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Histomorphological and Quantitative Variation of Lanugo Hair

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ABSTRACT:

Hair as an exoskeleton is a unique characteristic of mammals; Human hair is a highly versatile material with significant potential in several areas such as population classification, forensic science for personal identification and also from evolutionary perspectives. Many research reported sexual dimorphism of quantitative characters in adult terminal hair and thereby provided imperatively roles in evolutionary aspects and personal identification. Apart from the three phases to hair growth such as anagen, catagen and telogen phases, the age of hair can be divided into three types such as the first hair, known as lanugo begins to grow on the entire body of the embryo at 3-4 months of pregnancy and falls out within 7-8 months, followed by Vellus and terminal hair. To best of the knowledge this is the first attempt on Histomorphological and Quantitative variation of Lanugo Hair consisted of 250 lanugo hair strands (125 male and 125 females) obtained from spontaneously aborted fetus (around 3 months). Before microscopy for histomorphological (medulation) and quantitative aspects (hair length in mm and Shaft diameter in µm), each hair strands were washed and cleaned following standard technique. The result demonstrated no variation in terms of non-medulated lanugo hairs for both the sexes. With regard to the quantitative characteristic hair length demonstrated significant ($p<0.05$) sexual dimorphism indicating of higher hair length among the females but shaft diameter did not reveal any variation between the sex. Since, peripheral 5α-reductase activity is increased by local growth factors and circulating androgens and androgen cause a few things to happen during hair development, but their primary role is in converting vellus hairs into terminal hairs. Therefore, the present study envisaged the hormonal influence is not as much effective to produce sexual dimorphism with regard to shaft diameter in the lanugo hair.

Key words: *Fetal hair, Medulation, Quantitative variable, Sexual dimorphism*

INTRODUCTION

Human hair is a highly versatile material with significant potential in several critical areas such as population classification, forensic science for personal identification (Hausman, 1925) and also from evolutionary perspectives (Plavcan, 2001; Chatterjee and Bandyopadhyay, 2018). Genetic basis of hair traits have also been taken into consideration for understanding the variation of phenotypes (Das Chaudhuri and Chopra, 1983; 1984)

Hair is very useful from personal identification point of view because a number of variations in the morphological characteristics of human head hair form exists worldwide. Although Haddon (1924) was the first who had attempted to utilize head hair forms as a category for ethnic classification. After that plethora of human hair studies (Hausman, 1925; Kirk, 1940; Banerjee, 1965; Robertson, 1982) were published to find out the variation in morphological characteristics. But these were mainly done on adult human scalp hair, study of fetal scalp hair in this regard is inexpressive.

Furthermore, sexual dimorphism of hair is also an important key for personal identification in human (Chanda and Bandyopadhyay, 2006). There are few studies on the sexual dimorphism of hair (Bukva, 1993; Zemelman, 2002; Chanda and Bandyopadhyay, 2006) and as well as variation spatial distribution (Mistry *et al.,* 2012). Nevertheless, all the studies have been conducted in adult hairs, while studies on sexual dimorphism of fetal hair are very scanty (Danforth 1925; Duggins and Trotter, 1950) and/or not found.

Hair is also used significantly as a criterion to evaluate the age effects (Kirk, 1940) According to the age hair can be divided into three types. The first hair, known as lanugo begins to grow on the entire body of the embryo at 3-4 months of pregnancy and falls out within 7-8 months, followed by Vellus and terminal hair (Montagna and Van Scott, 1958).

Although very few studies on fetal hair in terms of vellus type has been conducted ((Danforth 1925; Duggins and Trotter, 1950) and observed similar kind of variation in morphological characteristics like that of terminal hair. However, studies on histomorphological variation of lanugo hair are yet to be reported. To best of the knowledge, the present study is the maiden

attempt to discern the histomorphological and quantitative variables with reference to the sexual dimorphism in human scalp lanugo hair.

MATERIALS AND METHODS:

The material for the present study consisted of hair samples from 10 spontaneously aborted fetuses (3 intra uterine months) consisting 5 male and 5 females from Bengalee Hindu Caste population. 25 hair strands from each fetus were taken for examination of Medullation, hair shaft Diameter and Length. Thus the total number of hair strands studied was 250. Sex determination of the fetus was done by utilizing the nuclear sexing method.

The hair samples were collected directly from the occipital region of the scalp of the fetuses by scraping with a sharp blade. Each of the hair strands were washed and cleaned using standard technique (Sen and Das Chaudhuri, 2001) and then were soaked and dried in room temperature. For microscopical study for the both histomorphological and quantitative variables (shaft diameter), each washed hair strand was mounted on microscopic glass slides with 40 x ocular microscope (Binoculour: Letiz, WETZLAR, Germany) with 0.65 objective resolutions. On the other hand for quantitative variables the above mentioned resolution was used and measurements have been obtained in µm by micrometer fitted with the microscope. Diameter of the shaft was measured at the three points- root, mid-point and tips (approx.) then the mean was taken. The lengths of the each shaft were measured by slide-caliper (Martin's) in mm. The data was tested for Q-Q plot and found to be in normal distribution. The cut off was set as $p=0.05$

RESULTS:

Examination on the histomorphological characteristics of the lanugo hairs revealed no medullation.

Length of the strands (Table 1) demonstrated significant ($p<0.05$) sexual variation (dimorphism), in terms of higher hair lengths in female compared to the males of same intra uterine months. On the other hand (Table 1) no sexual dimorphism has been found in shaft diameter.

DISCUSSION:

Examination on the histomorphological characteristics of the present attempt revealed the occurrence of entirely non-medulated lanugo hairs (Scalp), obtained from the spontaneously

aborted fetus of 3 months. However, the quantitative characteristics in terms of lanugo hairs demonstrated significant ($p<0.05$) sexual dimorphism in length but not in shaft diameter. Apart from the three phases to hair growth such as active growing phase (anagen), followed by involutional stage (catagen), and finally, the telogen phase in which the hair is resting, Peripheral 5α-reductase activity is increased by local growth factors and circulating androgens. This enzyme catalyzes the conversion of testosterone (Deplewski and Rosenfield, 2000) to dihydrotestosterone (DHT). In body hair DHT stimulates differentiation of the hair follicle from vellus to terminal hairs. However, lanugo hairs are the first hair begins to grow on the entire body of the embryo at 3-4 months of pregnancy and falls out within 7-8 months, followed by Vellus and terminal hair (Montagna and Van Scott, 1958). Androgens are responsible for changing many aspects of hair growth, including the size of the hair follicle (Messenger, 1993). Androgens cause a few things to happen during hair development, but their primary role is in converting vellus hairs into terminal hairs (Kvedar *et al.,* 1985). In addition to changing the appearance, androgens also extend the growth phase for body hair. Therefore, the present study envisaged variable hormonal influence produce sexual dimorphism with regard to hair length and shaft diameter in the lanugo hair.

Table 1. Distribution of Length and Shaft Diameter of the lanugo hair according to the sex

Name of The Group	**Length (mm)**	**Diameter (µm)**
	Mean ± SD	**Mean ± SD**
Male (n=125)	2.35 ± 1.29	17.98±3.39
Female (n=125)	3.00 ± 2.29*	18.19±2.83

*$p<0.05$

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There is no Authors' Potential Conflict of Interest.

REFERENCES:

Banerjee AR. 1965. On variation of human head hair: Hair Form and Medullation. *Z Morphol Anthropol* 57(1):56-69.

Bukva V. 1993. Sexual Dimorphism in the Hair Follicle Mites (Acari: Demodecidae): Scanning Electron Microscopy of Soricidex Dimorphus. *Folia Parasitol (Praha)* 40(1):71-9.

Chanda S, Bandyopadhyay AR. 2006. Sexual dimorphism in the hair histological characters among the adult bengali population of Kolkata. *Ind. J. Phys. Anthrop & Hum Genet* 25(2):111-117.

Chatterjee M, Bandyopadhyay AR. 2018. Hair Ultrastructure: A comparative study on Old world and new world monkey. *Human Biology Review* 7(1): 28-33

Danforth CH. 1925. Studies on Hair with Special Reference to Hypertrichosis. *Arch Derm Syphilol* 12(3):380-401.

Das Chaudhuri AB, Chopra VP. 1983. Genetic Basis of hair Histomorphological Variables. *Am J Phys Anthropol* 60(1):1-6.

Das Chaudhuri AB, Chopra VP. 1984. Variation in Hair Histological Variables: Medulla and Diameter. *Hum Hered* 34(4):217-221.

Deplewski D, Rosenfield RL. 2000. Role of Hormones in Pilosebaceous Unit Development. *Endocr Rev* 21(4):363–392.

Duggins OH, Trotter M. 1950. Age Changes in Head Hair From Birth to Maturity. II. Medullation in Hair of Children. *Am J Phys Anthropol* 8(3):399-415.

Haddon AC. 1924. The Races of Man and their distribution. London: Cambridge University Press

Hausman LA. 1925. The Relationships of Microscopic Structural Characters of Human Head Hair. *Am J Phys Anthropol* 8(2):173.

Kirk PL. Human Hair Studies: 1940. General Consideration of Hair Individualization and Its Forensic Importance. *Am Inst Crim L & Criminology* 31(4):486-496

Kvedar JC, Gibson M, Krusinski PA. 1985. Hirsutism: Evaluation and Treatment. *J Am Acad Dermatol* 12(2):215–255.

Messenger AG. 1993. The Control of Hair Growth: An Overview. *J Invest Dermatol* 101(1):S4-S9.

Mistry S, Chatterjee M, Ghosh JR, Chakrabarti NK, Bandyopadhyay AR. 2012. Variations of Scalp, Pubic and Axial hair. *Anthropologisher Anzieger* 69(1):117-125.

Montagna W, Van Scott EJ. 1958. The anatomy of the hair follicle. In: Montagna W, Ellis RA, editors. The Biology of Hair Growth. New Work: Academic Press; Pp. 1-32.

Plavcan JM. 2001. Sexual Dimorphism in Primate Evolution. *Am J Phys Anthropol* 116(33):25-53.

Robertson J. 1982. An Appraisal of Use of Microscopic Data in the Examination of Human Head Hair. *J Forensic Sci Soc* 22(4):390-395.

Sen J, Das Chaudhuri AB. 2001. Brief Communication: Choice of Washing Method of Hair Samples for Trace Element Analysis in Environmental Studies. *Am J Phys Anthropol* 115(3):289-291.

Zemelman V, Von Beck P, Alvarado O, Valenzuela CY. 2002. Sexual Dimorphism in Skin, Eye and Hair Color and the Presence of Freckles in Chilean Teenagers from Two Socioeconomic Strata. *Rev Med Chil* 130(8): 879-84.