



## Research Article

# Gingival Pigmentation Pattern in Correlation to Skin Color in a Group of Kurdish People in Sulaimani City

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## ABSTRACT

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**Keywords:** Depigmentation, Fitzpatrick scale, gingival pigmentation, Interdental papilla, Skin color.



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**Background:** Melanin pigmentation of the gingiva appears in all ethnicities. Excessive pigmentation is an esthetic concern that has increased awareness about depigmentation procedures. This epidemiological study aims to find the correlation between skin color and gingival pigmentation in Sulaimani Governorate, Kurdistan/Iraq.

**Subjects and Methods:** A total of 820 apparently healthy and non-smokers, including 338 males and 482 females with healthy gingiva, aged between (18-40 years old) were enrolled in this study. Clinical examination on the participants' gingivae was performed to assess color, and the distribution of pigmentations. Afterward the of participants skin color were visually examined and divided into six groups according to the Fitzpatrick scale.

**Results:** Skin color of (53%) of our participants was medium to light brown. Most of the pigmentations were observed in the attached gingiva and interdental papilla (26.83%) and least being in the marginal gingiva and interdental papilla (9.27%). A statistically significant correlation was found between the participants' skin color, and the intensity of their gingival pigmentations

**Conclusion:** Darker-skinned subjects have heavier gingival pigmentation compared to fair-skinned people in Sulaimani Governorate, Kurdistan/ Iraq. The intensity of gingival pigmentation increases with age with the highest rate of gingival pigmentation was in the upper and lower second premolar to premolar area.

## Introduction

The gingiva is a fundamental part of the periodontium that hides the alveolar processes of the jaws and the cervical part of the teeth (1).

Esthetics has become a significant point of dentistry, and clinicians must balance reaching acceptable gingival esthetics with addressing physical and functioning issues (2).

The gingiva's color is critical to overall esthetics (3). The color of the gingiva varies between individuals and is believed to be related to cutaneous pigmentation (2).

The color of healthy gingiva varies from pale pink to a dark bluish purple. Between these two points of normalcy, a wide variety of colors exists (4). Clinically, it varies between individuals in various mouth areas and correlates with skin color (3). Moreover, the color of gingiva is determined by various factors, including differences in the number, size, and distribution of melanosomes, activity of the melanocytes in the basal cell layer of the epithelium, dissimilarities in the type of melanin, and the masking influence of the heavily keratinized epithelium (4).

Melanin hyperpigmented gingiva is an esthetic concern for many individuals, primarily if the hyperpigmentation occurs on the facial aspect of the gingiva and is visible during smiles and speech, especially in cases with a gummy smile (5).

The gingiva is the most frequently pigmented intraoral tissue and the most visible during inspections. While melanin is the most common cause of gingival pigmentation, other pigments such as carotene, oxyhemoglobin, and reduced hemoglobin are also found in the masticatory mucosa and contribute to the average color of the integument (6).

Melanin is the primary pigment that gives tissues their color. It appears in the oral tissues as early as three hours after birth and is sometimes the only sign of pigmentation on the body (4).

Melanin is a non-hemoglobin-derived pigment produced by melanocytes, dendritic cells of neuroectodermal origin found in the gingival epithelium's basal and spinous layers. Melanin granules are phagocytosed and contained within melanophages or melanophores, the epithelium, and connective tissue cells (7). Pigmented areas are thought to form only when melanin granules synthesized by melanocytes are transferred to keratinocytes.

In some populations, gingival hyperpigmentation is considered a genetic trait and is more appropriately referred to as physiologic or racial gingival pigmentation (8). However, the gingiva may also exhibit pigmentations due to other etiologies. Benign and malignant lesions, intentional cultural tattooing, drugs, heavy metal ingestions-poisonings, iatrogenic, smoking, and systemic problems can all cause gingival pigmentation (9).

The skin plays an essential role because it acts as a physical barrier against mechanical, chemical, and microbial factors that may affect the body's physiological status (10). Melanin on the epidermis has significant evolutionary and physiological consequences, particularly for unclothed humans. Thus, through its optical and chemical filtering properties, a high melanin content (racial pigmentation) protects the skin against ultraviolet (UV)-induced skin damage (11).

There are considerable variations in the intensity of melanin pigmentation between persons of different ethnical/racial groups and between persons of the same ethnical/racial group, and these variations are normal (12). Physiological/ethnical melanin pigmentation of the oral mucosa is common in black individuals (8). Moreover, it is more frequent in darker-skinned whites (Caucasians) than lighter-skinned whites (4).

Fitzpatrick and Breathnach designated this close relationship between melanocytes and keratinocytes as the epidermal-melanin unit.

The Fitzpatrick scale (also Fitzpatrick skin typing test or Fitzpatrick photo typing scale) is a numerical classification schema for human skin color. It describes a way to classify the skin by its reaction to exposure to sunlight (13).

Previous studies have demonstrated the link between gingival pigmentation and skin color; for example, the study done by Ponnaiyan et al demonstrated the link between gingival pigmentation and skin color, which is that distribution of gingival pigmentation is greater in dark skinned populations (14).

This epidemiological study aimed to find the correlation between gingival color and skin color in Sulaimani Governate, Kurdistan/Iraq.

## **Subjects and Methods**

This cross-sectional study was carried out in Sulaimani Governate, Kurdistan/Iraq from November 2021 to March 2022. A total of 820 participants, male and female, non-smoker healthy subjects with healthy gingiva were included, as well as subjects in the age range from 18-40 years old. A clinical examination of the gingiva from the second premolar of the right side to the second premolar of the opposite side was performed to assess the color of the gingiva and anatomic distribution of gingival pigmentation. The intensity of gingival pigmentation was also observed. Afterward, the skin color was visually examined and assessed as white, medium white, olive (medium brown), or dark brown. The exclusion criteria were participants with systemic disease, those using certain drugs that cause gingival pigmentation, and females with hormonal disturbance. In addition, pregnant and lactating women, participants with amalgam tattoos, smokers, and subjects with periodontal disease, and any gingival pathology that might cause gingival pigmentation were excluded. Ethical approval was obtained from the Ethics Committee of the College of Dentistry, University of Sulaimani. number (79/21) at (9/11/2021).

This study used the Dummett-Gupta Oral pigmentation Index (DOPI) for evaluation of physiologic gingival pigmentation intensity (9). The examination of gingival color was performed under the light of a dental chair from 9 am to 11 am.

This index shows the assignment of a composite numerical value to the total melanin pigmentation manifested on clinical examination of various oral tissues. The criteria are as follows:

- 0=Pink tissue (no clinical pigmentation)
- 1=Mild, light brown tissue (mild clinical pigmentation)
- 2=Medium brown or mixed pink or brown tissue (moderate clinical pigmentation)
- 3=Deep brown or blue/black tissue (heavy clinical pigmentation)

Subsequently, the skin colors were assessed by visual examination under natural light and were divided into six groups according to the Fitzpatrick scale. Skin color was classified by evaluating the color of the inner aspect of the upper arm, which is relatively unexposed to sunlight. These findings were recorded in a specially designed case sheet for each participant.

The criteria of the Fitzpatrick scale are as follows: (13)

- Type I: Pale white skin, red or blond hair, blue eyes, freckles
- Type II: white or fair skin, red or blond hair, blue, hazel, or green eyes
- Type III: medium white or fair skin, any eye or hair color
- Type IV: light brown skin (olive, moderate brown)
- Type V: dark brown skin
- Type VI: deeply pigmented dark brown (very dark brown to black)

**Statistical Analysis:**

Data analysis was performed using the statistical package for social sciences (SPSS) program version 22. Frequency and percentages with the mean and standard deviation were used for both qualitative and quantitative data respectively. Chi-square test was used for determining associations between categorical data. P-values equal to or less than (0.05) were regarded as statistically significant.

**Results**

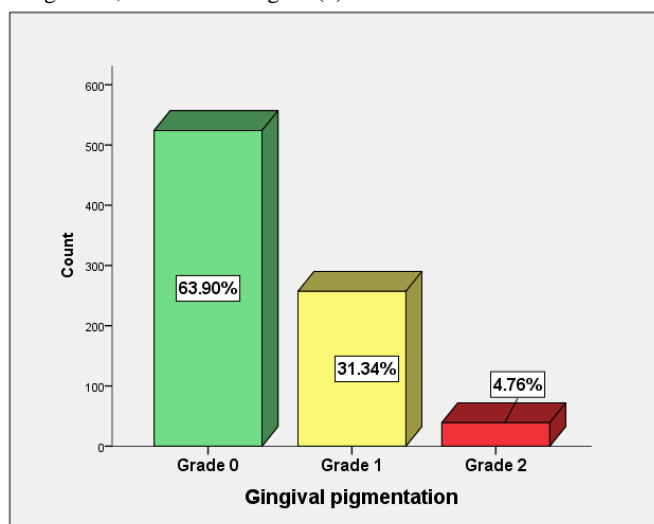
The mean age and standard deviation of the study participants were (25.26 ± 6.23).

Regarding the participants' sociodemographic characteristics, 41.2% were males while 58.8% were females. In terms of skin color, the lowest percentage (5%) of the participants had light skin color, while 53% had medium to light brown colored skin. The remaining sociodemographic characteristics are shown in Table (1).

**Table 1:** Sociodemographic characteristics of the participants

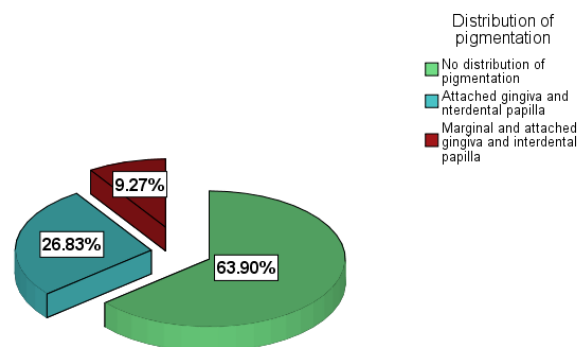
Sociodemographic Parameters	Frequency	Percent
Gender	Male	338 41.2
	Female	482 58.8
Color of skin	Light pale, white	4 .5
	White, fair	54 6.6
	Medium, white to light brown	435 53.0
	Olive, moderate brown	287 35.0
	Brown, dark brown	40 4.9
	Total	820 100.0

Regarding the participants' gingival pigmentation, grade 0 was the most frequent grade of pigmentation, while the least frequent was grade 2, as shown in Figure (1).



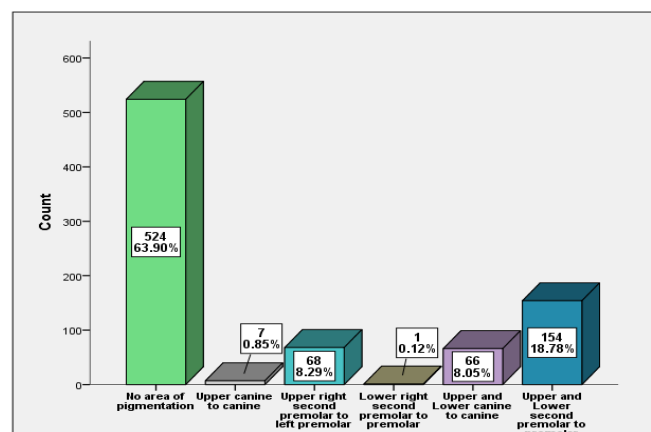
**Figure 1:** Gingival Pigmentation among participants

Regarding distribution of pigmentation, the majority (63.9%) of participants had no distribution of pigmentation, while in the remainder it was distributed in the marginal or attached gingiva and interdental papilla, as shown in Figure (2).



**Figure 2:** Distribution of Pigmentation among participants

Concerning the area of pigmentation, the results ranged from 63.9% who had no area of pigmentation to just 0.12% who had pigmentation in the lower right second premolar-to-premolar, with these and the remaining percentages shown in Figure (3).



**Figure 3:** Area of Pigmentation among participants

**Table 2:** Association between Gingival Pigmentation and Skin Color

Color of skin	Gingival pigmentation			Total	P Value
	Grade 0	Grade 1	Grade 2		
Light pale, white	Count 4	0	0	4	< 0.001
	% .8	0.0%	0.0%	.5%	
White, fair	Count 54	0	0	54	
	% 10.3%	0.0%	0.0%	6.6%	
Medium white, to light brown	Count 423	12	0	435	
	% 80.7%	4.7%	0.0%	53.0%	
Olive, moderate brown	Count 43	243	1	287	
	% 8.2%	94.6%	2.6%	35.0%	
Brown, dark brown	Count 0	2	38	40	
	% 0.0%	.8%	97.4%	4.9%	
Total	Count 524	257	39	820	
	% 100.0%	100.0%	100.0%	100.0%	

In addition, a strong association was found between gingival pigmentation and skin color, as the p-value was highly significant

(< 0.001). For example, only 2.6% of participants with olive or moderate brown skin color had Grade 2 gingival pigmentation, while about 97.4% of those with brown or dark brown skin color had Grade 2 gingival pigmentation; meanwhile, those with white or fair skin color had no gingival pigmentation, these and the remaining results being shown in Table 2.

Regarding association of gender with variables, we found a strong association between gender and the rest of the variables as the p- values in all of the associations were highly significant (< 0.001). For example, while 55% of the males had Grade 0 pigmentation, about 70% of the females had grade 0 pigmentation, also 11.8% of the males had pigmentation, compared to 4.8% of females, these and the remaining results being shown in Table 3.

**Table 3:** Association between Gender and other parameters

Parameters	Count	Gender		Total	P-Value
		Male	Female		
Gingival pigmentation	Grade 0	187	337	524	< 0.001
	%	55.3%	69.9%	63.9%	
	Grade 1	128	129	257	
	%	37.9%	26.8%	31.3%	
	Grade 2	23	16	39	
Color of skin	Light pale, white	3	1	4	< 0.001
	%	.9%	.2%	.5%	
	White, fair	5	49	54	
	%	1.5%	10.2%	6.6%	
	Medium white to light brown	165	270	435	
Distribution of pigmentation	Olive, moderate brown	141	146	287	< 0.001
	%	41.7%	30.3%	35.0%	
	Brown, dark brown	24	16	40	
	%	7.1%	3.3%	4.9%	
	No distribution of pigmentation	187	337	524	
Area of pigmentation	Attached gingiva and interdental papilla	105	115	220	< 0.001
	%	31.1%	23.9%	26.8%	
	Marginal and attached gingiva and interdental papilla	46	30	76	
	%	13.6%	6.2%	9.3%	
	No area of pigmentation	187	337	524	
Total	Upper canine to canine	5	2	7	< 0.001
	%	1.5%	.4%	.9%	
	Upper right second premolar to left premolar	22	46	68	
	%	6.5%	9.5%	8.3%	
	Lower right second premolar to premolar	0	1	1	
	%	0.0%	.2%	.1%	
	Upper and Lower canine to canine	26	40	66	
	%	7.7%	8.3%	8.0%	
	Upper and Lower second premolar to premolar	98	56	154	
	%	29.0%	11.6%	18.8%	
Total	Count	338	482	820	
%	100.0%	100.0%	100.0%		

Regarding association between age group and other parameters (gender, gingival pigmentations, color of skin..... etc.), a significant association was found between gender and age group (p-value of 0.004), while the remaining parameters had highly significant associations with age (all p-values were less than 0.001). For example, only 36.3 % of the males were aged 18-24 years, while 63.7% of the females were in this age group. Moreover, 70% of participants within this age group had grade 0 pigmentation, compared to the age group of 32-39 years, in which only 49% had

grade 0 pigmentation, these and the remaining results being shown in Table 4.

**Table 4:** Association between age group and other parameters

Parameters	Count	Age Group			Total	P-Value
		(18 - 24) Years	(25-31) Years	(32-39) Years		
Gender	Male	170	87	81	338	0.004
	%	36.3%	48.6%	46.8%	41.2%	
Gingival pigmentation	Female	298	92	92	482	< 0.001
	%	63.7%	51.4%	53.2%	58.8%	
Color of skin	Grade 0	331	107	86	524	< 0.001
	%	70.7%	59.8%	49.7%	63.9%	
	Grade 1	122	66	69	257	
	%	26.1%	36.9%	39.9%	31.3%	
	Grade 2	15	6	18	39	
	%	3.2%	3.4%	10.4%	4.8%	
Distribution of pigmentation	Light pale, white	1	2	1	4	< 0.001
	%	.2%	1.1%	.6%	.5%	
	White, fair	48	5	1	54	
	%	10.3%	2.8%	.6%	6.6%	
	Medium white to light brown	267	90	78	435	
	%	57.1%	50.3%	45.1%	53.0%	
	Olive, moderate brown	135	76	76	287	
	%	28.8%	42.5%	43.9%	35.0%	
	Brown, dark brown	17	6	17	40	
	%	3.6%	3.4%	9.8%	4.9%	
Area of pigmentation	No distribution of pigmentation	331	107	86	524	< 0.001
	%	70.7%	59.8%	49.7%	63.9%	
	Attached gingiva and interdental papilla	108	52	60	220	
	%	23.1%	29.1%	34.7%	26.8%	
	Marginal and attached gingiva and interdental papilla	29	20	27	76	
	%	6.2%	11.2%	15.6%	9.3%	
	No area of pigmentation	331	107	86	524	
	%	70.7%	59.8%	49.7%	63.9%	
	Upper canine to canine	7	0	0	7	
	%	1.5%	0.0%	0.0%	.9%	
Upper right second premolar to left premolar	26	17	25	68		
%	5.6%	9.5%	14.5%	8.3%		
Lower right second premolar to premolar	1	0	0	1		
%	.2%	0.0%	0.0%	.1%		
Upper and Lower canine to canine	30	20	16	66		
%	6.4%	11.2%	9.2%	8.0%		
Upper and Lower second premolar to premolar	73	35	46	154		
%	15.6%	19.6%	26.6%	18.8%		
Total	Count	468	179	173	820	
%	100.0%	100.0%	100.0%	100.0%		

## Discussion

Gingival hyperpigmentation is a condition of major concern, and many patients present to the periodontist with the unesthetic condition of dark gingiva, which is genetically present in some populations and known as physiologic or racial pigmentation (14).

Melanin pigmentation in different populations has been reported to vary between 0% to 89% and to be affected by ethnic factors and smoking habits (15).

This present study is the first study carried out among the Kurdish population in Sulaimani city that has established a correlation between gingival pigmentation and skin color, and which included both participants with gingival pigmentation and those without gingival pigmentation (Grade 1). For example, a previous study carried out in India included only participants who had gingival pigmentation (16). In the present study, the majority of cases had no gingival pigmentation, while among those with pigmentation, it was mostly grade 1 pigmentation (solitary unit(s) of pigmentation in papillary gingiva without extension between neighboring solitary units), and the lowest percentage had Grade 2 pigmentation. This finding is in agreement with a study done at the Islamic Azad University in Tehran (17), but contrasts with the finding of the study done in India by Ponnaiyan et al. (14). This could be due to the majority of the present study's participants having type 3 or 4 skin color according to the Fitzpatrick scale, ranging from medium, light brown, to moderate brown (13). Meanwhile, the majority of participants in the Ponnaiyan et al study had type 5 or type 6, ranging from dark brown to black according to the Fitzpatrick scale (13).

Regarding the distribution of pigmentation, the present study discovered that pigmentation was most commonly found in the attached gingiva and interdental papilla, which agrees with a study done on a south Indian population (16) and a study done in Pakistan (18). However, this result differed from that produced in a study done in Nigeria, where they found attached gingiva was the most common category of pigmentation (19). This indicates that there are ethnic variations in the pigmentation of the gingiva.

The color of gingiva has been correlated to skin color in the present study, and the association was highly significant. It was observed that darker-skinned subjects had heavy gingival pigmentation, whereas fair-skinned subjects had mild gingival pigmentation (those recording type 4 or type 5 skin color according to the Fitzpatrick scale) (13). These findings are similar to the previous studies on Indian populations, where the incidence of pigmentation of the gingiva was found to increase with complexion changes to the darker shades (14) (16) (20).

In the present study, a strong association was found between gingival pigmentation patterns and gender, with gingival pigmentation being more frequent among males than females. However, a study done in Brazil showed that physiological pigmentation of the oral mucosa affected males and females equally (21). This finding is contradictory to a study done among a Nigerian population which found no correlation between gingival pigmentation and gender (19).

The present study found that the intensity of gingival pigmentation increased with age and that gingival hyperpigmentation is more common in adults aged 32-39 years. This finding agrees with the study done in Pakistan (18). Nevertheless, another study (20) found that gingival hyperpigmentation is more frequent in younger adults (18-25 years). This could be due to the size of keratinocytes and thickness of the epidermis, since older adults have larger keratinocytes and thicker epidermis (22).

The highest rate of gingival pigmentation identified in this study was in the upper and lower second premolar to premolar, in contrast to the study of (14), in which the highest rate of gingival

pigmentation was found in the area of the incisors, and the rate decreased considerably in the posterior areas. This could be due to racial variation, different anatomic distribution of gingival pigmentation in the mouth, or greater exposure to sunlight.

## **Conclusion**

Gingival pigmentation has become a significant esthetic concern among patients today. Because of this, depigmentation procedures have emerged as a mainstay of periodontal treatment. It can be concluded from the findings of the present study that the majority of the population in Sulaimani city have type 3 and type 4 skin color (medium, white to light brown and olive, moderate brown) according to the Fitzpatrick scale. The majority of our participants also had no pigmentation, and among those who had pigmentation, the majority was in the attached gingiva and interdental papillae. This study concludes that it has statistically established an association between the intensity of gingival pigmentation and skin color. In addition, the intensity of gingival pigmentation was found to increase with age, and the highest rate of gingival pigmentation was in the area of upper and lower second premolar to premolar.

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## **Conflict of Interest**

No conflict of interest

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