

A STUDY OF MEDULLA DISTRIBUTION IN SCALP HAIR OF SCHEDULED CASTES OF UTTARAKHAND

Abhilekh Negi and H. B. S. Chauhan

ABSTRACT

The present study deals with distribution of medulla in scalp-hair of Scheduled Caste subjects of Uttarakhand. Light microscope was used for examining the hair strands. 2080 scalp hair (1040 male and 1040 female) drawn from 260 individuals (130 male and 130 female) were examined for medulla distribution. From each individual, two hair strands were taken from every side, i.e. front, right, left and back side. The medulla has been classified into four-types, viz. continuous, discontinuous, fragmented and absent. The result shows continuous medulla type has highest frequency (46.15%), succeeded by absent medulla type (30.769%) among the males. Among females, the medulla was absent in 42.3% of the subjects. The continuous medulla type was found among 23.07% of the females. In the scalp hair of males, continuous medulla type has the highest frequency in all four sides of head (53.846% in front side, 46.153% in right side, 38.462% in left side and 46.153% in back side). In the scalp hair of females, the medulla was found absent on all four sides of head. Human hair show some age, sex and population variations, which find application in anthropological, trichological and forensic investigations.

Keywords: Hair, Medulla, Medulla-Type

INTRODUCTION

Hair is an appendage of the skin that grows out of hair follicle. The root is that portion of the hair which lies in the follicle, whereas the portion above the skin surface is called the shaft. The enlarged base of the root is called the bulb, which surrounds a mass of loose connective tissue termed the dermal papilla. Hair is composed of a group of proteins (Keratins) that interconnect to form stable fibrils (Saferstein, 1982). Hair is a complex structure of keratinized epithelial cells and provides nature's most effective sun block (Slominski and Paus, 1993). The scientific study of hair is called trichology and this field dates back to the mid 1800s.

Human hair has a significant role in forensic-investigations, anthropology studies and Trichology. Human hair has played a significant role in forensic anthropology

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for decades. The morphological characteristics of human hair have long been utilized for personal identification in forensics. Human head and pubic hair are most often used in microscopic trace evidence which acts as a strong evidence against a suspect. Hair are readily shed and unwittingly left behind, they are not easily destroyed by any one and are relatively easy to discover. Hair strands present remarkable structural differences, according to the ethnic groups, and within the same group. These properties are related with strand's characteristics and with cosmetic attributes (de Sá Dias *et al.*, 2007).

Hair basically consists of three layers - cuticle, cortex and medulla. The microscopic examination of a hair cross-section reveals an outer layer of cuticle scales, an inner portion called the cortex and the centre most (a thread like structure) called the medulla. The presence of medulla varies from individual to individual and between hair of a given individual (Gaur *et al.*, 2007). In animals, the dark appearance of medulla is often due to pigments. In humans, the medulla appears dark under transmitted light because it is filled with air. However, the medulla may take on a yellowish colour if the medullary cells are filled with liquid, and its structure may be translucent but distinct when examined in a liquid having a refractive index near that of the cortex and cuticle (Saferstein, 1982). In humans, medulla is narrow and occupies about one third of the width of hair shaft diameter. It is located in the centre of hair. Different authors have used different terms for the types of medulla among humans. Hausman (1925) uses the terms for human head hair medulla as absent, fractional, broken and continuous (Hausman, 1925). Whereas Duggins and Trotter (1950) used the term scanty to express the medullary masses occurring at widely spaced intervals along the shaft. Medulla cells grouped together in large segments were called broken, and an unbroken column of medullary cells were defined as continuous (Duggins and Trotter, 1950). Kirk (1966) suggested the term for human hair medulla as absent, fragmental, and continuous. Gaudette and Keeping (1974) categorise medulla types as absent, fragmental, and continuous. Hicks (1977) classified it as fragmentary, continuous and discontinuous. Not much is known about the variations in medulla types of scalp hair of populations of Uttarakhand. To fill this gap, the present study was conducted to study the medulla distribution among the scheduled caste of Uttarakhand and find out gender differences if any. The study was started with the hypothesis that there are no variations in the medulla type among the Scheduled Castes of Uttarakhand and there are gender differences in this context.

MATERIALS AND METHODS

2080 scalp hair from 260 Scheduled caste individuals (130 males; 130 females) were taken from four scalp areas and preserved in a 4mm x 6mm zip-pouch separately. Medulla types were analyzed with the help of light microscope. Results were compared between sexes and scalp areas. Before taking hair samples, the purpose of the study was explained and permission of the subject was sought to take hair sample. The subject was asked to sit on a stool. A small daub of methanol was used

to clean the scissors and forceps. By holding the hair strands with the help of forceps, two hair strands were cut (nearer to the scalp) from four different places on the scalp, i.e. front, right, left and back side. The samples were collected in transparent zip-pouches after numbering them with a marker.

In the laboratory, the collected hair strands were washed in tap water and then soap water, and finally with distilled water. After blotting the hair dry, they were steeped in a mixture of ether and absolute alcohol in equal proportions for 10 minutes. Then they were washed in xylene for 5 minutes and mounted in Canada balsam on a glass slide under a square cover slip. The classification of medulla types given by Hicks (1977) has been followed here (Figure 1).

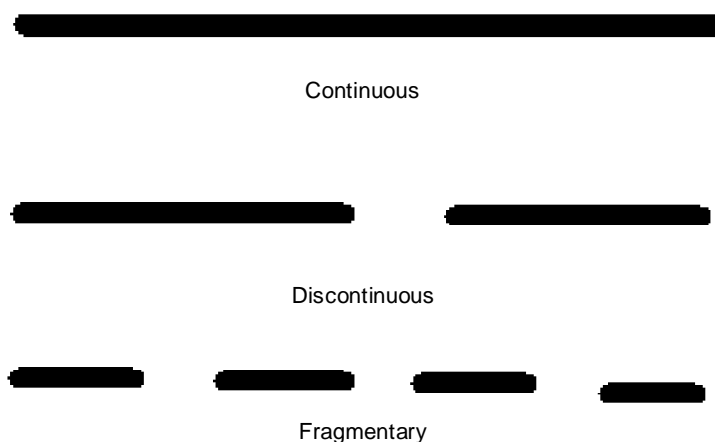


Figure 1: Various types of medulla

RESULTS AND DISCUSSION

Table 1 depicts the percentages of various types of medulla in the present sample of Scheduled Caste males and females from Uttarakhand. Out of a total of 2080 hair samples, 1040 (50%) have been taken from males and 1040 (50%) from females. As can be seen in the table, among the males 480 (46.15%) belong to continuous medulla type, 180 (17.31%) belong to discontinuous category, 60 (5.77%) belong to fragmented type and in 320 (30.77%) cases medulla was absent. In female hair samples, 240 (23.08%) belong to continuous type of medulla, 180 (17.31%) belong to discontinuous category, 180 (17.30%) to fragmentary type and in 440 (42.31%) cases medulla was found to be absent. It clearly indicates that among Scheduled Caste males of Uttarakhand, continuous type of medulla (46.15%) has the highest frequency succeeded by absent type (30.77%); in females surprisingly absent medulla type (42.31%) has the highest frequency succeeded by continuous medulla type (23.08%).

Table 1 shows that the calculated value of chi-square at 3 degree freedom is 158.95 and the tabulated value of chi-square for 3 degree of freedom at 5% significance

level of is 7.81. The calculated value of chi-square is greater than tabulated value of chi-square at 3 degree of freedom. Hence the hypothesis is rejected; i.e. the variable 'Gender' and the variable 'Medulla type' are dependent.

Table 2 shows the percentage distribution of medulla types in hair strands of the four sides of head of Scheduled Caste males of Uttarakhand. Out of a total of 1040 hair samples, 260 (25%) strands each have been taken from front, right side, left, and back side of the head. It is clear from the table that from the front side, 140 (53.846%) belong to continuous type of medulla and 40(15.385%) belong to discontinuous category. Surprisingly, fragmentary type of medulla was absent among the males. In 80 (30.769%) cases, medulla was absent. From right side hair samples, 120 (46.153%) belong to continuous type, 40 (15.385%) belong to discontinuous category, 20 (7.693%) belong to fragmentary type and in 80(30.769%) cases medulla was absent. Among left side hair samples, 100 (38.462%) belong to continuous type, 60 (23.077%) belong to discontinuous category, 20 (7.693%) belong to fragmentary type and in 80 (30.769%) cases medulla was absent. In hair samples from back side, 120 (46.153%) belong to continuous type, 40 (15.385%) belong to discontinuous category, 20 (7.693%) belong to fragmentary type and in 80 (30.769%) cases medulla was absent. The continuous medulla type of medulla, with frequencies of 53.846%, 46.153%, 38.462%, 46.153% on front, left, right and back sides, respectively, has the highest frequency. Table-2 also shows that the calculated value of chi-square is 33.33 and the tabulated value of chi-square is 16.92 at 9 degree of freedom at a significance level of 5%. Since the calculated value of chi-square is greater than the tabulated value, the hypothesis that the variable 'Scalp portion' and the variable 'Medulla type' are dependent stands rejected.

Table 3 shows the percentage distribution of medulla types in hair strands of the four sides of head of Scheduled Caste females of Uttarakhand.

Out of a total of 1040 hair samples, 260 (25%) samples have been taken from front, right side, left, and back sides each. From front side hair samples, 60 (23.077%) belong to continuous medulla type, 60 (23.077%) belong to discontinuous category, 40 (15.385%) belong to fragmentary type, and in 100 (38.462%) cases medulla was absent. Among the left side hair samples, 60 (23.077%) belong to continuous medulla type, 40 (15.385%) belong to discontinuous category, 40 (15.385%) belong to fragmentary type and in 120 (46.153%) cases medulla was found to be absent. In hair samples from back side, 60 (23.077%) belong to continuous medulla type, 40 (15.385%) belong to discontinuous category, 60 (23.077%) belong to fragmentary type and in 100 (38.462%) cases medulla was absent.

In Table 3 it can be seen that the calculated value of chi-square is 16.97 and the tabulated value of chi-square is 16.92 at 9 degrees freedom and 5% level of significance. Since the calculated value of chi-square is slightly greater than tabulated value of chi-square, the hypothesis that the variable 'Scalp portion' and the variable 'Medulla type' are not-dependent is accepted.

CONCLUSIONS

After analyzing the results, we clearly see that in the distribution of medulla among Scheduled Castes of Uttarakhand, continuous medulla type is dominating in males succeeded by the absent type. But in females, absent medulla type has the highest frequency, followed by continuous medulla type. Same pattern has been noticed in the every side (front, right, left, and back sides) of the scalp. Gender wise, significant differences can be seen in the frequencies of medulla types among Scheduled Caste individuals of Uttarakhand. But within gender, the side differences are significant in male scalp hair only.

Table 1: Percentage distribution of medulla types in scalp hair of Scheduled Caste males and females of Uttarakhand

Medulla Type	Male		Female	
	No. of Hair Strands	%	No. of Hair Strands	%
Continuous	480	46.15	240	23.08
Discontinuous	180	17.31	180	17.31
Fragmentary	60	5.77	180	17.30
Absent	320	30.77	440	42.31
Total	1040	100	1040	100

χ^2 @ degree of freedom 3 Chi sq. (χ^2)=158.95, df= 3, p=0.00

Table 2: Percentage distribution of medulla types in hair strands of the four sides of head of Scheduled Caste males of Uttarakhand

Scalp Portion	Front Side Hair		Right Side Hair		Left Side Hair		Back Side Hair	
	No. of Hair Strands	%	No. of Hair Strands	%	No. of Hair Strands	% age	No. of Hair Strands	% age
Continuous	140	53.846	120	46.153	100	38.462	120	46.153
Discontinuous	40	15.385	40	15.385	60	23.077	40	15.385
Fragmentary	0	0	20	7.693	20	7.693	20	7.693
Absent	80	30.769	80	30.769	80	30.769	80	30.769
Total	260	100.00	260	100.00	260	100.00	260	100.00
		Chi sq. (χ^2)= 33.33,		df=9,		p=0.0117		

Table 3: Percentage distribution of medulla types in hair strands of the four sides of head of Scheduled Caste females of Uttarakhand

Medulla Type	Front Side Hair		Right Side Hair		Left Side Hair		Back Side Hair	
	No. of Hair Strands	%	No. of Hair Strands	%	No. of Hair Strands	%	No. of Hair Strands	%
Continuous	60	23.077	60	23.077	60	23.077	60	23.077
Discontinuous	60	23.077	40	15.385	40	15.385	40	15.385
Fragmentary	40	15.385	40	15.385	40	15.385	60	23.077
Absent	100	38.462	120	46.153	120	46.153	100	38.462
Total	260	100.00	260	100.00	260	100.00	260	100.00
		Chi sq. (χ^2)= 16.97,		df= 9,		p=4.919		

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