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Variation in Morphological Features of Human Head Hair of Different Regions of India

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ABSTRACT: - In present study 30-30 hair sample were collected from Eastern region, Western region, Northern region, and Southern region and examined. Characterization of individuals was based on their mean value of diameter of cortex, medulla and ratio of diameter of cortex and medulla of hair sample. After analysis it was found that the highest and lowest mean value of Eastern region was (12.8µm, 7.00µm) Western region (12.5µm, 6.5µm) Northern region (10.3µm, 7.00µm) and Southern region (8.55µm, 7.5µm) for cortex accordingly and the highest and lowest mean value of Eastern region was (7.62µm, 3.5µm) Western region (6.33µm, 4.00µm) Northern region (6.66µm, 3.5µm) and Southern region (5.00µm, 3.66µm) for medulla. The ratio of cortex and medulla was highest and lowest in Eastern region (2.28µm, 1.45µm) Western region (1.87µm, 1.44µm) Northern region (2.00µm, 1.9µm) and Southern region (2.26µm, 1.5µm).
Keywords: medulla, cuticle, mean value, diameter

INTRODUCTION: - "Hair is a filamentous biomaterial that grows from follicles found in thick terminal and fine vellus hair. Hair often refers to two distinct structures: the part beneath the skin called the hair follicle or when pulled from the skin, called the bulb. This is located in the dermis and maintains stem cells which not only re-grow the hair after it falls out, but also are recruited to regrow skin after a wound and the shaft, which is the hard filamentous part that extends above the skin surface. A cross section of the hair shaft may be divided roughly into three zones, the cuticle which consists of several layers of flat, thin cells laid out overlapping one another as roof shingles, the cortex which contain the keratin bundles in cell structures that remain roughly rod-like and in some cases, the medulla, a disorganized and open area at the fibers centre. As the study reveals **(Montagna, 1963)** that the hair is a root embedded in the skin is a living tissue and grows to produce the hair which is a dead tissue. The living part, the hair follicle, is an appendage of the skin and develops as an invagination of the epidermis. **(Ortonne and Prota, 1993)** reported that the cortex is the main body of the hair and contains many of the Characteristics used in the microscopic comparison process. The cortex is composed of elongated and spindle-shaped cells. The cortex contains the structures that primarily give hair its color, the pigment granules. There are two chemical forms of pigment in human hairs: Eumelanin and Phaeomelanin. The pigment Eumelanin manifests in the colors of brown and black, and phaeomelanin in the colors of yellow and red, with each pigment having a slightly different size and shape.

METHODOLOGY: - 30-30 hair Samples were collected from the age group between 20-30 years of male and female students of university, who belongs to different region such as, North, East, West and South. Collected hair samples were preserved in plastic bag. After that they were labeled and photographed according to their name, age, region and gender. Each hair sample is first washed with acetone and after that with alcohol in order to remove dust and debris from it for slide preparation. The cast of cuticle of each hair were prepared by nail polish mount method and they were examined over microscopic glass slide. Before preparing the microscopic slide of the hair sample, it was first treated with bleaching agent H_2O_2 to bleach the hair so that internal structure of hair got visible. Bleached hair samples were repeatedly washed with water to remove any traces of H_2O_2. It was put inside the absolute alcohol to remove moisture then it was placed over the microscopic slide and a drop of glycerin

is put over it, examined under high resolving power microscope. All morphological character of hair such as diameter, shape of cuticle, breadth of the medulla, breadth of cortex and ratio of cortex\medulla were examined and noted down and later on comparison was made to evaluate the characteristics of hair of different regions of India. Mean value of cortex and medulla and their ratio (cortex\medulla) among male and female of various regions (Eastern region, Western region, Northern region and Southern region) were statistically calculated by following-

$$\text{Mean} = \frac{\sum Xi}{n}$$

RESULTS AND DISCUSSION: - 30-30 hair sample were collected from Eastern region, Western region, Northern region, and Southern region and examined carefully.

Table 1: Mean value of diameter of cortex, medulla and ratio of cortex and medulla of male and female students belonging to Eastern, Western, Northern and Southern region.

S. NO.	PLACE	Male (M)	Female (F)	MEAN VALUE				RATIO CORTEX: MEDULLA	
				Cortex		Medulla		Male	Female
				M	F	M	F		
Eastern Region									
1	Manipur	6	5	9.5	12.8	5.33	5.6	1.78	2.28
2	Nagaland	7	2	8.28	8.00	4.57	4.00	1.81	2.00
3	Meghalaya	2	8	7.00	11.12	3.5	7.62	2.00	1.45
Western Region									
4	Ahmadabad	7	8	7.85	8.87	4.28	5.25	1.83	1.68
5	Bikaner	4	4	12.5	7.5	7.75	4.00	1.61	1.87
6	Jaipur	4	3	6.5	10.0	4.5	6.33	1.44	1.57
Northern Region									
7	Varanasi	3	2	9.33	7.00	6.33	3.5	1.47	2.00
8	Raebareli	2	5	9.5	9.2	5.00	4.8	1.9	1.91
9	Lucknow	3	3	9.00	10.3	4.66	6.66	1.93	1.54
10	Allahabad	2	2	8.5	9.00	6.00	5.5	1.41	1.63
11	Agra	5	3	7.8	7.00	4.2	4.00	1.85	1.75
Southern Region									
12	Kochi	9	9	8.55	8.11	3.77	4.55	2.2	1.78
13	Bangalore	6	6	7.83	7.5	3.66	5.00	2.1	1.5

students belonging to Manipur is highest (2.28) and lowest is of male student belonging to Nagaland (1.81). The cuticle is thin and scale pattern is imbricate. Male students belonging to Bikaner have highest mean value (12.5) in cortex where as male students of Jaipur have the lowest mean value (6.5), it also been observed that male students of Bikaner have highest mean value (7.75) and female students of same area have lowest mean value (4.00) for medulla, and the cortex medulla ratio for female students belonging to Bikaner is highest (1.87) and lowest is of male student belonging to Jaipur (1.44). The cuticle is thin and scale pattern is flattened. Female students belonging to Lucknow have highest mean value (10.3) in cortex where as female students of Agra have the lowest mean value (7.00), it also been observed that female students of Lucknow have highest mean value (6.66) and female students of Varanasi have lowest mean value (3.5) for medulla, and the cortex medulla ratio for female students belonging to Varanasi is highest (2.00) and lowest is of male student belonging to Raebareli (1.9). The cuticle is thin and scale pattern is imbricate. Male students belonging to Kochi have highest mean value (8.55) in cortex where as female students of Bangalore have the lowest mean value (7.5), it also been observed that female students of Bangalore have highest mean value (5.00) and male students of same area have lowest mean value (3.66) for medulla, and the cortex medulla ratio for male students belonging to Kochi is highest (2.26) and lowest is of female student belonging to Bangalore (1.5). The cuticle is thin and scale pattern is imbricate and flattened.

DISCUSSION: - Variations of human head hair were identified by their mean value of cortex, mean value of medulla and ratio of cortex and medulla. **Saferstein (1998)** recommended that forensic aspects of hair examination can be used as physical and chemical properties of hair that could be served as individual characteristics of identity. The result for the study is in accordance with the work performed earlier by **Paneerchelvam *et al.*, (2008)** who reported that the forensic analysis of hair centre's on color and structure determined through microscopic magnification. The hair shaft has three forensically relevant layers: the cuticle, cortex and medulla. The cuticle has overlapping external scales, which helps in species identification. **Riggott *et al.*, (1981)** observed that on the basis of medullary diameter and cortex individualization of the person is possible. In present study 120 human hair samples have been examined for mean value of diameter of cortex, medulla and ratio of diameters of cortex and medulla. In comparative study mean value of diameter of cortex, medulla and ratio of diameters of

cortex and medulla were determined and it was found that the mean value of diameter of cortex, medulla and ratio of diameter of cortex and medulla were varying according to regions (Eastern, western, Northern and southern) on the basis of above parameter it may be possible to characterized the person regionally.

SUMMARY AND CONCLUSION: - In present study it was tried to characterize the morphological features of human head hair of persons belonging to different regions of India and to use the human hair characteristics as marker for identification of person. Samples were collected from the students belonging to different regions of India. The samples were bleached by H_2O_2 and examined under high magnifying microscope to measure their mean value of diameter of cortex, medulla and ratio of diameter of cortex and medulla with the help of micrometer. The cast of hair's cuticle were prepared with the help of nail polish mounting method for the study of their shape of cuticle From this study it was concluded that the variation in morphology of hair and their characteristics, may be used as marker for identification of person who are belonging from different region (Eastern, Western, Northern and Southern) of India. It can be also used as for personal identification on the basis of hair examination.

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