e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2024; 16(3); 291-297

Original Research Article

Microanatomy of Age Related Changes in Epidermal Thickness of Human Male Skin: A Cadaveric Study

Godly Sara Sabu[1], Romi S.[2], Sajey P. S.[3]

[1]Assistant Professor, Department of Anatomy, Government T. D. Medical College, Alappuzha
[2]Professor, Department of Anatomy, Azeezia Medical College, Azeezia Institute of Medical Sciences and Research, Kollam
[3]Associate Professor, Department of Anatomy, Government T. D. Medical College, Alappuzha

Received: 25-01-2024 / Revised: 05-03-2024 / Accepted: 08-03-2024
Corresponding Author: Dr. Sajey P. S.
Conflict of interest: Nil

Abstract:

Background: Human skin undergoes tremendous changes as age advances and also due to factors like exposure to sunlight, hormonal factors, stress etc. Changes can occur at macroscopic and microscopic levels. A better knowledge of the normal gross and histological features of each age group is essential for early diagnosis of any pathological abnormalities pertaining to that particular age group. This study aims to provide normal microscopic changes occurring in human skin in various age groups. The objective of the study is to find out the microanatomy of age related changes in human male skin and to correlate the changes in epidermal thickness.

Method: A descriptive study on microanatomy of age related changes in human skin was conducted in the Department of Anatomy, Govt. T. D. Medical College, Alappuzha. 66 specimens of human male skin from anterior abdominal wall were collected from the Department of Forensic Medicine, after taking detailed informed written consent. The specimens were grouped into 4 different age groups. A study of microanatomical changes in epidermal thickness of human skin according to age was done using Haematoxylin and Eosin stain.

Results: The changes in epidermal thickness were observed. After preparing the master chart in Microsoft Excel, the observations were analysed using SPSS Version 18.

Conclusion: Epidermal thickness of skin showed an increase from 20 years, upto 60 years of age, and a decline was seen thereafter. Epidermal thickness is low in younger age group but the thickness increases as age advances, which might be due to increased mechanical work done in late teens and adulthood.

Keywords: Epidermal Thickness, Microanatomy, Human Skin.

Introduction

Skin is complex and largest organ of human body, forming 16% of the body weight, which acts as an effective barrier against microbial invasion and maintains body temperature. Skin consists mainly of two layers- epidermis, which is the outermost protective layer, constituted by keratinocytes and non-keratinocytes, the latter includes melanocytes, Langerhans cells and Merkel cells [1] and dermis, which predominantly contains collagen and elastin fibres, along with hair follicles, sweat glands, sebaceous glands, nerve endings and blood vessels.

The layers of epidermis from deep to superficial are stratum basale, stratum spinosum, stratum granulosum, stratum lucidum and stratum corneum. Beneath these two layers, lie subcutaneous fatty tissue, the hypodermis, which is mainly involved in temperature regulation. Aging of skin is caused by intrinsic as well as extrinsic factors, which is characterised by wrinkling, laxity, depigmentation [2] etc. Hormonal changes are also involved in aging process, especially in females. It is characterised by decrease in epidermal turnover rate, leading to epidermal atrophy [3]. Evidence of increasing age includes wrinkles and sagging, along with the obvious greying of the hair, and with aged skin, histological, biochemical as well as functional changes occurs [4].

Skin aging is particularly important because of its social impacts. It is a visible and an ideal model organ for investigating the aging process. [5] Skin is involved in a wide number of pathological conditions. Any lesion affecting the skin can give a diagnostic clue for diseases occurring elsewhere in the body. Normal microanatomy of the skin is definitely to be known to easily identify the pathology. Moreover, skin adds to the external beauty and has got more cosmetic importance nowadays. So it is the need of the hour to have a look on the various alterations in microanatomy of skin as age advances, which leads to loss of

elasticity, loss of texture, thinning, appearance of age spots etc. Based on all these facts and observations, it is found worthwhile to study about the microanatomy of age related changes in human skin.

Materials and Methods

A descriptive study on microanatomy of age related changes in human skin was conducted in the Department of Anatomy, Govt. T. D. Medical College, Alappuzha.66 specimens of human male skin from anterior abdominal wall of autopsied bodies, subjected to autopsy within 8 hours after death, were collected from the Department of Forensic Medicine, Govt. T. D. Medical College, Alappuzha and were processed in the Histology laboratory of Department of Anatomy, Government T.D. Medical College, Alappuzha. Autopsy specimens with gross skin pathology like skin cancer, burns, and extensive scars, conditions which alter cell morphology like leprosy, psoriasis etc., and patients diagnosed with cutaneous manifestations of systemic diseases and autopsy bodies, whose relatives did not sign informed consent form were excluded.

Initially the age and sex of the deceased were recorded. A detailed written informed consent was obtained from the relatives. Confidentiality of the information obtained was assured. Specimens of skin from anterior abdominal wall of about 3 x 3 cm size, were dissected out during autopsy. The specimens were immediately transferred to a labelled bottle containing fixative solution, 10% formalin. Specimens obtained were trimmed properly and from each specimen, 6 bits were taken. The tissue bits were put in labelled tissue capsules and processed by standard methods. At first, specimens were subjected to a process of dehydration by serial passage through solutions of alcohol of gradually increasing strengths (50%, 70% and 90%), ending with two changes through absolute alcohol. The dehydrated tissue bits were then cleared in Xylene. Finally, they were put in paraffin bath for infiltration. The paraffin infiltrated specimens were then embedded in paraffin wax using L-blocks. After trimming the blocks, they were cut serially at 5 µm thicknesses using rotary microtome and mounted on slides. [15,16] All these slides were stained by routine Haematoxylin and Eosin staining method [17]. Mounted specimens were observed under low power and high power objectives of a binocular research microscope with built in light source. 2 slides were prepared from each block and in each slide; different fields were examined for the epidermal thickness. Photographs of histological specimens were taken using camera attached to research microscope and images were documented.

Epidermal thickness was measured under low power objective with a horizontal eye piece micrometer which was calibrated with a stage micrometer. A stage micrometer was a glass slide of three inches in length with a scale engraved on it. The scale was one millimetre long and was divided into 0.1 and 0.01 parts of a millimeter. The value of one eye piece division was determined by calibrating with stage micrometer for every optical combination to be used.

Epidermal thickness was measured as the distance between the stratum corneum and the region where dermis begins. From each slide, 5 fields were assessed and in each field, 5 measurements of equal distance were taken and average of those values were calculated as the epidermal thickness of that particular field. From all the average values, mean epidermal thickness was computed for each age group.

Research microscope was used for capturing series of images using 10X magnification and 40X magnification. The data collected were tabulated using master chart in Microsoft Excel and were analysed with the help of descriptive statistics using SPSS software version 18. Findings were expressed as mean and standard deviation.

Results

Changes in the microanatomy of epidermal thickness of human male skin according to age were studied in detail under low power magnification. Specimens from anterior abdominal wall from 66 cases were taken and were categorized into 4 age groups- Group I (< 20 years), Group II (21-40 years), Group III (41-60 years) and Group IV (> 60 years). The following findings were observed.

Table 1: The Number of Specimens Collected for Study

Sl. No	Age Group	Total no. of specimens
1.	Group I : < 20 Years	02
2.	Group II : 21- 40 Years	19
3.	Group III : 41-60 Years	27
4.	Group IV : > 60 Years	18
	Total	66

Table 2: Epidermal Thickness of Human Male Skin in Different Age Groups

Group I Age (in yrs)	ET (µm)	Group II Age (in yrs)	ET (µm)	Group III Age (in yrs)	ET (µm)	Group IV Age (in yrs)	ET (µm)
0	6.06	**21**	20.03	**41**	37.90	**61**	51.27
12	12.10	**24**	21.37	**42**	38.00	**62**	50.00
		27	21.84	**42**	40.01	**64**	47.93
		28	22.01	**43**	41.82	**65**	45.00
		30	23.08	**44**	42.62	**67**	42.90
		32	23.84	**44**	43.56	**68**	35.82
		32	23.96	**45**	45.00	**69**	34.00
		34	24.01	**46**	47.82	**70**	30.62
		35	24.89	**47**	49.95	**71**	27.11
		35	24.92	**48**	50.27	**72**	24.90
		36	26.82	**48**	50.28	**73**	21.01
		36	28.60	**48**	50.76	**75**	20.84
		37	31.00	**49**	51.26	**76**	20.06
		37	31.49	**50**	51.84	**78**	19.61
		37	32.00	**50**	52.00	**79**	18.53
		38	34.05	**51**	52.78	**81**	16.92
		38	35.00	**52**	52.79	**82**	16.59
		39	36.92	**52**	52.79	**87**	15.49
		40	37.76	**53**	52.80		
				54	52.92		
				55	53.00		
				56	53.02		
				56	53.42		
				58	53.60		
				59	53.84		
				60	53.20		
				60	53.00		

(ET: Epidermal thickness)

Table 3: Mean Epidermal Thickness of Human Male Skin in Different Age Groups

Age (years)	Mean (µm)	Standard Deviation (SD)	Frequency	P value
<20	9.0800	4.26527	42.419	<0.001
21-40	27.5578	5.62720		
41-60	49.2697	5.16830		
>60	29.9237	12.63630		

Table 3 shows that epidermal thickness of skin in males increases with aging upto 60 years and starts to decline after 60 years. The association between epidermal thickness and age is statistically significant with a p value < 0.001.

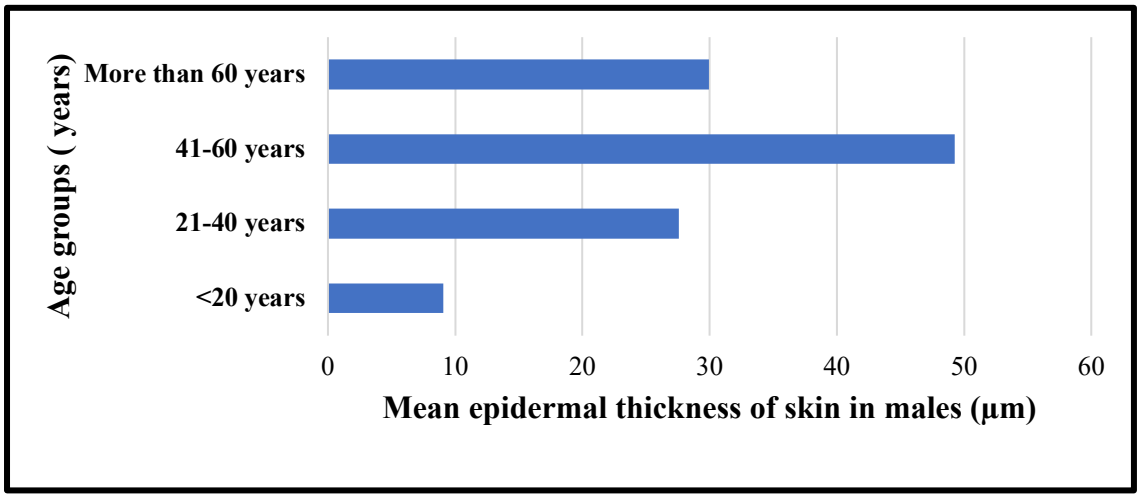

Figure 1: Bar Diagram Showing Changes in Epidermal Thickness of Skin in Males with Aging

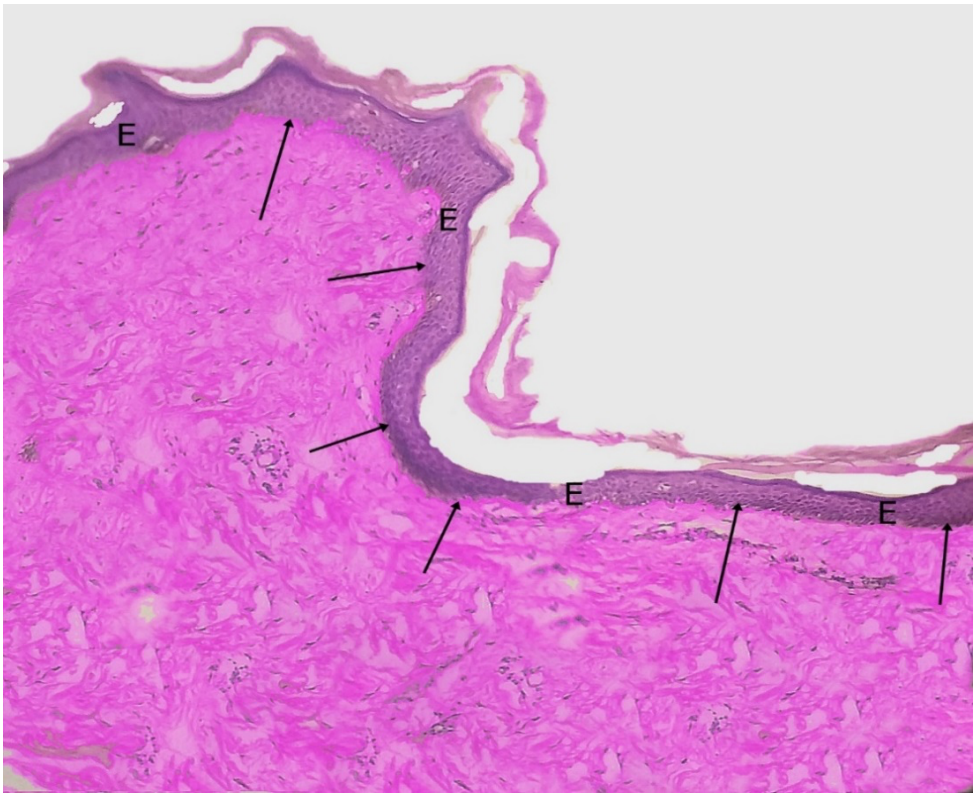

Figure 2: (Plate 1) Newborn male skin, arrows showing flattened Dermo-epidermal junction (DEJ). E denotes epidermis. 100X, H & E

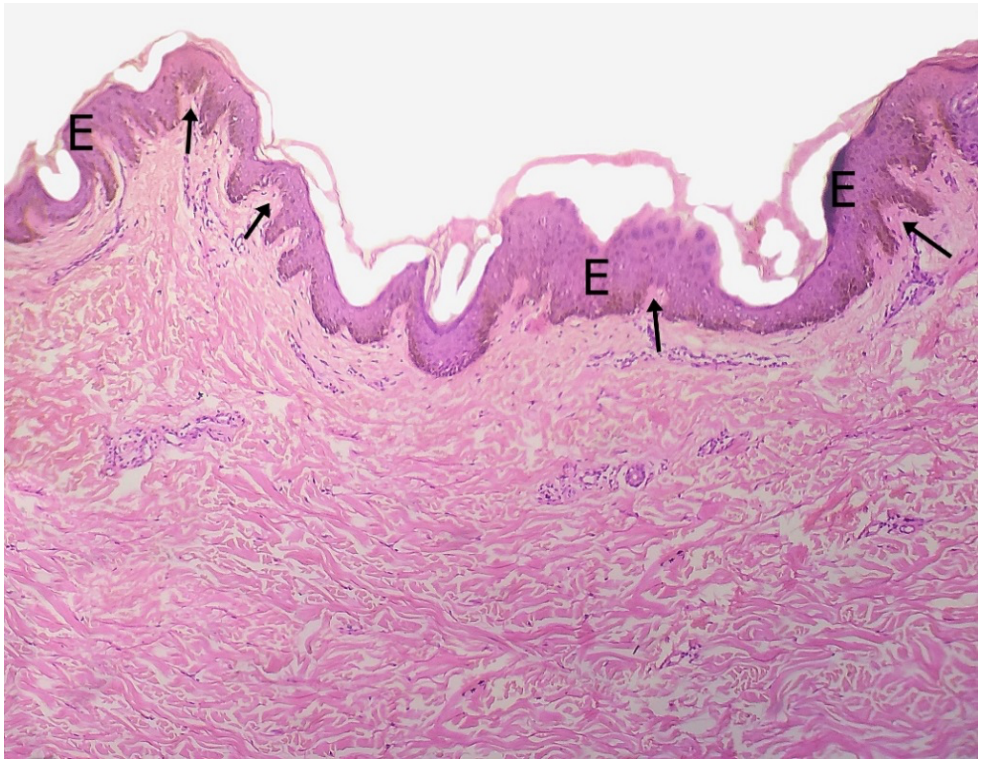

Figure 3: (Plate 2) 21 year old male skin, arrows showing dermal papillae. E denotes epidermis. 100X, H & E

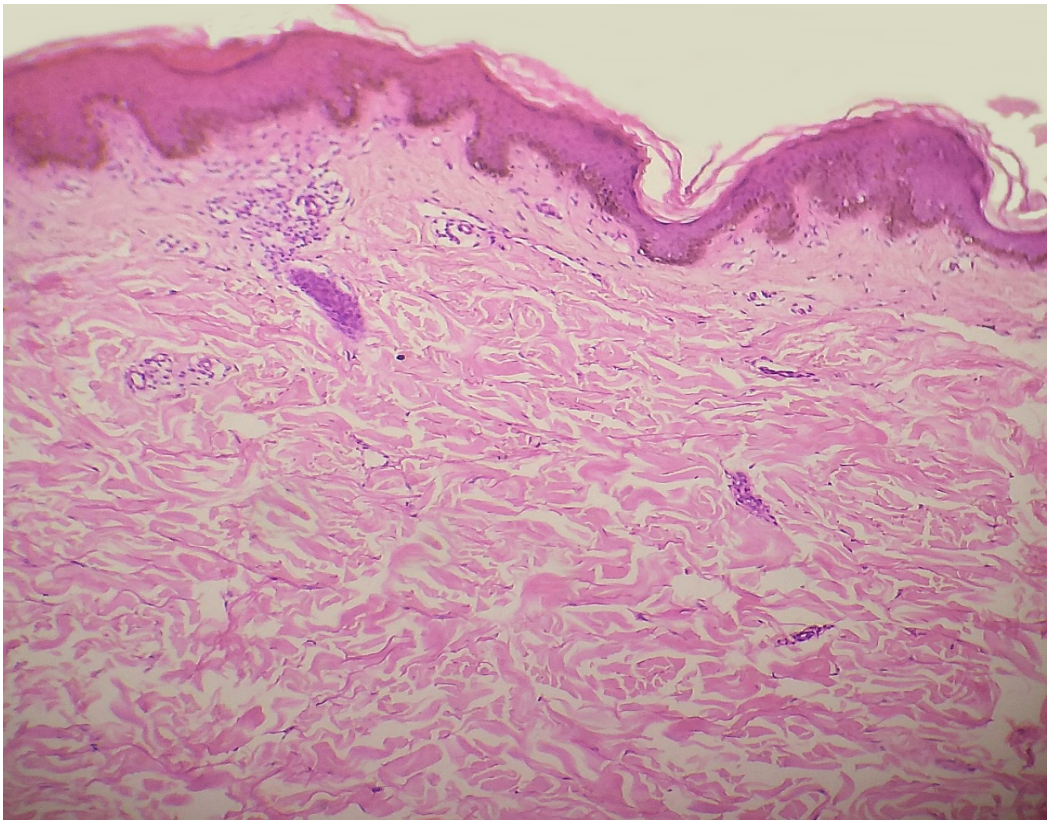

Figure 4: (Plate 3) 59 year old male skin. 100X, H &E

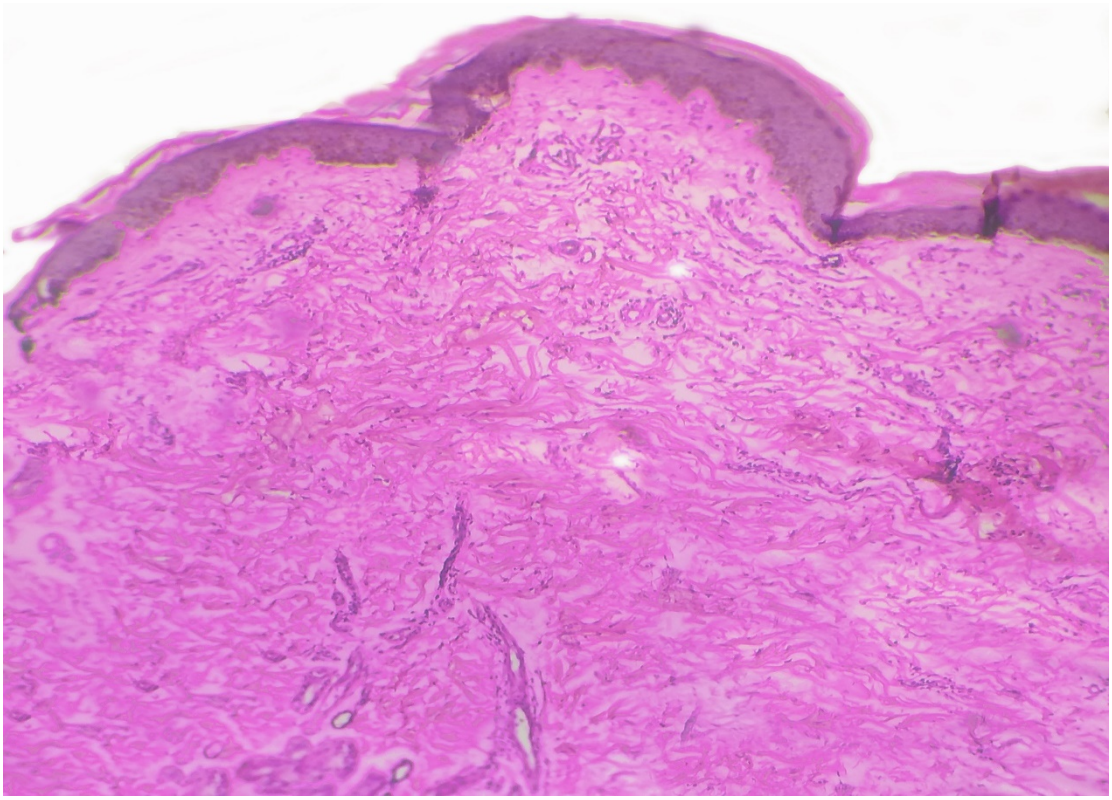

Figure 5: (Plate 4) 72 year old male skin. 100X, H&E.

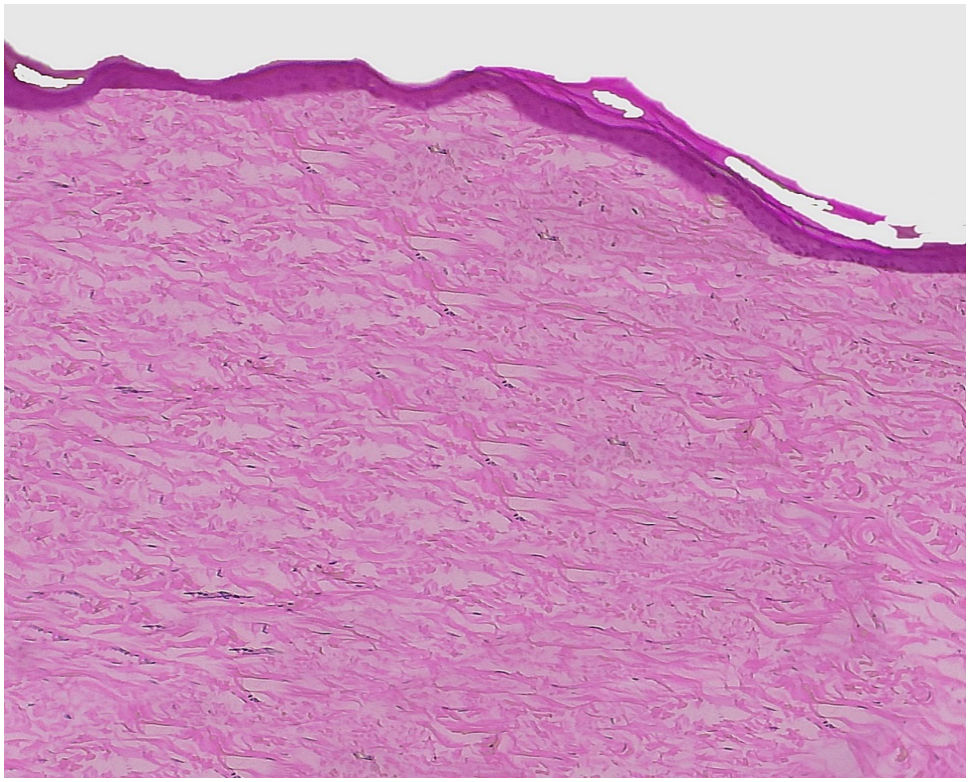

Figure 6: (Plate 5) 87 year old male skin. 100X, H & E.

Discussion

Scientific and research works in the field of cellular and molecular biology, and cell cycle regulation have paved the way to advance our knowledge in integumentary system, which involves skin and other appendages like hair and nail. Skin is divided into thick and thin, based on its epidermal thickness. The present study is aimed to demonstrate the normal age related changes in epidermal thickness of human male skin. Specimens from anterior abdominal wall were taken from 66 cases and were categorised into 4 age groups. 6 bits each were taken from all cases. 2 slides were prepared from each block and in each slide, 5 different fields were studied. Aging has become one of the emerging healthcare challenges which can lead to biological and physiological degradation, and it is associated with life style diseases like diabetes, hypertension, dyslipidemia etc. [6] As age advances, common skin disorders in elderly population demands attention, as there can be benign and malignant conditions underlying it. [7] Knowing age related changes also help in providing innovations in transdermal drug delivery systems. [8]

The mean thickness of the epidermis was found to be lower in age group I (9.0800µm) (Plate 1), which was in accordance with the study put forward by Samiappan Manimegalai [9], et al, which stated that there was a slight increase in the mean epidermal thickness upto 50 years, following which values remained constant upto 60 years. In the present study, there was a significant increase in the mean epidermal thickness upto 60 years (Group II – 27.5578 µm and Group III- 49.2697 µm) (Plates 2 and 3).Above this age, mean epidermal thickness started to decline (Group IV-29.9237 µm) (Plate 4), with significant decline in extremes of age groups (above 75 years) (15.49 µm at 87 years in this study) (Plate 5). The association between epidermal thickness and age in all age groups was found to be statistically significant with a p value < 0.001.

Reduction in epidermal thickness in older individuals is a reason for decreased moisture content, which leads to dryness and scaling of skin. According to Waller JM and Maibach HI [10] (2005) the thickness of the epidermis started to increase till 20 years of age, and then the thickness remained constant followed by thinning of the epidermis in older individuals. Langton AK, Sherratt MJ, Griffiths EM, Watson REB [11] (2010) also mentioned in their study that epidermal thickness decreased after 60 years of age.

As per study by Fenske and Lober [12] (1986) as age advances, epidermis becomes thinner with flattening of dermo-epidermal junction. Helfrich YR, Sachs DL, Voorhees JJ [13] (2008) mentioned in a study that ageing produces epidermal atrophy, loss of Rete Pegs and thinner dermis, but photo ageing produces marked epidermal atrophy or may also produce increased epidermal thickness. In the skin from the abdomen, the Rete Pegs were found to be reduced and the thickness of the epidermis

was also found to be reduced from 60 years of age. The thickness of the epidermis gets reduced in old age due to altered cellular morphology as studied by Langton AK, Sherratt MJ, Griffiths EM, Watson REB. [11] (2010) in a study on age related skin changes, by Levakov, Aleksandra, et al [14] (2012) the thickness of the epidermal layers and the number of cellular living layers is greater in younger skin.

Conclusion

Aging is a complex process which is beyond human control. It is due to environmental, dietary, hormonal, metabolic and genetic factors. It inevitably affects both structural and functional stability of skin which is mainly due to progressive molecular damage.

Skin acts as a window in reflecting various age related changes. Pathologies related to skin can be benign or malignant. Skin disorders can affect the quality of life of individuals. Some cutaneous manifestations serve as eye openers to diseases elsewhere in the body. Like all other organs, special care has to be given to skin. Geriatric population has to be given proper dermatological care as there is increased risk of infection, impaired wound healing, roughness and fragility of skin in them.

The observations of the undertaken study indicate that age changes do occur in human skin. There is a definite pattern of sequential changes in relation to different periods of life. It is important to know the spectrum of effects of aging process, which will be beneficial to Dermatologists and Cosmetologists. The present study may serve as a platform for early diagnosis of skin pathologies and management and also for cosmetic interventions. It is worthwhile to have more researches in this field to maintain the youthful charm and regenerative capacity of skin in older people.

Acknowledgement

I am extremely grateful to all the relatives of the deceased, who willingly gave me consent to take adequate specimens, for the completion of my study. I thank God Almighty for giving me the strength, knowledge, ability and opportunity to undertake this research study and to persevere and complete it satisfactorily.

References

1. Standring S, Wigley CB, Borley NR, Collins P. The Anatomical Basis of Clinical Practice. Gray's Anatomy. 40th ed. Vol. 2. 2008. 145–148 p.
2. Tobin DJ. Introduction to skin aging. J Tissue Viability. 2017 Feb 1; 26(1):37–46.
3. Roupe G. [Skin of the aging human being]. Lakartidningen. 2001 Mar 7; 98(10):1091–5.
4. Farage MA, Miller KW, Elsner P, Maibach HI. Intrinsic and extrinsic factors in skin ageing: a review. Int J Cosmet Sci. 2008 Apr; 30(2):87–95.
5. Gilchrest BA, Krutmann J. Skin Aging. Heidelberg- Springer. 2006; 1:19–21.
6. Limbert G, Masen MA, Pond D, Graham HK, Sherratt MJ, Jobanputra R, et al. Biotribology of the ageing skin—Why we should care. Biotribology. 2019 Mar 1; 17:75–90.
7. Gilchrest BA. Skin aging and photoaging: An overview. J Am Acad Dermatol. 1989 Sep 1; 21(3, Part 2):610–3.
8. Khan M, S. Roberts M. Challenges and innovations of drug delivery in older age. Adv Drug Deliv Rev. 2018 Sep 1; 135.
9. Samiappan Manimegalai, Jamuna Meenakshi Sundaram, Nandhini Venkatachalam. Age changes in human skin from 3 years to 75 years of age. Int J Anat Res. 2015; 3(4):1578–84.
10. Waller JM, Maibach HI. Age and skin structure and function, a quantitative approach (I): blood flow, pH, thickness, and ultrasound echogenicity. Skin Res Technol Off J Int Soc Bioeng Skin ISBS Int Soc Digit Imaging Skin ISDIS Int Soc Skin Imaging ISSI. 2005 Nov; 11(4):221–35.
11. Langton AK, Sherratt MJ, Griffiths CEM, Watson REB. A new wrinkle on old skin: the role of elastic fibres in skin ageing. Int J Cosmet Sci. 2010 Oct; 32(5):330–9.
12. Fenske NA, Lober CW. Structural and functional changes of normal aging skin. J Am Acad Dermatol. 1986 Oct; 15(4 Pt 1):571–85.
13. Helfrich YR, Sachs DL, Voorhees JJ. Overview of skin aging and photoaging. Dermatol Nurs. 2008 Jun; 20(3):177–83; quiz 184.
14. Levakov A, Vucković N, Dolai M, Kaćanski MM, Bozanić S. Age-related skin changes. Med Pregl. 2012 Jun; 65(5–6):191–5.
15. Santhosh Kumar Mondal. Manual of histological techniques. 2017; (1):16–7.
16. D R Singh. Principles and Techniques in Histology, Microscopy and Photomicrography. 2015; 19–70.
17. Bancroft J D, Marilyn G. Theory and Practice of Histological Techniques. London Churchill Livingstone. 2002; (5):125.