOP is a widely acknowledged clinical indicator for evaluating gingival inflammation and periodontal health and it is crucial for effective diagnosis, treatment planning, and monitoring of periodontal therapy outcomes. In Nigeria, the prevalence of periodontal disease is significant, as various studies have indicated high rates of gingivitis and periodontitis across diverse population groups[4]. Lagos, as one of the largest and most densely populated cities in Nigeria, presents unique challenges in oral health care delivery and disease management due to its diverse population and varying socio-economic conditions. Self-reported measures of oral health, including bleeding on brushing (BOB), are often used in epidemiological studies and public health

surveys due to their cost-effectiveness and ease of administration. These measures rely on individuals' perceptions and recollections of their oral health status, which can be influenced by various factors such as knowledge, awareness, and cultural beliefs[5]. While self-reported data can provide valuable insights into population health trends, their accuracy and reliability compared to clinical assessments are often questioned. There is a gap in the individuals perception and report of their gingival health compared to clinical assessments such as BOP. Several studies have explored the correlation between self-reported and clinically measured BOP, with mixed findings. Some research indicates a moderate to strong correlation, suggesting that self-reported BOB can be a reliable proxy for clinical measurements while other studies reported poor agreement, highlighting potential discrepancies between perceived and actual periodontal health[6-9]. For example, a household-based survey among Nigerian children found that while many reported good oral health practices, clinical examinations revealed a high prevalence of gingivitis, indicating a mismatch between perceived and actual oral health status[8]. Another study focusing on adults in Nigeria emphasized that self-reported oral health problems often do not align with clinical evaluations, underscoring the importance of further research across different population groups and geographical contexts to understand these discrepancies better[9]. The highlighted discrepancies between self-reported oral health and clinical findings emphasize the need for further investigation across different population groups and geographical contexts and suggest a need for more comprehensive and accurate oral health assessments in Nigeria, which could help in developing targeted interventions and improving overall dental care. This research aimed to evaluate the correlation between self-reported and clinical measurements of Bleeding on Probing (BOP) in some communities in Lagos.

II. Material And Methods

This cross-sectional study was conducted in two communities; Iyana-Iba in Ojo local government and Ipodo in Ikeja local government councils in Lagos State, Nigeria during medical outreach organized by the Government. At Iyana-Iba, the outreach was in the Ojo campus of Lagos State University (LASU) which is readily accessible to residents within the environment as the gates are situated close to the main roads. The Ipodo outreach was at Ipodo market in front of the king's palace in Ikeja.

Study Design Cross-sectional study
Study Location: Ojo campus of Lagos State University (LASU), Ojo local government and Ipodo market in front of the king's palace in Ikeja local government; both in Lagos, Nigeria.
Study Duration: May 2024 to June 2024
Sample size: 236 participants.
Sample size calculation: The minimum sample size was determined based on the formula: $n = \frac{Z^2 P(1-P)}{d^2}$

P (Prevalence of gingivitis from previous Nigerian study)=85.2%[10]
d (Error margin= 5%
Z (statistic for a 95% level of confidence) = 1.96

$$n = \frac{3.84 \times 0.852 \times (1-0.852)}{0.05 \times 0.05} = 193.7 \text{ (approx 194)}$$

Putting Non-response rate at 10%, the minimum sample size required for this study was two hundred and fourteen (214). To exceed the minimum, 236 consecutive consenting individuals who met the inclusion criteria were included in the study.

Subjects & selection method: The targeted population were individuals who reside in the two communities and presented at the medical outreach organized. The subjects were selected by a convenient sampling method by including all consecutive individuals who consented to participate in the study.

Inclusion criteria:
1. Aged ≥ 18 years
2. Resident in the target community for a minimum of 6 months.
3. Physical presence at the medical outreach

Exclusion criteria:
1. Age < 18 years Mentally disabled
2. Refusal to give consent

Procedure methodology: Written informed consent was obtained from each participant. A structured, interviewer-administered questionnaire was used to obtain the sociodemographic and other relevant data, including their oral hygiene practices. Each participant thereafter received an intraoral examination, where their

oral hygiene and gingival health status were assessed under natural light with sterile mirrors and the CPI periodontal probes.

The Simplified Oral Hygiene Index of Greene and Vermillion was used to measure oral hygiene, while the Bleeding on Probing–BOP index assessed the extent of gingival bleeding and inflammation.

Simplified Oral Hygiene Index (OHI- S) Greene and Vermillion, is a composite index of oral debris score and calculus score which assesses the oral debris and calculus accumulation.

The scores are on a graded scale of 0- 3 using six surfaces of six index teeth (16, 11, 26, 31, 36 and 46)

The debris scores are assigned as follows:

0 - No debris or stain found.

1 - Soft debris or extrinsic stain covering not more than 1/3rd of the tooth surface.

2 - Soft debris or stain covering more than 1/3rd but not more than 2/3rd of the exposed tooth surface.

3 - Soft debris covering more than 2/3rd of the exposed tooth surface.

The calculus scores were assigned as follows:

0 - No Calculus present.

1 - Supragingival calculus covering not more than one-third of the exposed tooth surface.

2 - Supra gingival calculus covering more than one-third but not more than two-third of the exposed tooth surface or the presence of individual flecks of subgingival calculus around the cervical portion of the tooth or both.

3 - Supra gingival calculus covering more than two-third of the exposed tooth surface or a continuous heavy band of subgingival calculus around the cervical portion of tooth or both. The sum of the points given for every separate tooth was divided by number of teeth to give the score for the individual.

The sum of the Simplified Calculus index (CI- S) and the Simplified Debris index (DI- S) gives the Simplified Oral Hygiene index (OHI- S) score for the individual.

The categorization of debris index and calculus index was as follows: 0.0–0.6 = Good; 0.7–1.8 = Fair; and 1.9–3.0 = Poor, while that of oral hygiene status was as follows: 0.0–1.2 = Good; 1.3–3.0 = Fair; and 3.1–6.0 = Poor.

Bleeding on Probing–BOP index assessed the extent of gingival bleeding and inflammation. Four surfaces of all teeth were assessed regarding whether probing elicits bleeding (+) or not (−), on a scale of 0 and 1. 0 =Absent, 1= Present. BOP score (%) was calculated as the total number of sites with gingival bleeding on probing divided by the total number of sites examined (4 sites at each tooth), multiplied by 100.

Percentage of bleeding points was categorized as follows: Acceptable gingival health BOP< 10%; Mild Gingivitis ≥10% to < 30%; Moderate Gingivitis ≥30% to <50% and Severe Gingivitis ≥50%.

Statistical analysis: This was carried out using SPSS 24 (IBM SPSS Inc). Descriptive statistics were carried out for socio-demographic variables such as age, marital status, occupation, educational status and profession. For descriptive variables that are continuous, parameters such as mean, median, minimum, and maximum and measures of variability was determined. For descriptive variables that are categorical, simple frequency and percentages were determined. The relationship between the prevalence of self-reported gingival bleeding and bleeding on probing in the subjects was determined statistically using Pearson's chi square and Fisher's exact as appropriate.

Phi correlation coefficient was used to determine the relationship between the self-reported gingival bleeding and the bleeding on probing. Statistical significance was inferred at $p \leq 0.05$.

III. Results

Table 1 shows the sociodemographic and clinical characteristics of the respondents as well as their oral hygiene practices. The mean age of the respondents was 46.56 ± 9.95 with the males having a significantly higher mean age (48.70±10.73) than the males. There were however no significant differences between the other sociodemographic and oral hygiene practices, even though males had a higher proportion of respondents with tertiary education (88.8%), and those that had never visited the dentist (94.4%) while females had a higher proportion of those that brush twice daily (38.1%), those that used toothbrushes (88.4%), those that used medium toothbrushes (54.4%) and those that used dental floss (17.0%).

Table 1: Socio-Demographic Characteristics and Oral Health Practice of Participants

		Male 89 (37.7%)	Female 147 (62.3%)	p-value
Age Range: Mean: ≤ 25yrs	 21yrs – 85yrs 46.56 ± 9.95 9 (3.8%)	 24yrs – 85yrs 48.70±10.73 2 (2.2%)	 21yrs – 62yrs 45.27±9.24 7 (4.8%)	 0.026*

26yrs - 45yrs	89 (37.7%)	32 (36.0%)	57 (38.8%)	X^2= 9.295
46yrs - 65yrs	133 (56.4%)	50 (56.2%)	83 (56.4%)	
>65yrs	5 (2.1%)	5 (5.6%)	0 (0%)	
Educational level				
Primary	7 (3.0%)	3 (3.3%)	4 (2.7%)	0.474
Secondary	26 (11.0%)	7 (7.9%)	19 (12.9%)	X^2=1.493
Tertiary	203 (86.0%)	79 (88.8)	124 (84.4%)	
Frequency of Routine Dental visits				
Once a year	18 (7.6%)	4 (4.5%)	14 (9.5%)	0.783
Every 6months	3 (1.3%)	1(1.1%)	2 (1.4%)	X^2=0.489
Every 3months	1 (0.4%)	0 (0%)	1 (0.7%)	
Never visited	214 (90.7%)	84 (94.4%)	130 (88.4%)	
Frequency of tooth brushing				
Once	157 (66.5%)	66 (74.2%)	91 (61.9%)	0.053
Twice or more	79 (33.5%)	23 (25.8%)	56 (38.1%)	X^2= 3.737
Material used for cleaning mouth				
Toothbrush	207 (87.7%)	77 (86.5%)	130 (88.4%)	0.319
Chewing stick	8 (3.4%)	5 (5.6%)	3 (2.0%)	X^2= 2.287
Toothbrush & chewing stick	21 (8.9%)	7 (7.9%)	14 (9.5%)	
Type of toothbrush you use				
Don't use toothbrush	5 (2.1%)	4 (4.5%)	1 (0.7%)	0.036*
Soft	54 (22.9%)	20 (22.5%)	34 (23.1%)	X^2= 8.528
Medium	116 (49.2%)	36 (40.4%)	80 (54.4%)	
Hard	61 (25.8%)	29 (32.6%)	32 (21.8%)	
Use fluoridated toothpaste?				
No	67 (28.4%)	28 (31.5%)	39 (26.5%)	0.416
Yes	169 (71.6%)	61 (68.5%)	108 (73.5%)	X^2= 0.663
How do you brush your teeth?				
Horizontally	16 (6.8%)	8 (9.0%)	8 (5.4%)	0.210
Vertically	31 (13.1%)	9 (10.1%)	22 (15.0%)	X^2= 8.397
Horizontal & vertical	142 (60.2%)	54 (60.7%)	88 (59.9%)	
Roll technique	11 (4.7%)	7 (7.9%)	4 (2.7%)	
Vertical & roll	30 (12.7%)	8 (9.0%)	22 (15.0%)	
Horizontal, vertical & roll	1 (0.4%)	0 (0%)	1 (0.7%)	
Don't use toothbrush	5 (2.1%)	3 (3.4%)	2 (1.4%)	
Smoking status				
No	233 (98.7%)	86 (96.6%)	147 (100%)	0.081
Formerly(<1yr)	1 (0.4%)	1 (1.1%)	0 (0%)	X^2= 5.019
Lightly (<10sticks/day)	2 (0.8%)	2 (2.2%)	0 (0%)	
Use of dental floss?				
Yes	33 (14.0%)	8 (9.0%)	25 (17.0%)	0.085
No	203 (86.0%)	81 (91.0%)	122 983.0)	X^2=2.963
Use of toothpick?				
Yes	157 (66.5%)	59 (66.3%)	98 (66.7%)	0.953
No	79 (33.5%)	30 (33.7%)	49 (33.3%)	X^2=0.003
Use interdental brush?				
Yes	4 (1.7%)	1 (1.1%)	3 (2.0%)	1.000[c]
No	232 (98.3%)	88 (98.9%)	144 (98.0%)	

* Statistically significant (p-value ≤ 0.05)

Table 2 presents the self-reported gingival bleeding or self-assessed gingival inflammation of the respondents, stratified by gender. One hundred and twenty-four respondents or 52.5% reported gingival bleeding with 80.7% stating that the bleeding occurs sometimes and 91.9% stating that it occurs while brushing. Self-reported gingival bleeding was reported more by females (61.3%) and they also had a higher frequency of gingival bleeding (58.3%) and bleeding during brushing (63.2%) even though the association was not significant.

Table 2: Self-Reported Gingival Bleeding (SRGB)

		Male	Female	p-value
Do your gums bleed?				
No	112 (47.5%)	44 (39.3%)	68 (60.7%)	0.635
Yes	124 (52.5%)	45 (36.3%)	79 (61.3%)	X^2=0.225
Frequency of gum bleeding				0.542 X^2= 0.372
Often / always	24 (19.3%)	10 (41.7%)	14 (58.3%)	
Sometimes	100 (80.7%)	35 (35.0%)	65 (65.0%)	
When do your gums bleed?				
Unprovoked	3 (2.4%)	0 (0%)	3 (100%)	0.241[c]
While brushing	114 (91.9%)	42 (36.8%)	72 (63.2%)	0.192, X^2=1.705
While eating	8 (6.5%)	4 (50.0%)	4 (50.0%)	0.389[c]

Table 3 displays the normatively assessed oral hygiene and gingival status of the respondents, providing a gender-based breakdown of the data. Males had a higher mean OHIS score (1.73±1.30) and a higher mean bleeding on probing index score (12.32±17.37) even though the associations were not significant. Females had a higher proportion of subjects with good oral hygiene status (64.9%), healthy gingiva or Gingival inflammation < 10% of sites bleeding on probing (65.4%) and healthy gingiva based on gingivitis severity (65.4%).

Table 3: Clinical Parameters

		Male	Female	
OHI-S score				
Mean:	1.58±1.19	1.73±1.30	1.49±1.12	
Oral Hygiene Status				
Good 0-1.2	94 (39.8%)	33 (35.1%)	61 (64.9%)	0.466
Fair 1.3 -3.0	115 (48.7%)	43 (37.4%)	72 (62.6%)	X^2=1.529
Poor 3.1 -6.0	27 (11.4%)	13 (48.1%)	14 (51.9%)	
BOP Index score				
Mean:	11.80±20.06	12.32±17.37	11.48±21.58	
Healthy < 10%	159 (67.4%)	55 (34.6%)	104 (65.4%)	0.155
Gingivitis ≥ 10%	77 (32.6%)	34 (44.2%)	43 (55.8%)	X^2=2.020
Gingivitis Severity				
Healthy < 10%	159 (67.4%)	55 (34.6%)	104 (65.4%)	
Mild ≥ 10% - < 30%	42 (17.8%)	18 (42.9%)	24 (57.1%)	0.105
Moderate ≥ 30% - < 50%	20 (8.5%)	12 (60.0%)	8 (40.0%)	X^2=6.141
Severe ≥ 50%	15 (6.4%)	4 (26.7%)	11 (73.3%)	

Table 4 provides detailed data on how self-reported gingival bleeding corresponds to clinical diagnosis of gingivitis or healthy gingiva. Fifty-two or 67.5% of those who had Gingivitis (BOP ≥ 10%) correctly self-reported gingival bleeding, while 72 respondents or 45.3% of those that had healthy gingiva correctly self-reported it. The association was statistically significant (0.001).

Table 4: Self-reported and clinically diagnosed gingival bleeding

	Clinically diagnosed		p-value
SRGB	BOP < 10% Healthy n=159 (67.4%)	BOP ≥ 10% Gingivitis n=77 (32.6%)	
No	87 (54.7%)	25 (32.5%)	0.001*
Yes	72 (45.3%)	52 (67.5%)	X^2=10.299

* Statistically significant (p-value ≤ 0.05)

There was a significant relationship between self-reported gingival bleeding and clinically assessed gingival bleeding (BOP)P value = 0.005. There was also a weak positive correlation of 0.23 and this was significant. (Table 5 and 6)

Table 5: Self-reported gingivitis and clinically diagnosed Bleeding on probing (BOP) according to gender

SRGB	BOP<10% Healthy n=159 (67.4%)	BOP≥10% Gingivitis n=77 (32.6%)	p-value	Phi & Cramer correlation	
				coefficient	p-value
Male Yes	23	22	0.005*	0.230	0.005*
Male No	32	12	X^2= 12.661		
Female Yes	49	30			
Female No	55	13			

* Statistically significant (p-value ≤ 0.05)

Table 6: Sensitivity and Specificity of SRGB

	Sensitivity	Specificity
Male	64.7	58.2
Female	69.8	52.9
All	67.5	54.7

IV. Discussion

The study highlighted significant sociodemographic differences among the respondents, notably in terms of age and educational attainment. Males had a significantly higher mean age (48.70 ± 10.73) compared to females (46.56 ± 9.95), which might reflect broader demographic trends within the sampled communities. Additionally, males were more likely to have tertiary education (88.8%) and had a higher proportion of individuals who had never visited a dentist (94.4%). This disparity in dental visitation could be attributed to gender differences in health-seeking behaviors, with men often less likely to engage in preventive health

practices[11].These findings also align with previous research conducted in Nigeria, where males often demonstrate lower utilization of dental services and less engagement in preventive dental care compared to females[12,13]. The lower frequency of dental visits among males might be attributed to traditional gender roles and economic factors that prioritize other health issues over dental care[13].

Conversely, females demonstrated better oral hygiene practices. A higher proportion of females reported brushing twice daily (38.1%), using toothbrushes (88.4%), medium toothbrushes (54.4%), and dental floss (17.0%). These behaviors are consistent with findings from Nigerian studies indicating that females generally have better oral health practices and are more likely to adhere to recommended dental hygiene routines[14,15]. The gender differences in oral hygiene practices might be due to greater health awareness and more proactive health management among women. A notable finding from this study is that 52.5% of respondents reported experiencing gingival bleeding, predominantly occurring occasionally (80.7%) and during brushing (91.9%). Females reported higher rates of gingival bleeding (61.3%) compared to males. This gender disparity in self-reported gingival bleeding is consistent with findings from other studies suggesting that women are more likely to report health issues, including oral health problems, and seek medical or dental care[14,16]. Although the association between gender and self-reported gingival bleeding was not statistically significant, the observed trend suggests that women may be more attuned to their oral health status. This heightened awareness among women could be leveraged in public health campaigns aimed at improving oral health behaviours across both genders.

Clinical assessments revealed that males had higher mean OHIS scores (1.73 ± 1.30) and BOP index scores (12.32 ± 17.37), although these differences were not statistically significant. This indicates a trend towards poorer oral hygiene and greater gingival inflammation among males. On the other hand, females had a higher proportion of good oral hygiene status (64.9%) and healthy gingiva, characterized by less than 10% of sites bleeding on probing (65.4%). These findings are in line with previous research showing that females tend to have better periodontal health and adhere more rigorously to oral hygiene practices[17,18]. The clinical data underscores the importance of regular oral hygiene practices in maintaining periodontal health. The higher adherence to recommended oral hygiene practices among females, as evidenced by their better clinical outcomes, supports the effectiveness of these practices in preventing gingivitis and maintaining healthy gingivae[19].

A noteworthy finding of this study is the significant relationship between self-reported gingival bleeding and clinically assessed BOP. Specifically, 67.5% of respondents with clinically diagnosed gingivitis (BOP ≥ 10%) correctly self-reported gingival bleeding, while 45.3% of those with healthy gingiva accurately reported their condition. These findings align with previous studies that highlight the level of agreement between self-reported and clinically assessed periodontal health[20]. For example, Gilbert et al[5], reported that self-reported measures were good screening tools, but often lack the accuracy of clinical assessments. The weak correlation observed in this study is also comparable to findings by Buhlin et al6and Arowojolu et al[13] who observed variability in the accuracy of self-reported periodontal conditions. The significant association and the weak positive correlation suggest that while self-reported gingival bleeding can be indicative of clinical gingival status, it is a good screening tool but should be interpreted with caution in treatment planning. Thus, while self-reported data can provide valuable preliminary insights, particularly in large-scale epidemiological studies, they should be supplemented with clinical evaluations to ensure accuracy and reliability.

The study's findings have significant implications for public health strategies and periodontal disease management. The high prevalence of self-reported gingival bleeding and its correlation with clinical measures highlight the need for public awareness and education campaigns aimed at improving oral hygiene practices and encouraging regular dental check-ups. Gender-specific interventions might be beneficial, given the observed differences in oral hygiene practices and clinical outcomes. Self-reported measures are characteristically less expensive to collect compared to clinical data and are particularly beneficial in large-scale epidemiological studies in geographically dispersed and diverse populations where resources might be limited. These surveys are less invasive and can be easily administered to large populations and do not require specialized equipment, or extensive training for data collection, making them accessible and straightforward to implement. They are however subject to recall bias, social desirability bias, subjective judgments and perceptions, variability in interpretation by respondents from different cultural backgrounds and varying levels of health literacy.

Future public health initiatives should focus on enhancing the accuracy of self-reported oral health measures through improved educational tools and self-assessment techniques. Additionally, integrating regular clinical screenings in community health programs could bridge the gap between self-reported and clinically assessed periodontal health, ensuring more comprehensive and accurate monitoring of gingival health in diverse populations.

This study's limitations include potential recall bias in self-reported data and its cross-sectional design, which limits the ability to infer causality. Future research should employ longitudinal designs to track changes over time and explore the underlying factors influencing the discrepancies between self-reported and clinically

assessed gingival health. Expanding the study to include a more diverse population across different geographical contexts would also provide a broader understanding of the reliability and validity of self-reported oral health measures.

V. Conclusion

The association between self-reported gingival bleeding (Bleeding on Brushing; BOB) and clinically assessed gingival bleeding (BOP) was significant and demonstrated a weak positive correlation.

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