

AGE CHANGES IN HUMAN SKIN FROM 3 YEARS TO 75 YEARS OF AGE

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ABSTRACT

Background: Natural aging process is reflected by gradual changes in the structure of the skin. These changes become very marked in old age. The changes in the epidermis and dermis as age advances is reflected externally as wrinkling, dryness, loss of elasticity, thinning and tendency towards purpurae on minor injury. So the aim of this study is to measure the thickness of the epidermis.

Materials and Methods: The study was done in skin specimens by grouping the individuals in 4 age groups namely Group A (3-20yrs), Group B (21-50yrs), Group C (51-65yrs) and Group D (>65yrs). The specimens were stained with Haematoxylin and Eosin stain and the changes in the thickness of the epidermis was observed.

Results: The epidermis was found to be thin in children from 3 years of age. The thickness of the epidermis starts increasing in young individuals and is thick till 50 years of age. Then the thickness of the epidermis starts reducing and becomes very thin in older persons.

Conclusion: As the average life expectancy is increasing, the aging of skin presents a growing problem for the dermatologists. The computer system for image processing and analysis has made possible, measuring the thickness of the epidermis. Human aging is characterized by a number of disorders like epidermolysis bullosa and pemphigus vulgaris affecting the structure of the skin. So it is necessary to study the normal changes that occur in the skin as age advances which predisposes to various disorders. The study is done among Indian population.

KEY WORDS: Thickness of the Epidermis, Human Skin, Age Changes, Dermatologists.

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INTRODUCTION

Skin is a complex organ forming 8% of the total body mass, which interacts with the environment and also protects the host from the external environment. It acts as an effective barrier against microbial invasion and maintains body temperature. It is a major sensory organ reflecting the earliest signs of various systemic

disorders. It undergoes series of changes as age advances which can be studied microscopically in the various layers of the skin. These changes are reflected externally as wrinkling, dryness, loss of elasticity and various changes.

Skin has mainly two layers namely, epidermis and dermis. The layers of epidermis from deep to superficial are as follows. The Basal layer

(Stratum basale), spinous or prickle cell layer (Stratum spinosum), Granular layer (Stratum granulosum, Clear cell layer (Stratum lucidum) and cornified layer (Stratum corneum). The first three layers are metabolically active and the superficial layers undergo terminal keratinization and cornification. Dermis has a papillary layer and a reticular layer. In epidermis, the deep layer, the Stratum basale constitutes a single layer of columnar to cuboidal cells resting on the basement membrane. Cells are attached to each other by desmosomes and to the basement membrane by hemidesmosomes. These are the stem cells having increased mitotic activity, replacing the cells in the superficial layer. Stratum spinosum, the second layer forms second layer of keratinocytes. During routine Haematoxylin and Eosin preparations, the cells shrink and detach from each other except at the sites of attachments of desmosomes, which appears like spines. The synthesis of keratin filaments is continued in this layer and they are arranged in bundles of tonofilaments. Stratum granulosum, the third layer has cells containing dense keratohyaline granules, so called the granular layer. These granules produce soft keratin of the skin. This layer also contains membrane bound lamellar granules. These granules are discharged into the intercellular spaces in the Stratum granulosum and to the adjacent layer, Stratum lucidum if present or to the Stratum corneum. The lipid layer of the membrane seals the skin by making it impermeable to water. Stratum

Lucidum, the fourth layer is visible only in thick skin and is translucent. The cells are tightly packed and lack nuclei or organelles. The flattened cells contain densely packed keratin filaments. Stratum corneum, the fifth layer has cells which are dead flattened cells filled with soft keratin filaments. The superficial cells from this layer are desquamated and replaced by new cells from the Stratum basale. The epidermis also contains melanocytes, langerhan cells and merkel cells. Melanocytes are pigment cells derived from the neural crest. The langerhan cells are antigen presenting cells. Merkel cells are mechanoreceptors for cutaneous sensations [1]. Since skin is the major sensory organ and it forms eight percent of the total body mass and

also the microstructure of epidermis and dermis is altered and reflected externally with increasing age, it would be absolutely necessary to study the various changes that occur in the micro structure of the epidermis.

MATERIALS AND METHODS

Skin was obtained from the plastic surgery department in 10% formalin bottle. Approval from ethics committee and informed consent was obtained from the patient. Normal skin was obtained from both males and females from 3 years to 75 years of age from different parts of the body except palm and sole. Thickness of the epidermis was measured from the skin samples of different ages in the extensor aspect of the leg. The specimens were fixed in formalin for 24 hours and processed in series of alcoholic changes and xylene. The specimen was dehydrated by placing it in wax in the incubator overnight and embedded in wax. Blocks were prepared. Then the blocks were cut in microtome of 0.4 microns thickness and placed in glass slide. The slides were placed in incubator overnight for removal of wax. The next day the slides were stained with Haematoxylin and Eosin by the following procedure.

The slides were placed in xylene for 30 minutes for dewaxing. Slides were hydrated in series of alcoholic changes for 1 minute each, in absolute alcohol, 90%, 70% and 50% alcohol. Then stained with Haematoxylin for 3 minutes and rinsed in running water following which the slides were differentiated in 0.3% acid alcohol. Then the slides were rinsed in running tap water for 10 minutes, stained with Eosin, dehydrated in absolute alcohol, cleared in xylene with alcohol and mounted. The slides were stained with Haematoxylin and Eosin and were observed for changes in the thickness of the epidermis.

RESULTS

The change in the skin with increasing age is a complex process. The structural changes lead to disturbances in the functions of the skin, making the skin susceptible to various diseases. Hence the microscopic structural changes in the layers of the skin were studied by grouping the individuals in 4 age groups.

Group A: Skin specimens from 5 persons of 3 to 20 years of age of which 2 specimens were from females and 4 from males.

Group B: Skin specimens from 12 persons of 21 to 50 years of age of which 3 specimens were from females and 9 were from males.

Group C: Skin specimens from 8 persons of 51 to 65 years of age of which 5 specimens were from females and 3 specimens were from males.

Group D: Skin specimens from 4 persons of more than 65 years of which 3 specimens were from females and 1 from male.

The microscopic changes in the thickness of the epidermis were observed in the Haematoxylin and Eosin stained slides. The epidermal thickness was measured and analyzed using the computer system for image processing and analyses and observed under light microscope using 10X in micrometers.

EPIDERMAL THICKNESS:

Group A: 3-20Years: The thickness of the epidermis among Group A individuals between 3-20 years of age was as found in Table 1. The mean thickness of the epidermis was 5.37micrometers. The epidermis was thin as found in fig. 1.

Table 1: Thickness of the epidermis among Group A individuals between 3-20 years of age.

Age in years	Epidermal Thickness In Micrometers
3	5.62
8	5.11
16	5.23
16	5.62
20	5.27

The epidermal thickness among Group A persons from 3-20years of age is represented as bar diagram.

Graph 1: Epidermal Thickness - Group A: 3-20 Years.

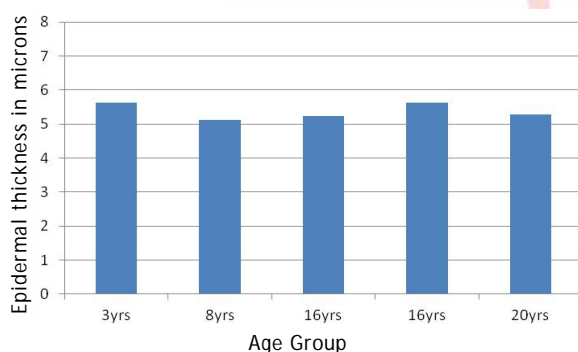


Fig. 1: Group A: 3-20yrs. Epidermis – Thin.

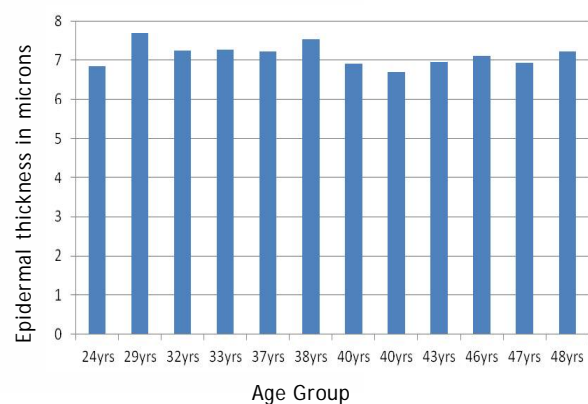


Group B: 21-50 Years: The thickness of the epidermis among Group B individuals from 21-50 years of age was as found in Table 2. The mean epidermal thickness was 7.09 micrometers.

Table 2: Thickness of the epidermis among Group B individuals from 21-50 years of age.

Age In Years	Epidermal Thickness In Micrometers
24	6.86
29	7.69
32	7.23
33	7.26
37	7.21
38	7.54
40	6.91
40	6.69
43	6.95
46	7.1
47	6.94
48	7.21

Graph 2: Epidermal Thickness - Group B: 21-50 Years.



Mean Epidermal Thickness: Group B: The mean epidermal thickness among Group B individuals from 21-30years (fig 2), 31-40years (fig 3) and 41-50 years (fig 4) was as found in Table 3 in which no significant difference was observed.

Table 3: mean epidermal thickness among Group B individuals from 21-30years, 31-40 years and 41-50 years.

Age Group In Years	Epidermal Thickness In Micrometers
21-30	7.8
31-40	7.15
41-50	7.05

Fig. 2: Group B: 21-30yrs. Epidermis –Thick.

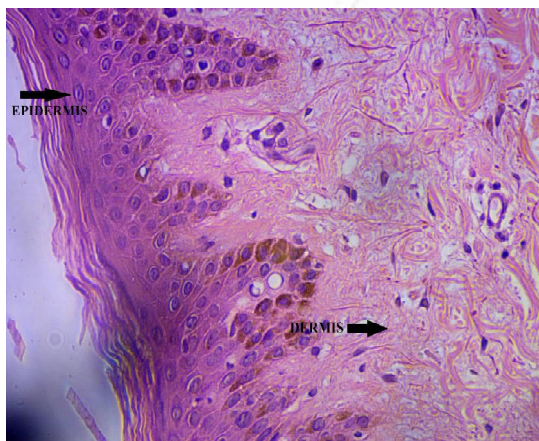
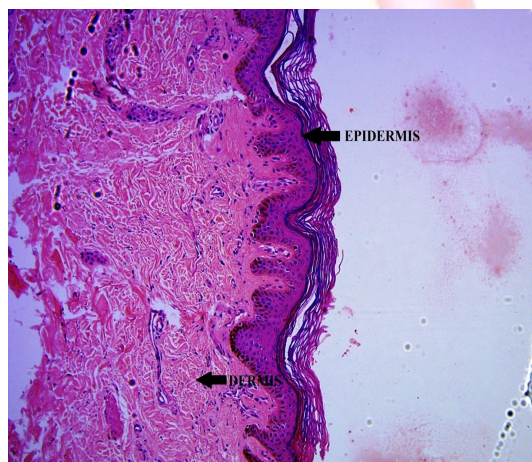


Fig. 3: Group B: 31-40yrs. Epidermis – Thick.

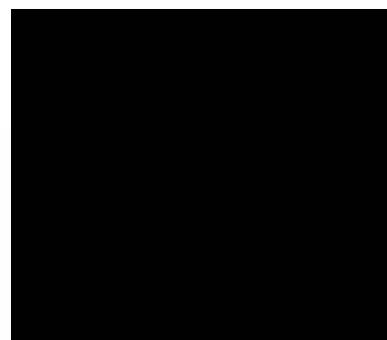


Fig. 4: Group B: 41-50yrs. Epidermis – Thick.



Group C: 51-65 Years: The epidermal thickness among Group C individuals from 51-65years of age was as found in Table 4. The mean thickness of the epidermis was 6.89micrometers. The epidermis was found to be thin as found in fig 5

Table 4: Epidermal thickness among Group C individuals from 51-65years of age.



The epidermal thickness in Group C persons from 51-65years of age is represented as bar diagram

Graph 3: Epidermal Thickness- Group C: 51-65 Years.

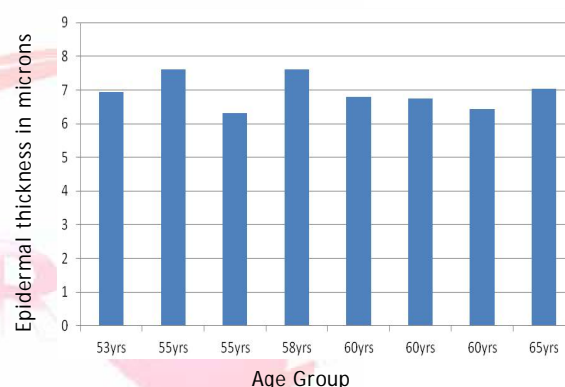
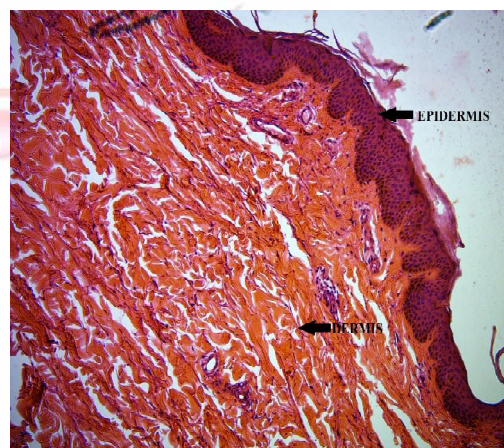


Fig. 5: Group C: 51-65yrs. Epidermis-Thin.



Epidermal Thickness: Group D: > 65 years: The epidermal thickness among Group D individuals of more than 65 years of age was as found in Table 5. The mean thickness of the epidermis was 5.25micrometers. The epidermis was found to be very thin as found in fig 6.

Table 5: Epidermal thickness among Group D individuals of more than 65 years of age.

Age In Years	Epidermal Thickness In Micrometers
66	6.1
70	5.78
71	4.363
75	4.79

The epidermal thickness in Group D persons of >65 years of age is represented as bar diagram.

Graph 4: Epidermal Thickness- Group D: > 65 Years.

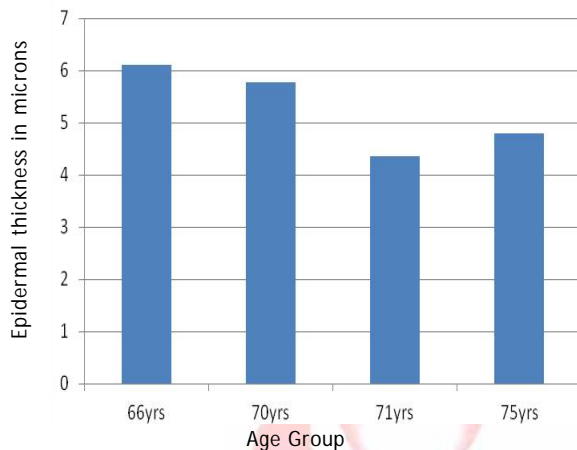
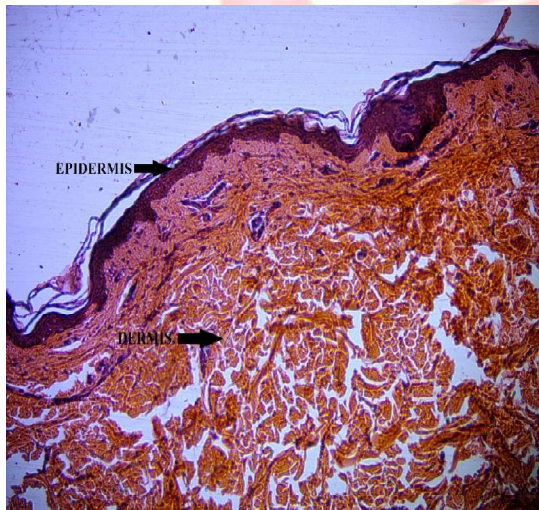


Fig. 6: Group D: >65yrs. Epidermis-Very Thin.



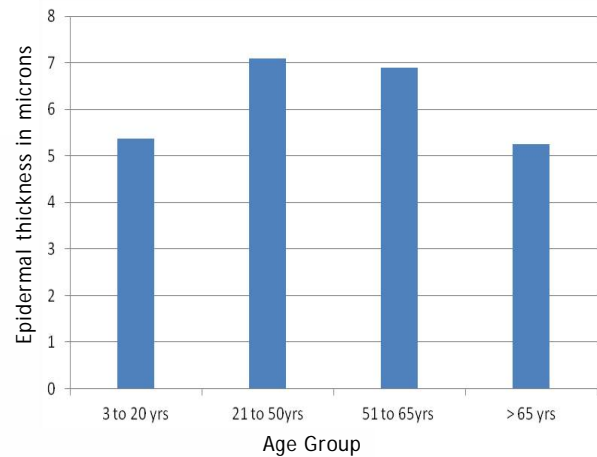
Mean Epidermal Thickness: The mean thickness of the epidermis among Group A persons of 3-20 years of age, Group B persons of 21-50 years of age, Group C persons of 51-65 years of age and Group D persons of more than 65 years of age was as found in Table 6.

Table: 6: Showing the Mean Epidermal Thickness in Group A, B and C.

Age Group In Years	Mean Epidermal Thickness In Micrometers
A 3-20	5.37
B 21-50	7.09
C 51-65	6.89
D >65	5.25

The mean thickness of the epidermis in Group A (3-20yrs), Group B (21-50yrs), Group C (51-65yrs) and Group D (>65yrs) is represented as bar diagram.

Graph 5: Mean Epidermal Thickness.



Epidermal Thickness Among 3-75 yrs of Age:

The difference in the thickness of the epidermis from 3 years to 75 years of age was varying. The epidermis in Group A persons from 3-20 years of age is thin. The thickness of the epidermis started to increase from 21 years of age and the epidermis is thick in Group B persons of 21- 50 years of age. The thickness of the epidermis starts to decrease from 51 years of age and the epidermis is thin in Group C persons from 51-65 years of age. The epidermis is very thin in Group D persons of > 65 years of age as represented in the line diagram.

Graph 6: Epidermal thickness from 3-75 years of age.

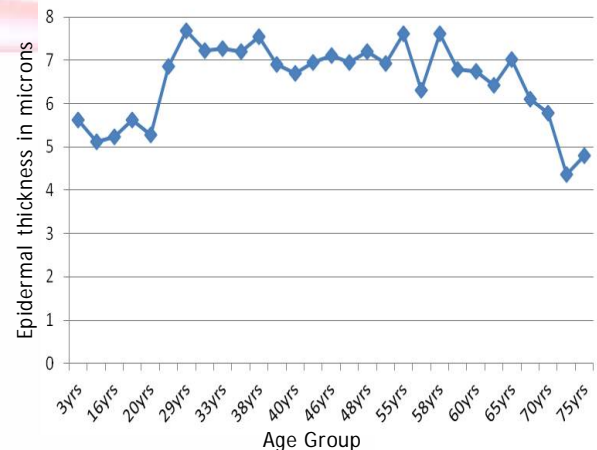


Table: 7: Statistical analysis to compare the variations in the thickness of the epidermis among four age groups using ANOVA.

Age Group In Years	Number Of Persons In Each Group	Mean	Standard Deviation	F Value	P Value
3-20	5	5.37	0.23569	32.831	<0.001
21-50	12	7.1325	0.28603		
51-65	8	6.9338	0.48583		
>65	4	5.2575	0.8179		
TOTAL	29	6.5152	0.91896		

The difference in the thickness of the epidermis between group A from 3 years to 20 years of age and Group B from 21 years to 50 years of age was found to be statistically significant with P value < 0.001 .

The difference in epidermal thickness between Group A from 3 years to 20 years of age and Group C from 51 years to 65 years of age was found to be statistically significant with P value < 0.001 . The difference in epidermal thickness between Group B from 21 years to 50 years of age and Group D of more than 65 years of age was found to be statistically significant with P value of < 0.001 .

The difference in epidermal thickness between Group C from 51 years to 65 years of age and Group D of more than 65 years of age was found to be statistically significant with P value of < 0.001 .

The difference in epidermal thickness between Group A from 3 years to 20 years of age and Group D of more than 65 years of age was not statistically significant.

DISCUSSION

The various changes observed microscopically in the layers of the skin and skin appendages produces changes in the structure and functions of the skin which is mainly reflected in old age. As the average life expectancy keeps increasing, this becomes an increasing problem for the dermatologists [2]. Most of the studies have quoted little or no difference in the structure of the epidermis in different areas of the body.

The microscopic features of the skin of individuals of different age groups reveal that the epidermis is thinner in older individuals [3]. Similar to the above report in the present study, the epidermis was observed to be reduced in thickness and was found to be very thin in older individuals.

The thickness of the epidermis started to increase till 20 years of age, and then the thickness was remaining constant followed by thinning of the epidermis in older individuals [4].

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 [5]. This leads to decrease in the moisture content of the Stratum corneum producing dryness or roughness of the skin, which is the common skin problem encountered in old age.

These findings did not correlate with the present study as the thickness of the epidermis was found to decrease from 50 years of age. The thickness of the epidermis was reduced with increasing age.

The skin of the scalp was found to have thick epidermis at the age of 22 and then it starts to decrease slowly. After 56 years the thickness was found to get reduced to the same as in childhood [6]. In the present study the thickness of the epidermis was found to be maximum in Group B individuals of 21-50 years of age and was observed to decrease from 50 years of age and it was observed to be thinner in Group D individuals of more than 65 years of age.

Aging produces epidermal atrophy, loss of Rete Pegs and thinner dermis, but photo aging produces marked epidermal atrophy or may also produce increased epidermal thickness [7]. In the present study epidermal thickness was found to reduce with increasing age. So the present study explains that the epidermis is thin in children from 3 years of age and starts increasing in younger individuals. The epidermis remains constantly thick till 50 years of age and then the thickness starts reducing after 50 years and then becomes very thin in older individuals.

CONCLUSION

Intrinsic aging predisposes the skin to various skin diseases. The various changes in the skin reflected externally act as markers for prevention and early diagnosis of systemic diseases. Following an injury, the ability to repair wounds by re-epithelialisation of the Stratum corneum is reduced in aged persons [8].

Microscopic changes in the skin during the old age may leads to cystic and lacunae formation. These changes make the elastic fibers more porous and the skin becomes lax [9].

The permeability barrier of the epidermis is altered due to decrease in the number of nucleated cell layers. In young skin calcium level

is low in Stratum basale and Stratum spinosum, but the intracellular and extracellular calcium level is high in Stratum granulosum. The normal distribution of calcium is lost in aged epidermis. This can be the reason for the altered permeability barrier in aged epidermis. The epidermis gets thinned out in aged persons. The hydration is affected producing dry, cracked, pruritic and fissured skin called xerosis. If the fissures and cracks are deep, then the dermal capillaries will be invaded producing bleeding fissures [10].

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Conflicts of Interests: None

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