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Determination of Age and Sex from Nail Lines

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Abstract: This study analyzes fingernail samples to investigate the relationship between age and longitudinal ridges, assessing their forensic significance. Samples from individuals aged 5 to 80 years were examined under a stereo microscope to observe ridge density and pattern variations. Results were evaluated to determine the applicability in forensic age estimation and identification. Different samples were tested and after clearly observing the different patterns in the nail result were analysed for determining the significance of nail patterns or nail lines in the determination of age.

Keywords*: Longitudinal Ridges, Ridge Density, Forensic Age.*

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I. INTRODUCTION

Nail development starts in the matrix, where keratinocytes form keratin, which pushes the older cells outward to create the nail plate. Fingernails develop 3-4 mm each month, toenails 1-2 mm, with total regrowth in 4–18 months. The nail plate, composed of three layers of keratin, shields the nail bed, which provides nutrients and sensation. The eponychium (cuticle) seals against infection, while the hyponychium serves as a defense against bacteria, fungi, and debris. Growth is determined by age, hormones, genes, and overall health. Heat, good circulation, and good diet facilitate more rapid growth, whereas aging, sickness, stress, and exposure to chemicals inhibit it. Frequent trimming and moisturizing are important to maintain strength and flexibility, but excessive manicures or rough products may make nails weaker. Vertical ridges are a natural part of aging, but horizontal lines, discoloration, or pitting can signal deficiencies, trauma, or conditions such as diabetes, thyroid disease, or circulatory disease. Alterations in nail texture, color, or growth pattern can be an indication of underlying medical issues, so nail health is a valuable sign of general health.

II. MATERIALS AND METHODS

Sixteen nail samples of length approximately 0.5 to 1 cm are obtained from individuals aged between 5 to 80 years, 8 males and 8 females. Patients allowed their nails to grow up to 1 cm carefully without any medical conditions or damage. Samples were obtained by cutting with a blade, then washed and stored in plastic bags to avoid scratches. Each of the samples was trimmed to 0.5 cm for improved visibility and captured under a stereo microscope. Longitudinal ridges were enumerated from photographs to examine the relationship between nail lines, line density, age, and gender differences to assess the research hypothesis.

III. RESULTS

Upon analysis, some individuals has prominent nail density, and for others less or absent irrespective of age. No correlation found between longitudinal nail ridges and age. So it is ineffective for age and sex determination in forensics.

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Table 1 Demonstration of Line Densities of Nails in Different Age Gapes of Males and Females

SL.NO	AGE GROUP (IN YEARS)	LINE DENSITY (AROUND 0.5 CM LENGTH)	
		MALE	FEMALE
1.	5-10	Less	Absent
2.	10-20	Prominent	Less
3.	20-30	Less	Absent
4.	30-40	Prominent	Less
5.	40-50	Less	Less
6.	50-60	Less	Less
7.	60-70	Prominent	Prominent
8.	70-80	Prominent	Less

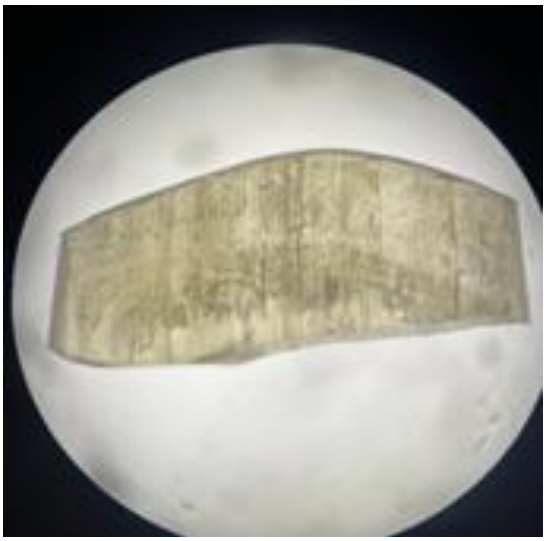

Fig 1 Sample between Age Group 30-40 Years (Male)

Fig 2 Sample between Age Group 30-40 Years (Female)

IV. DISCUSSION AND CONCLUSION

Research was done in order to conclude the age and sex from the nail lines. In the research 16 samples of nails of length approximately 0.5 to 1 cm are gathered from individuals from age of 5 to 80 years, 8 each from males and females. Longitudinal nail ridges found no relationship with age and sex in this research, thus dismissing their application for forensic identification. Ridge patterns also differed between people and were less determined by biological aging than environmental factors. While it is rapid and non-surgical, it is not dependable. With time and further development using new imaging and AI technologies, future research may improve on its potential but should not base forensic science on unproven techniques such as ridge patterns.

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