Quantification of Hair Follicles in the Scalp in Mexican Mestizo Population

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Keywords

Hair counts · Hair density in mestizo population · Scalp biopsy

Abstract

Introduction: There are no reports of the density of hair follicles in the scalp of Mexican mestizo population, necessitating the determination of normal references values for this population compared with other ethnic groups. **Objective:** To determine the average hair follicle count on the scalp in Mexican mestizo population. **Materials and Methods:** A total of 50 scalp samples (25 men and 25 women) from Mexican mestizo individuals aged between 19 and 60 years, with no clinical evidence of hair disease, obtained by biopsy punch at General Hospital “Dr. Manuel Gea González” were collected over 2 years. The total follicular density, vellus and terminal hair follicles, and the percentage in anagen and catagen-telogen phase were measured. χ^2 was used as the basic statistical test. **Results:** The mean number of total hair follicles in our Mexican mestizo population was 23.2 ± 4.2 , which is lower compared with Thais, Iranians, and Caucasians. However, the ratio of terminal and vellus hair follicles

was higher than in Thais, Caucasians, and African-Americans. The percentage of terminal hairs in anagen phase was lower than in the other populations, and higher in telogen, without exceeding 15%, established as the normal reference value. There was an association between sex and terminal hairs in telogen phase ($p < 0.05$). The average follicular density per mm^2 was slightly higher compared with African-Americans and Asians. Women had more terminal hairs than men. **Conclusions:** The density of total follicles is lower in the Mexican mestizo population compared with Iranians, Thais, and Caucasians. However, the greater number of terminal hairs compared to vellus hairs gives the appearance of greater overall volume. The results of this study can be used as a reference for diseases of the scalp in the Mexican population.

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Introduction

Mestizo individuals constitute 93% of the Mexican population and predominate in the rest of Latin America. The density of hair follicles on the scalp differs between

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Fig. 1. Transverse section of a 4-mm punch biopsy of healthy scalp skin from a 34-year-old mestizo female with straight hair (magnification $\times 40$). Total follicle count: 25 (24 terminal hairs, 1 vellus hair), 1.75 follicles/mm².

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Fig. 3. Transverse section of a 4-mm punch biopsy of healthy scalp skin from a 26-year-old mestizo male with curly hair (magnification $\times 40$). Total follicle count: 23 (20 terminal hairs, 3 vellus hairs), 2 follicles/mm².

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Fig. 2. Transverse section of a 4-mm punch biopsy of healthy scalp skin from a 24-year-old mestizo male with straight hair (magnification $\times 40$). Total follicle count: 24 (21 terminal hairs, 3 vellus hairs), 1.75 follicles/mm².

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Fig. 4. Transverse section of a 4-mm punch biopsy of healthy scalp skin from a 31-year-old mestizo female with curly hair (magnification $\times 40$). Total follicle count: 32 (30 terminal hairs, 2 vellus hairs), 2.5 follicles/mm².

ethnic groups (Caucasians, African-Americans, and Asians) [1–7]. However, these values have not been measured in Mexican mestizo population. A scalp biopsy is the most objective and useful method for evaluating hair

disorders, based on the qualitative and quantitative data that it provides, which is vital for proper examination of follicular pathologies. The objective of this study was to quantify hair follicles in the Mexican mestizo population and compare the results with values in Caucasians, African-Americans, and Asians (Korean, Thai, Taiwanese, and Iranian).

Table 1. Hair follicle counts in 4-mm punch biopsy in Mexican mestizo population

	Men	Women	Total
Number of cases	25	25	50
Mean age, years	31.48±11.95 (19–60)	36.80±8.5 (20–60)	34.14±10.57 (19–60)
Mean total follicles	22.80±3.45 (17–23)	23.60±5.14 (15–32)	23.20±4.29 (15–32)
Mean of terminal follicles	20.32±2.96 (16–25)	21.84±4.9 (13–31)	21.08± 4.07 (13–31)
Mean of vellus follicles	2.48±0.96 (1–4)	1.76±1.0 (0–4)	2.12±1.04 (0–4)
Terminal hairs in anagen, %	18.52±2.80 (13–23)	20.46±4.94 (12–30)	90.7
Terminal hairs in catagen-telogen, %	1.80±0.81 (1–3)	1.42±0.58 (0–2)	7.84
Mean follicular units			7.56±1.63 (5–12)
Mean of follicular units/mm ²	1.83±0.32 (1.25–2.5)	1.90±0.49 (1.25–3)	1.75±0.60 (1.25–3)

The standard deviation (±) and range are expressed for each of the averages.

Table 2. Hair type and number of hair follicles in Mexican mestizo patients

Type of hair	Male	Female	Total follicles	Terminal	Vellus
Straight (36)	21/25 (84%)	15/25 (60%)	23.53±3.96 (17–32)	21.33±3.71 (14–31)	2.19±1.06 (0–24)
Curly (4)	1/25 (4%)	3/25 (12%)	21.5±2.51 (18–24)	20±2.44 (18–23)	1.5±1.73 (0–4)
Wavy (10)	3/25 (12%)	7/25 (28%)	22.1±6.17 (15–32)	20.2±5.9 (13–30)	1.9±0.87 (0–3)

Mean, standard deviation, minimum, and maximum.

Materials and Methods

This descriptive and cross-sectional study was conducted in the Department of Dermatopathology of General Hospital “Dr. Manuel Gea González.” The sampling period was 2 years from February 2009 to December 2011. A 4-mm punch biopsy was performed in the occipital region of 50 healthy volunteers of both sexes (25 females and 25 males) aged between 19 and 60 years, with no clinically evident hairy scalp disease (e.g., diffuse alopecia or in patches, presence of scale, and folliculitis). The hair type was classified as straight, wavy, or curly. Subjects were familiarized with the details and purposes of the study and provided written informed consent.

Pregnant women, cases with damage or loss of tissue by biopsy, histological evidence of inflammation, or perifollicular scars were excluded.

A horizontal sectioning of scalp was made 1.5 mm from the surface, and serial sections were obtained until the superficial reticular dermis was reached at the level of the sebaceous glands. The samples were stained with hematoxylin-eosin and periodic acid-Schiff. A blinded dermatopathologist quantified the total hair follicles, terminal and vellus hairs, the ratio of terminal and vellus hairs, and the percentage of hair follicles in anagen and catagen-telogen phase [8, 9] (Fig. 1–4). The results were analyzed by χ^2 test.

Results

The mean age of the 50 study subjects was 34.14 ± 10.57 years (31.48 for men and 36.80 for women), ranging from 19 to 60 years. The mean total follicle count was 23.20 ± 4.29 , of which 21.08 ± 4.07 were terminal follicles and 2.12 ± 1.04 were vellus follicles, with a terminal:vellus hair ratio of 11.3:1. The mean density of follicle structures per mm² was 1.75 ± 0.60 . The percentage of follicles in anagen phase was 90.7 and 7.84% in catagen-telogen (Table 1).

Straight hair was the most predominant hair type – 84% (21/25) in men and 64% (16/25) in women – followed by wavy hair – 12% (3/25) and 28% (7/25), respectively. Curly hair was present in 4% (1/25) and 8% (2/25) of men and women, respectively. Although there were more total, terminal, and vellus follicles in straight hair, there were no significant differences in the number of hair follicles between hair types (Table 2). In the associations between the variables in our study, only sex and the number of terminal hairs in telogen phase had a χ^2 value of 7.64 with $p < 0.05$.

Table 3. Comparison between results in Mexican mestizo population and various studies in Caucasians, African-Americans, and Asians

	Caucasians		African-Americans	Asians				Mestizo
	Whiting	Sperling		Koreans	Taiwanese	Thais	Iranians	
Total number of cases	22	12	22	35	31	20	30	50
Mean age, years	43±3.5	34.7±12.2	31.7±8.5	33.1±10	37.0±15.3	55.1±15.8	35.5±14.7	34.14±10.57
Mean total follicles	40±2.2	35.5±5.5	21.5±5	16.1±3.6	21.3±4.8	28.3±9.2	36.3±7.2	23.20±4.29
Mean of terminal follicles	35±2.1	30.4±6.4	18.4±5	14.9±3.2	20.5±4.6	16.5±8.4	34±6.4	21.08±4.07
Mean of vellus follicles	5±0.6	5.1±3.5	3±2.1	1.1±1.3	0.8±1.0	6.9±7.0	2.4±1.2	2.12±1.04
Ratio terminal/vellus	7:1	6:1	6.1:1	13.5:1	25.3:1	2.4:1	17.4:1	11.37:1
Anagen/telogen, %	93.5/6.5	94.5/4.7	93.9/6.1	93.6/6.4	91.6/8.4	NA	93.7/6.3	90.7/7.84
Average follicular units	14±0.5	NA	NA	7.8±1.7	9.4±1.9	10.7±2.6	NA	7.56±1.63
Follicular structures/mm ²	3.1±0.8	2.7±0.4	1.65±0.4	1.2±0.3	1.69±0.4	2.6±0.6	NA	1.75±0.60

Discussion

There are several sophisticated imaging devices and software programs for quantifying hair follicles noninvasively (e.g., the phototrichogram), but they merely evaluate the number of follicles. Scalp biopsy remains the most objective and useful method for evaluating hair disorders. A precise histological diagnosis of the different alopecia diseases depends on determining the quantitative and qualitative alterations in the follicular units (e.g., anagen:catagen ratio, scarring, and pattern of inflammation) [10].

To determine whether an individual has alopecia, the normal density of the follicular units must be considered with regard to our Mexican mestizo characteristics, based on our unique genetic mixture – estimated as comprising 69% native Amerindian genes, 26% Caucasian, and 5% African [11–13].

The density of hair follicles on the scalp differs between ethnic groups (Caucasian, African-American, Korean, Thai, Taiwanese, and Iranian) [1–7]; however, no such data exist for the Mexican mestizo population.

Table 3 compares our results in a Mexican mestizo population and the reported findings on various ethnic groups.

In our study, the density of total hair follicles in the Mexican mestizo population was lower (23.2 ± 4.2) than in Iranians (36.3 ± 7.2), Thais (28.3 ± 9.2), and Caucasians (40 ± 2.2 , 35.5 ± 5.5) but higher than Blacks (21.5 ± 5) and healthy Asians (21.3 ± 4.8). The percentage of terminal hairs in anagen phase was 90.7 and 7.84% in catagen-telogen phase. The mean follicular density in the Mexican mestizo sample was 1.75 ± 0.60 follicles/mm².

We observed differences in total hair follicle density between genders: women had a mean of 23.6 ± 5.1 versus

22.8 ± 3.4 in men, and females had more terminal hairs (21.8 ± 4.9 vs. 20.3 ± 2.9). The mean follicular density per mm² was higher in females (1.9 ± 0.49) compared with males (1.8 ± 0.32).

Compared with previous studies in the Caucasian population, Whiting [2] reported a predominance of terminal and vellus hairs in men (36.4 ± 10.3 and 6.2 ± 4.4 , respectively) versus women (33.8 ± 9.8 and 2.9 ± 1.2). In African-Americans, women have more terminal hairs and vellus hairs (19.4 ± 3.4 and 3.9 ± 2.2 , respectively) than men (17.5 ± 6 and 2.3 ± 1.9) [3]. In contrast, Iranian males have more terminal and vellus hairs (35.2 ± 7.2 and 2.5 ± 1.4 , respectively) than females (31.1 ± 2.7 and 2.2 ± 0.8) [6]. In Koreans, the number of terminal hairs is higher in females (16 ± 2.9) compared with males (14 ± 3.3) [4]. But Taiwanese men and women have similar numbers of terminal hairs and vellus hairs (20.9 ± 4.1 and 0.9 ± 1.1 , respectively, in men, versus 19.9 ± 5.3 and 0.6 ± 0.8 in women) [5]. No such data have been reported for Thais [7].

With respect to the decrease in the density of follicular units of scalp with age, we did not observe any significant differences between age groups, similar to a study of 1,666 4-mm punch biopsies, cross-sectional cut, from 928 women aged between 13 and 84 years with various hair loss disorders – the mean number of follicular units per biopsy was 39.6 ± 10.8 , with a negative linear association between age and total follicle count. However, it was estimated that for each additional year in age, total follicle counts decreased by 0.077 (0.22%) for each 4-mm punch biopsy, albeit insignificantly [14].

We conclude that in both Mexican mestizo and Asian populations, although they have lower count of total hair follicles, the fact of having few vellus hairs confers the

clinical appearance of a follicular density that is similar to other races.

This study is relevant because it provides an average number of hair follicles in men and women without follicular disorders and can be used as a reference in the evaluation of diseases of the scalp in the Mexican mestizo population.

Statement of Ethics

The authors have no ethical conflicts to declare.

Disclosure Statement

The authors have no conflicts of interest to disclose.

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