Research Article

The relationship between gingival pigmentation and periodontal health among a cohort of college students residing in Diyala city, Iraq

Ahmed Shukur Mahmood[1, 2], **Ban Sahib Diab**[1*], **Natheer H AL-Rawi**[3]

1 College of Dentistry, university of Baghdad , Baghdad, Iraq.
2 College of Dentistry, University of Al-Farahidi, Baghdad, Iraq.
3 Department of Oral & Craniofacial Health Sciences, College of Dental Medicine, University of Sharjah, Sharjah, United Arab Emirate.
*Corresponding author: drban_sahib@codental.uobaghdad.edu.iq

Received date: 02-04-2022
Accepted date: 22-06-2022
Published date: 15-06-2025

Article DOI

Abstract: Background: Gingival pigmentation is a type of gum pigment caused by a range of endogenous and exogenous Factors . Melanin granules occur in the oral environment and aid in periodontal integrity by neutralizing reactive oxygen species produced by dento-gingival plaque-induced inflammation in the periodontal micro-environment. Objectives: The purpose of this study was to determine the prevalence of gingival pigmentation and its relation to periodontal health. Materials and methods: This study utilises a comparative cross-sectional design and recruits students between the ages of 19 and 22 from Diyala University's College of Physical Education and Sport Science. Gingival pigmentation, age, and gender were correlated among the participants. In order to quantify the severity of gingival pigmentation, Kumar et al.'s (2012) gingival pigmentation index was utilized. WHO's Community Periodontal Index (CPI) from 1997 was utilized to assess periodontal health. Results: Gingival pigmentation was present in 9.11% of the cases. Students with healthy gums and calculus were more prevalent in the group with gingival pigmentation, while students with bleeding gums were more prevalent in the group with free gingival pigmentation. Conclusions: Gingival pigmentation may help reduce susceptibility to gingival inflammation.

Keywords: gingival pigmentation, periodontal status, community periodontal index.

Introduction

The color of healthy gum is typically coral-pink, except it can vary from light chestnut in the direction to dark brown depending on the degree of keratinization, gingiva thickness, vascularization, and the presence of melanocytic cells [1-3]. Gingival pigmentation manifests as a hazy, deep purple discoloration, striae, brown, light brown, or black strands, areas, or strands with an irregular shape. The cause is melanin granules that are produced by melanoblasts. The most well-known endogenous pigment is melanin, a brown pigment derived from non-hemoglobin. It is produced by melanocytes located in the basal and supra-basal cell layers of the epithelium [4]. Pigmentation of the gingiva is tinting of the gum caused by a number of endogenous and exogenous etiologic features present in a diversity of lesions and situations [5].

Melanin is a polymeric pigment that absorbs light and is widely distributed in nature. It is among the primary dyes with the purpose of providing color headed for mammalian tissues [6].

A variety of conditions that induce persistent damage to the tissues enveloping and supporting the teeth due to provocative responses are collectively referred to as periodontal disease. Gingivitis and chronic periodontitis are the most prevalent plaque-induced inflammatory conditions [7] [8]. Bacteria in dental plaque infect the tissue surrounding the tooth, causing inflammation and periodontal disease [9]. Plaque may

eventually harden into calculus. Plaque-induced gingivitis is an inflammation of the marginal gingiva (that does not result in epithelial loss. Periodontitis develops when the epithelial attachment is lost [10]. Furthermore, markers of gingival inflammation were lower in pigmented gingival subjects compared to non-pigmented gingival subjects [11]. Oral mucosal melanin can take action as a protection barrier by scavenging antioxidants and preventing oxidative stress through binding toxins such as free radicals and polycyclic compounds in the direction of melanin. Melanin is known to scavenge free radicals connected with superoxide anion that are produced as a result of phagocytosis bursts through respiration [11].The aim of the study was to test the occurrence of pigmented gingiva among college students and its relation to periodontal health.

Materials and Methods

The study was conducted using an observational cross-sectional comparative design among students between the ages of 19 and 22 who were enrolled in the College of Physical Education and Sport Science at Diyala University from December 2021 to March 2022. There were 1295 students in total.The research group comprised the entire student population with gingival pigmentation who did not meet the exclusion criteria, thus constituting the sample size. This research investigated the prevalence of gingival pigmentation and conducted a comparison between age-matched control pupils and those with pigmented gingiva (study versus control). Prior to commencing the study, the Physical Education and Sport Science College of the University of Diyala granted ethical approval for the research. The ethical committee of the College of Dentistry at the University of Baghdad approved the research protocol after obtaining informed consent from each participant. The study excluded students who had oral disease, students with medical disorders and diseases, those who were taking medications that induce oral pigmentation, pregnant and lactating women, and smokers. For the purpose of documenting individual student information, including but not limited to name, age, gender, gingival pigmentation score, and CPI score, a case sheet has been generated. In order to quantify the severity of gingival pigmentation, Kumar et al. [12] gingival pigmentation index was in place. WHO 1997 [13], Community Periodontal Index (CPI), was utilized to evaluate periodontal health.

Statistical analysis

The statistical analysis was conducted using the Statistical Package for Social Science (SPSS version 22; Chicago, Illinois, USA).Descriptive statistics include frequency and percentage for qualitative variables and mean and standard error for quantitative variables. Inferential statistics involve one-way analysis of variance (ANOVA) and independent sample T-test. The significance level was established at $p \leq 0.05$.

Results

The study group comprised 118 students, of which 118 had gingival pigmentation, representing a prevalence of 9.11%. The control group consisted of 118 students who did not have gingival pigmentation and matched the study group in age and gender.

In the study and control groups, Table 1 presents the distribution of students based on their highest CPI scores. The data presented in this table indicates that the proportion of students in the study group who had calculus (CPI2) and healthy gingiva (CPI0) was greater. Conversely, the control group had a higher proportion of students with hemorrhaging gingiva (CPI1).Table 2 presents the distribution of students in the study group based on the severity of gingival pigmentation who obtained the highest CPI score. The data presented in this table indicates that a greater proportion of students who reported gingival hemorrhage (CPI1) and were healthy (CPI0) had a gingival pigmentation score of 2. Conversely, a smaller proportion of students who had calculus (CPI2) had a gingival pigmentation score 2.

Table 1: Distribution of students according to the highest score of community periodontal index among gingival pigmentation groups

CPI# scores	Groups					
	Study			Control		
	N.	%within group	%Total*	N.	%within group	%Total
CPI (0)	34	28.81	14.41	28	23.73	11.86
CPI (1)	23	19.49	9.75	41	34.75	17.37
CPI (2)	61	51.69	25.85	49	41.53	20.76

CPI: Community Periodontal Index

*Percentage per total number of students in both case and control groups (236)

Table 2: Distribution of students according to highest scores of community periodontal index by gingival pigmentation severity

CPI# scores	Gingival pigmentation severity								
	1			2			3		
	N.	%within group	%Total*	N.	%within group	%Total	N.	%within group	%Total
CPI (0)	8	23.53	6.78	19	55.88	16.10	7	20.59	5.93
CPI (1)	7	30.43	5.93	11	47.83	9.32	5	21.74	4.24
CPI (2)	21	34.43	17.80	19	31.15	16.10	21	34.43	17.80

#Community Periodontal Index

*Percentage per total number of students in both study and control groups (236)

Table 3 displays the average number of sextants for each CPI category in both groups. The table indicates that the average gingival bleeding value (CPI1) was notably lower in the study group. However, the average values for healthy sextants (CPI0) and sextants with calculus (CPI2) were higher in the study group, but these differences were not statistically significant.(p>05).

Table 3: Descriptive and statistical test of Community Periodontal Index sextant (mean and SE) by gingival pigmentation groups

CPI# scores	Groups						
	Study		Control				
	Mean	±SE	Mean	±SE	T test value	df	P value
CPI (0)	4.237	0.154	3.814	0.161	1.902	234	0.058NS
CPI (1)	0.771	0.095	1.373	0.149	3.400	234	0.001.*
CPI (2)	1.000	0.114	0.814	0.109	1.185	234	0.237NS

#Community Periodontal Index

NS: Not significant (P>0.05)

*Significant (p≤0.05)

Table 4 displays the average number of sextants for each CPI group based on the severity of gingival pigmentation scores. However, data analysis showed that none of the differences were statistically significant.

Table 4: Descriptive and statistical test of Community Periodontal Index sextants (mean ±SE) among group with gingival pigmentation

CPI# scores	Gingival pigmentation scores							
	1		2		3			
	Mean	±SE	Mean	±SE	Mean	±SE	F	P value
CPI (0)	4.083	0.283	4.592	0.228	3.879	0.298	2.047	0.134 NS
CPI (1)	0.833	0.185	0.653	0.142	0.879	0.178	0.560	0.573 NS
CPI (2)	1.083	0.193	0.755	0.171	1.273	0.231	1.883	0.157NS

CPI: Community Periodontal Index
NS: Not significant (P>0.05)

Discussion

This research aimed to determine the prevalence of gingival pigmentation among students and its correlation with periodontal condition by comparing two groups. The gingival pigmentation index was utilized to identify the existence and extent of pigmentation. The prevalence rate was 9.11%, lower than the 11.26% reported in a prior study conducted by Mohammed and Diab in Iraq in 2020. The variation could be attributed to the age discrepancy, with participants in the prior study ranging from 13 to 16 years old, but in this study they were 19 to 22 years old. This conclusion aligns with the research by Jainanai et al. [14], which identified a correlation between age and pigmentation growth in the Indian population.

The periodontal condition was evaluated in 1997 using the World Health Organization's Community Periodontal Index. This procedure is straightforward and efficient, offering a rapid assessment of the periodontal condition and the level of severity in the least amount of time. The data indicates that the study group had a greater proportion of healthy students and had lower levels of gingival bleeding compared to the control group. The results align with prior studies carried out by Nilima in 2011 [15] , and Mohammed and Diab [16] in 2020 , Eid in 2013 [17], Alasmari in 2018 [18].

Gingival pigmentation and oxidative stress are interconnected factors that can influence each other in the oral cavity. Oxidative stress, characterized by an imbalance between reactive oxygen species (ROS) production and antioxidant defenses, has been implicated in various oral conditions, including periodontal diseases .Studies have shown that oxidative stress can lead to tissue damage and inflammation in the gingiva, affecting the overall health of the periodontium [19]. Furthermore, oxidative stress has been shown to play a critical role in periodontitis, a condition that can also impact gingival pigmentation [20][21]. Understanding the interplay between oxidative stress and gingival pigmentation is crucial for comprehensively addressing both the physiological and aesthetic aspects of oral health [22] [23].

Therefore, the study suggests that gingival pigmentation may provide protection due to the defensive properties of melanin, which can help neutralize reactive oxygen species produced during inflammation caused by plaque in the periodontal environment. Free radicals generated from oxygen can trigger various processes leading to matrix breakdown in the inflamed periodontium.

Conclusion

Within the limitations of this study, it can be concluded that Gingival pigmentation and oxidative stress are intertwined factors that can influence the health and appearance of the gingiva. Further research into the mechanisms underlying their relationship is essential for developing effective strategies to manage both oxidative stress-related oral conditions and gingival pigmentation issues.

Conflict of interest: None.

Author contributions:

ASM and BSD; study conception and design. Formal analysis, methodology. BSD and NHA; Writing-original draft. BSD and NHA; Writing-review & editing. Supervision. All authors reviewed the results and approved the final version of the manuscript to be published.

Data Availability Statement

The corresponding author may provide the data from this study upon request.

Funding and Acknowledgments

None

References

1. Pavlic V, Brkic Z, Marin S, Cicmil S, Gojkov-Vukelic M, Aoki A. Gingival melanin depigmentation by Er laser: A literature review. J Cosmet Laser Ther. 2018;20(2):85-90. https://doi.org/10.1080/14764172.2017.1376092

2. Kaya GŞ, Yavuz GY, Sümbüllü MA, Dayı E. A comparison of diode laser and Er: YAG lasers in the treatment of gingival melanin pigmentation. Oral surg oral med oral patho oral radio. 2012 1;113(3):293-9. https://doi.org/10.1016/j.tripleo.2011.03.005

3. Abd Ali EH, Abbas MJ, Mohammed HO. Common Oral Diseases, Aging and Oral Immunity. Indian J Forensic Med Toxico. 2019 Oct 1;13(4). https://doi.org/10.5958/0973-9130.2019.00401.8

4. Abbas R, Bano M, Mazhar S, Shigri AA. Periodontal disease status among adult population attending private dental hospital at gadap town karachi-. Baqai J Health Sci. 2019 Jan 1;22(1).

5. Javali MA, Roopali T, Deshmukh J. Esthetic management of gingival hyperpigmentation: report of two cases. Int J Dent Clin. 2011;3(3):115-7 .

6. Kauzman A, Pavone M, Blanas N, Bradley G. Pigmented lesions of the oral cavity: review, differential diagnosis, and case presentations. J Can Dent Assoc. 2004;70(9):682-3.

7. Jakubovics NS, Goodman SD, Mashburn-Warren L, Stafford GP, Cieplik F. The dental plaque biofilm matrix. Periodontl 2000. 2021 Jun;86(1):32-56. https://doi.org/10.1111/prd.12361

8. Meleti M, Vescovi P, Mooi WJ, van der Waal I. Pigmented lesions of the oral mucosa and perioral tissues: a flow-chart for the diagnosis and some recommendations for the management. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2008;105(6):606-16. https://doi.org/10.1016/j.tripleo.2007.07.047

9. Reis RA, Stolf CS, de Carvalho Sampaio HA, da Costa Silva BY, Özlü T, Kenger EB, et al. Impact of dietary inflammatory index on gingival health. J periodontol. 2024 Jun;95(6):550-62. https://doi.org/10.1002/JPER.23-0292

10. Armitage GC. Periodontal diagnoses and classification of periodontal diseases. Periodontol 2000. 2004;34:9-21. https://doi.org/10.1046/j.0906-6713.2002.003421.x

11. Bolognia JL, Lapia K, Somma S. Depigmentation therapy. Dermatologic Therapy. 2001 Jan;14(1):29-34. https://doi.org/10.1046/j.1529-8019.2001.014001029.x

12. Kumar S, Bhat GS, Bhat KM. Development in techniques for gingival depigmentation-An update. Indian J Dent Res. 2012;23(2):213-21. https://doi.org/10.1016/j.ijd.2012.05.007

13. World Health Organization (WHO). Oral health survey: Basic methods. 4th ed. Geneva: WHO; 1997.

14. Janiani P, Bhat PR, Trasad VA, Acharya AB, Thakur SL. Evaluation of the intensity of gingival melanin pigmentation at different age groups in the Indian population: An observational study. J Indian Soc Pedod Prev Dent. 2018;36(4):329-33. https://doi.org/10.4103/JISPPD.JISPPD_192_17

15. Nilima S, Vandana KL. Melanin: a scavenger in gingival inflammation. Indian J Dent Res. 2011;22(1):38-43. https://doi.org/10.4103/0970-9290.79973

16. Mohammed NJ, Diab BS. Gingival pigmentation in relation to dental caries among students in Diyala City/Iraq. J Res Med Dent Sci. 2020;8(1):30-3.

17. Eid HA, Syed S, Soliman AN. The role of gingival melanin pigmentation in inflammation of gingiva, based on genetic analysis. J Int Oral Health. 2013;5(1):1-7.

18. Alasmari DS. An insight into gingival depigmentation techniques: The pros and cons. Inter J health sci. 2018 Sep;12(5):84.

19. Dursun E, Akalın F, Genç T, Çınar N, Erel Ö, Yildiz B. Oxidative stress and periodontal disease in obesity. Medicine. 2016;95(12). https://doi.org/10.1097/MD.0000000000003136

20. Lin YH, Tu YK, Lu CT, Chung WC, Huang CF, Huang MS, et al. Systematic Review of Treatment Modalities for Gingival Depigmentation: A Random-Effects P oisson Regression Analysis. J Esth Restor Dent. 2014 May;26(3):162-78. https://doi.org/10.1111/jerd.12087

21. Nessa N, Kobara M, Toba H, Adachi T, Yamamoto T, Kanamura N, et al. Febuxostat attenuates the progression of periodontitis in rats. Pharmacology. 2021;106(5-6):294-304. https://doi.org/10.1159/000513034

22. Centers for Disease Control and Prevention (CDC). Periodontal disease. 2015.

23. Hedin CA, Axéll T. Oral melanin pigmentation in 467 Thai and Malaysian people with special emphasis on smoker's melanosis. J Oral Pathol Med. 1991;20(1):8-12. https://doi.org/10.1111/j.1600-0714.1991.tb00879.x

تصبغات اللثة وعلاقتها مع حالة اللثة بين طلاب الكلية في مدينة ديالى/العراق.

احمد شكر محمود, بان صاحب ذياب، نذير هاشم الراوي

المستخلص:

تصبغ اللثة هو نوع من أصباغ اللثة ناتج عن مجموعة من المسببات الداخلية والخارجية. تحدث حبيبات الميلانين في البيئة الفموية وتساعد في سلامة اللثة من خلال تحييد أنواه الاوكسجين التفاعلية التي تنتج عن الالتهاب الناجم عن اللويحات السنية في البيئة الدقيقة للثة. الهدف من هذه الدراسة هو تحديد مدى حدوث تصبغ اللثة. المواد وطرق العمل: البحث مقطعي مقارن يقارن طلاب كلية التربية البدنية وعلوم الرياضة بجامعة ديالى الذين لديهم تصبغ لثة بالطلاب الذين ليس لديهم لثة متصبغة متطابقين بالعمر والجنس. لقياس شدة تصبغ اللثة, تم تطوير مؤشر تصبغ اللثة بواسطة كومار ورزملاءه في عام 2012 لاختبار حالة اللثة, تم استخدام مؤشر اللثة المجتمعي(**CPI**) من قبل منضمة الصحة العالمية في عام 1997. النتائج: بلغ معدل انتشار تصبغ اللثة 9.11. كان الطلاب الذين لديهم لثة صحية (**CPI 0**) والذين لديهم تكلس (**CPI 2**) أكثر انتشاراً في مجموعة الدراسة مقارنة بمجموعة المقارنة بينما الطلاب الذين يعانون من نزيف اللثة (**CPI**)1كانوا اكثر لنتشاراً في جموعة المقارنة الخالية من التصبغ. الاستنتاج: وفقاً لنتائج البحث, قد يساعد تصبغ اللثة في تقليل التعرض لألتهاب اللثة.