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The Effect of Aging on Skin Cells in Domestic Rabbits, a Histological Study: Oryctolagus Cunaculus Domesticus

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ABSTRACT

This study aims to analyze the histological changes in the skin of local rabbits with age for connective tissue. A group of histological staining techniques was used to examine skin samples taken from rabbits at different age stages. These techniques include routine staining (Harris's Hematoxylin and Alcoholic Eosin). Through these techniques, we were able to analyze and quantify changes in skin composition, including the dermis, epidermis, and subcutaneous adipose tissue. The results showed that aging leads to clear changes in the composition of the skin, The study also revealed changes in the structure of blood vessels in the skin, as an increase in the size and number of blood vessels was observed in aging skin tissue. These changes reflect the effects of aging on skin circulation, which may affect skin tissue nutrition and its ability to regenerate.

1. Introduction

The skin is a dynamic, regenerative organ, constituting about 15% of the total body weight and is the body's primary defensive exoskeleton. Developing and maintaining healthy skin with a fully functional barrier is the ultimate requirement for mature skin [1]. The defensive functions of the skin lie in the outer layer, depending on the interactions of all its layers to be effective [2]. Protecting the skin is the basic treatment for prevention [3]. All skin functions change with age [4].

The skin, which is the largest and external organ in the body, is exposed to the aging process and multiple clinical problems. Concomitant diseases that often increase as the body ages cause further deterioration in this important organ [5]. Aging causes organ weakness and failure, processes that are usually invisible, but are evident when the skin is affected [6]. Functional changes in the skin over time lead to many problems, and in the case of this visible organ, physical changes also have A significant impact, affecting interactions in the body [7].

Aging includes many skin and pigmentary changes [8]. As reviewed in previous studies, the appearance of pigmentation is caused by repeated exposure to ultraviolet radiation [9 , 10]. The change in the skin is linked to biological aging processes that occur naturally in areas protected from the sun [11 , 12]. The majority of these skin changes associated with aging are due to aging rather than pigment damage or lifestyle [13].

2. MATERIALS AND METHODS

2.1. Collecting rabbits

The animals under study, represented by local rabbits, were obtained with (40) rabbits at different age stages, including early, middle, and long-lived ones. The collection of these rabbits began during the month of August 2023 until the month of February 2024, and then they were divided into four groups:

1. **A, B one year (Bells, DORS)**
2. **A, Two year (Bells, DORS)**
3. **A, B Three year (Bells, DORS)**
4. **A, B eight Months (Bells, DORS)**

Small and medium-aged rabbits were obtained by raising and breeding rabbits in the animal house belonging to the College of Veterinary Medicine/Tikrit University, while older rabbits were obtained from rabbit breeders after ensuring their ages and that they were free of diseases, and then they were placed in special cages for several days. Their health condition was monitored periodically to ensure their safety, taking into account laboratory conditions in terms of ventilation, temperature that ranged between (28-25)˚C, and lighting (12 hours of light: 12 hours of darkness). The floor of the cages was spread with sawdust, which was replaced twice a week to ensure safety. The rabbits were then examined by a veterinarian to ensure their health and suitability for the current study.

The food used for the rabbit sample is fodder, which is a mixture of seeds according to specific concentrations and green fodder such as jet. The animals were raised in cages at room temperature and the tap water was normal. Anesthesia was done by inhaling chloroform.

2.2. Laboratory work

The groups of rabbits were brought to the surgical laboratory of the Animal House at the College of Veterinary Medicine / Tikrit University for the purpose of dissection, where their weights were initially recorded using a small animal scale. After preparing the laboratory animals and anesthetizing them with chloroform, then dissecting them, removing the hair from the neck area, taking samples and washing them to get rid of blood and impurities, we put them in plastic boxes containing diluted formalin with a concentration of 10% in order to avoid the sample decomposition until it is transported and worked on, where we use several mechanisms to get rid of the formalin.

2.3. Microscopic Examination and Measurements

1. **Fixation:** After classifying and sorting the organ to be studied, represented by the rabbit skin, it was transferred directly to the fixation medium to avoid autolysis, as the study samples were placed in plastic bottles containing formalin as a fixation medium at a concentration of 10%.

2. **Washing:** After (24) hours of storing the samples, they were washed with running tap water for (30) minutes to remove the fixative residue.

3. **Dehydration:** The samples were passed through a series of increasing concentrations of ethyl alcohol (100, 90, 80, 70)% to gradually remove water from the tissues, and the duration of each pass was (30) minutes, and the step of absolute alcohol (100%) was repeated twice to complete the final removal of water.

4. **Clearing:** The samples were transferred after removing the water from them to pure xylene medium in two stages for (15) minutes for each stage to completely remove the alcohol from the samples and make them more transparent
.

5. **Infiltration:** The samples were placed in molten crystalline paraffin wax (melting point 58˚C), where they were impregnated in three transfers at a rate of (60-30) minutes per transfer to ensure that the wax penetrates evenly into the tissue.

6. **Embedding:** The samples were embedded in the same wax used in impregnation, which was poured into special metal molds, and using forceps, the samples were carried and placed in it.

7. **Sectioning and mounting of tissues:** After trimming the wax molds containing the samples using a sharp blade, they were cut using a rotary microtome, type KEDEE 1508A, with a thickness of (6) micrometers to obtain tissue sections of the rabbit skin. The sections were then mounted on glass slides using Mayer's albumen with glycerol added to them in equal volumes for each. They were mixed in a small flask, then the mixture was filtered several times using several layers of medical gauze, and the filtrate was collected in a tightly capped bottle that was placed in the refrigerator until use after adding (1) gram of thymol crystals to it to prevent rotting.

8. **Staining:** The sections were stained with Harris hematoxylin-eosin according to the method of Luna (1968) and Bancroft and Stevens (1982) as follows:

- The wax was removed from the sections using hot xylol (45)°C, then the glass slides on which the sections were mounted were passed through two changes of xylol for (3) minutes each change until the wax was completely removed.
- The slides were passed through a series of decreasing concentrations of ethyl alcohol (50, 70, 90, 100)% for (5) minutes for each concentration, after which the slides were washed with distilled water for (5) minutes as well.
- The slides were passed through hematoxylin stain for (3) minutes, then washed with running water for (5) minutes and then passed through distilled water for (3) minutes.
- The slides were passed through the alcoholic eosin staining solution for approximately (5) minutes, then washed by immersing them once or twice in ethyl alcohol at a concentration of (70%) and then passed through increasing concentrations of ethyl alcohol (100, 90, 70, 50)% for (5) minutes each, repeating the absolute concentration step twice, and then the slides were transferred to xylol for (5) minutes for the purpose of clarification.

9. **Mounting:** The stained tissue sections were covered with the D.P.X mounting medium, then a glass cover was placed on them and left on a hot plate at a temperature of (37)˚C for the purpose of drying.

2.4. Harris's Hematoxylin and Alcoholic Eosin

Sections were stained with Harris hematoxylin-eosin according to the method of Luna (1968) and Bancroft and Stevens (1982).

2.5. Statistical analysis

The statistical analysis was performed using the SAS system, a pre-existing statistical program. This analysis involved calculating significant differences between groups of study animals by extracting the arithmetic averages for each group and comparing them. One-way analysis of variance (ANOVA) was used, along with knowledge of the standard error (SE).

3. Results and Discussion

3.1. Laboratory results

- **Bells 1 year (A)**

The skin tissue contains the epidermis, which is composed of several rows of epithelial cells, including basal row cells based on the basal membrane, then a row of spiny cells, then a row of dark-colored hyaline granular cells located on the surface of the skin, with the presence of keratin filaments consisting of several loose threads extending outward from the epidermis. The second layer is the subepidermal dermis, composed of bundles of colloidal fibers containing fibroblasts and groups of hair follicles surrounded by sebaceous glands (Figure1)

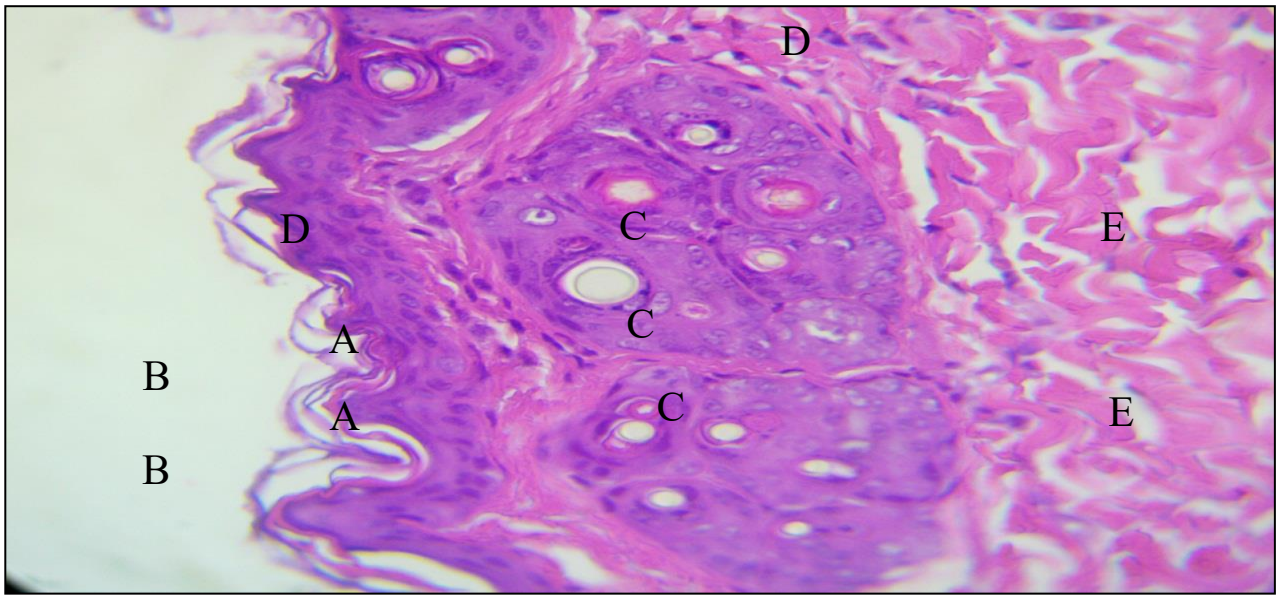

Figure 1: histological section of belly rabbit skin of 1 year (A) Skin tissue with stratified squamous cells (A) Keratin on the surface of the epidermis (B) Aggregates of hair follicles (C) In the dermis White blood cells (D) Colloidal fiber bundles (E) (H2E X40).

- **Belly 1 year (B)**

The skin tissue contains the epidermis, which is composed of several rows of epithelial cells, including basal row cells based on the basal membrane, then a row of spiny cells, then a row of dark-colored hyaline granular cells located on the surface of the skin, with the presence of keratin filaments consisting of several loose threads extending outward from the epidermis. The second layer is the subepidermal dermis, composed of bundles of colloidal fibers containing fibroblasts and groups of hair follicles surrounded by sebaceous glands (Figure 2)

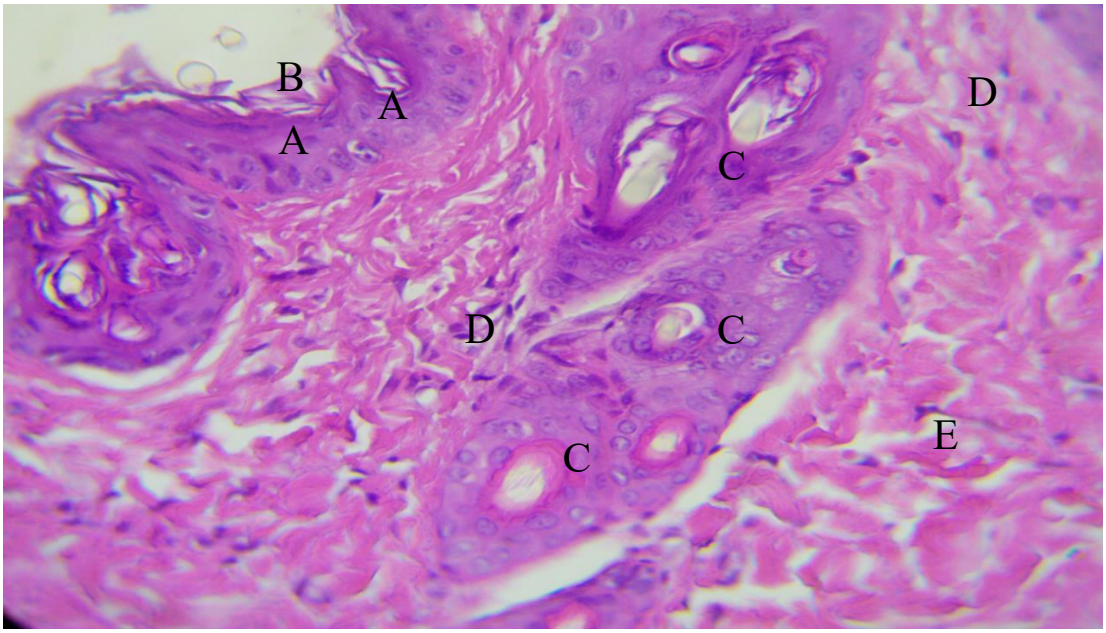

Figure 2: histological section of belly rabbit skin of 1 year (B) Skin epidermis (A) Keratin on the surface of the epidermis (B) Aggregates of hair follicles (C) In the dermis White blood cells (D) Colloidal fiber bundles (E) (H2E X40).

- **Belly 2 year (A)**

The skin tissue contained an epidermis with many folds. The epidermis was composed of pale-colored epithelial cells. The epidermis was surrounded by a layer of dark-colored granulosa cells, with several rows of loose keratinous filaments on the surface of the epidermis. The upper part of the dermis contained infiltration of white blood cells and macrophages around the groups of hair follicles that appeared. Degeneration on them and the dermis contained bundles of colloid fibers with fibroblasts (Figure 3)

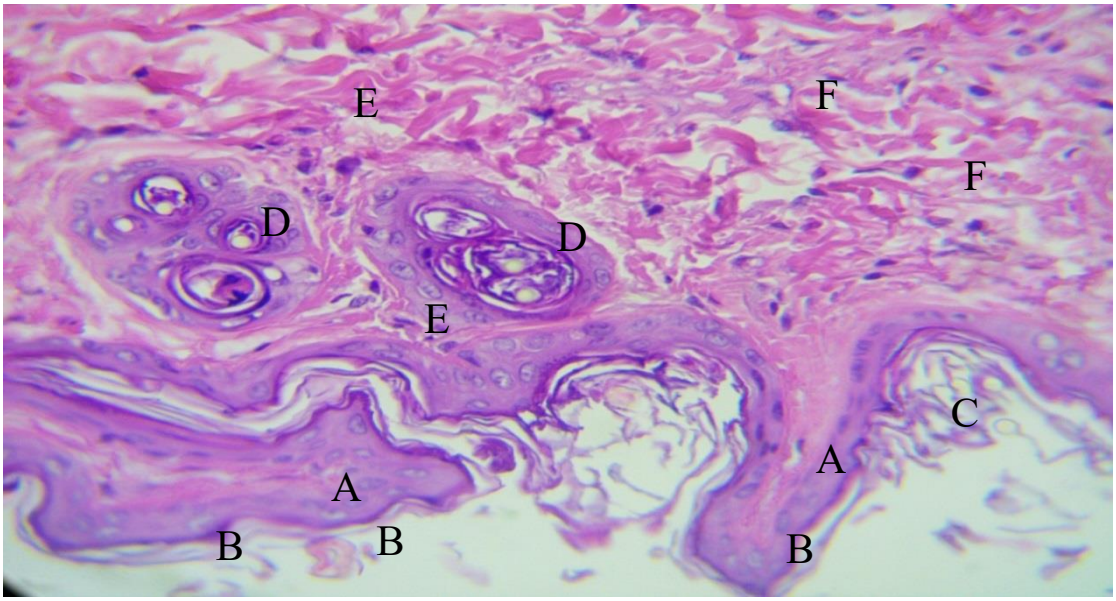

Figure 3: histological section of belly rabbit skin of 2 year (B) Skin tissue Epidermis (A) Row of dark granulosa cells (B) Loose keratin strands (C) Dermis with degenerated hair follicles (D) Macrophages (E) Colloidal fiber bundles (F) (H2E X40).

- **Belly 3 year (A)**

The epidermis of the skin appeared in the form of a narrow, dark band with the loss of most of its epithelial cells. Under the epidermis, numbers of small-sized groups of hair follicles were found. The rest of the dermis was found to be wide, composed of bundles of colloidal fibers extending into the subdermis layer (Figure 4)

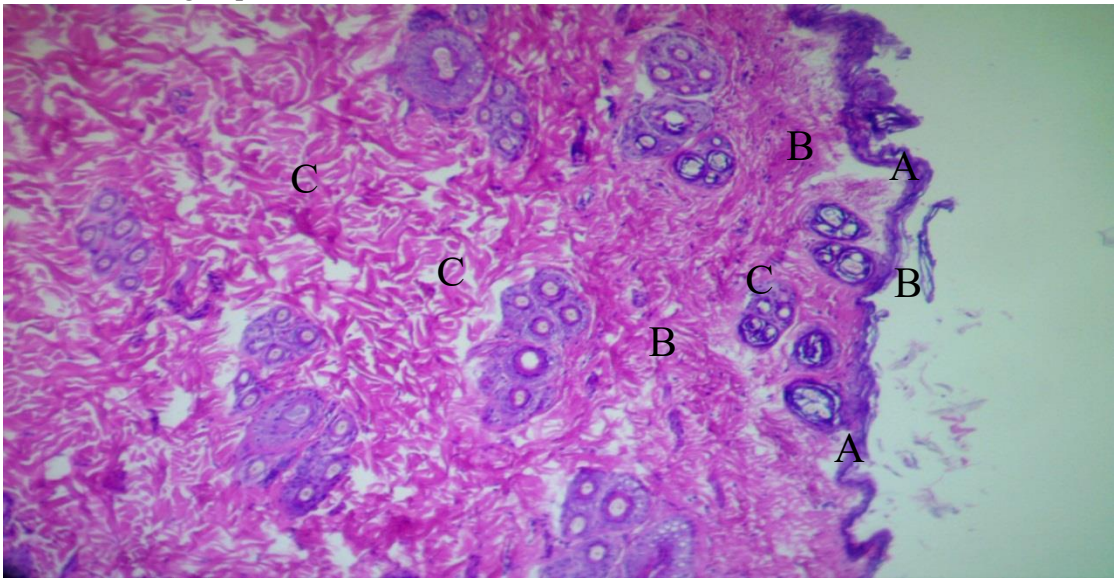

Figure 4: histological section of belly rabbit skin of 3 year (A) Skin epidermis with atrophic and degenerative cells (A) Dark-colored hair follicles (B) Widespread bundles of colloidal fibers in the dermis (C) (H2E X40).

- **Belly 3 year (A)**

The epidermis of the skin contains degenerated cells that are not clearly visible, as they are found in the form of a dark band with the presence of keratin filaments on the surface of the epidermis. The dermis of the skin contains groups of hair follicles. It appears in a degenerated form of the cortex and medulla of the hair follicles, and it is surrounded by infiltration of white blood cells and around it is loose connective tissue (Figure 5)

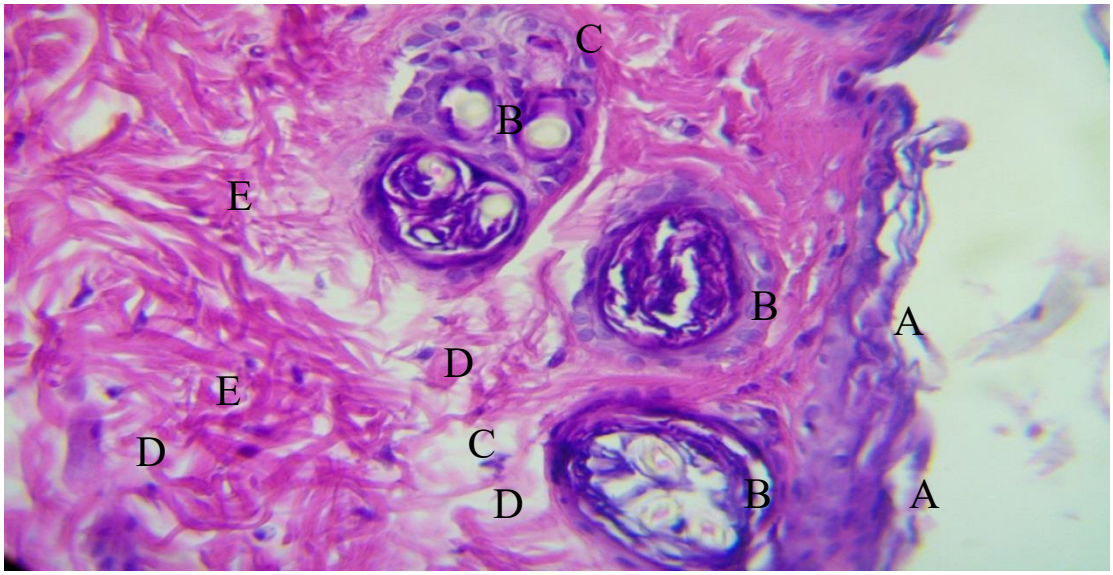

Figure 5: histological section of belly rabbit skin of 3 year Ventral (B) Degenerated epidermis with keratin shedding (A) Degenerated hair follicles in the dermis (B) Sebaceous glands (C) Macrophage cells (D) Colloidal fiber bundles (E) (H2E X40).

- **Belly 8 Months (A)**

The epidermis of the skin contained many wavy folds. The epidermis was composed of stratified squamous epithelial cells covered by a layer of hyaline keratin cells. On its surface, scattered keratin filaments were found. They were found in the dermis. Human papillae - the dermis. The dermis is wide and contains bundles of wavy colloidal fibers, which surround some hair follicles extending to the surface of the epidermis. (Figure 6)

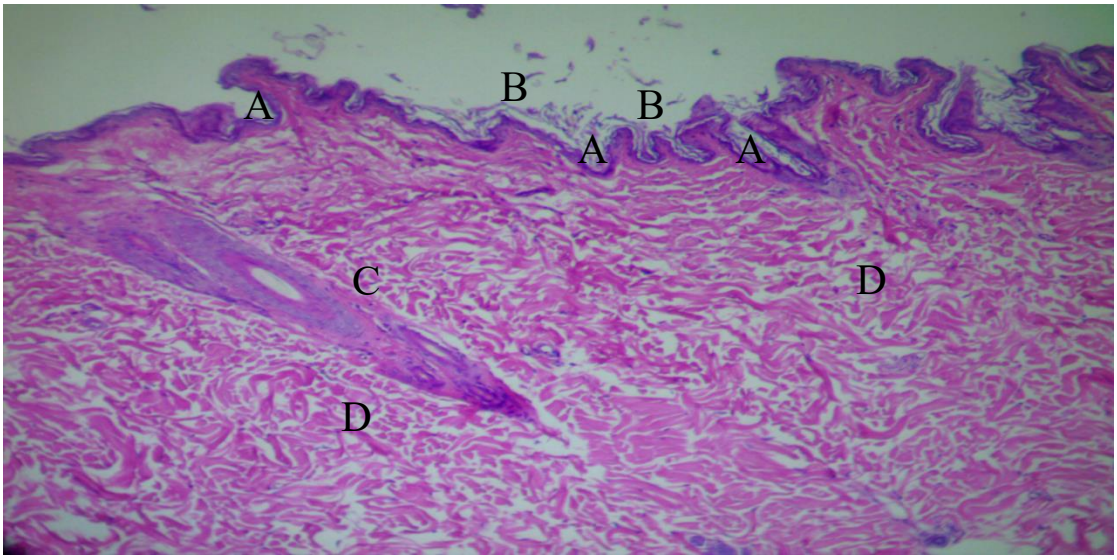

Figure 6: histological section of belly rabbit skin of 8 Months (A) Skin epidermis composed of squamous cells and dark-pigmented granulosa cells on the surface of the epidermis (A) Keratin filaments (B) Hair follicle (C) Epidermis composed of connective tissue fibers of the colloidal tissue (D) (H2E X40).

- **Belly 8 Months (B)**

The epidermis of the skin contains two rows of spiny epithelial cells, a row of basal cells based on the basement membrane, and a row of dark hyaline granular cells located at the surface of the epidermis and covered on the outside with strips of keratin. The dermis of the skin contains wavy colloidal fibers organized in several directions, with the presence of loose connective tissue in the Different areas of the dermis containing scattered white blood cells and macrophages (Figure 7)

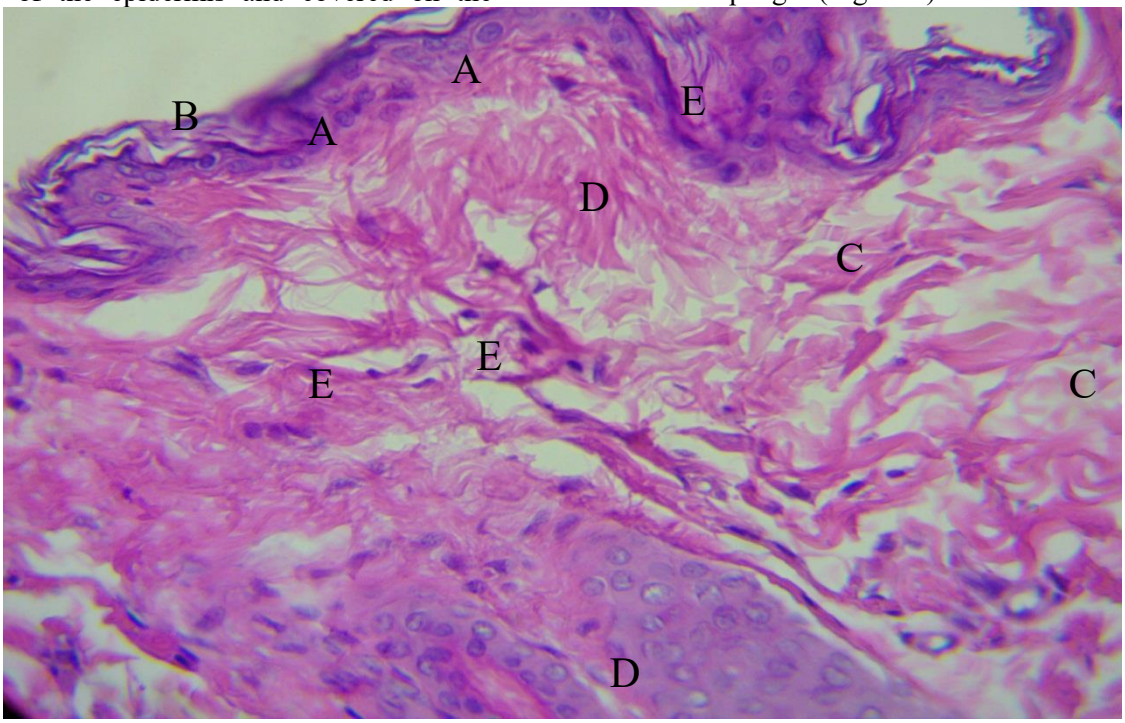

Figure 7: histological section of belly rabbit skin of 8 Months (B) Skin epidermis with stratified epithelium (A) Keratin (B) Wavy colloidal fiber bundles in the dermis (C) Hair follicle (D) White blood cells (E) (H2E X40).

- **DORS. 1 year (A)**

The epidermis of the skin is composed of rows of keratinized cells, undifferentiated in form, surrounded by numerous loose keratin bands. A part of the subepidermal dermis containing wide gaps composed of loose connective tissue adjacent to numbers of groups of hair follicles and some ducts of the sweat glands, and around them are some white blood cells (Figure 8)

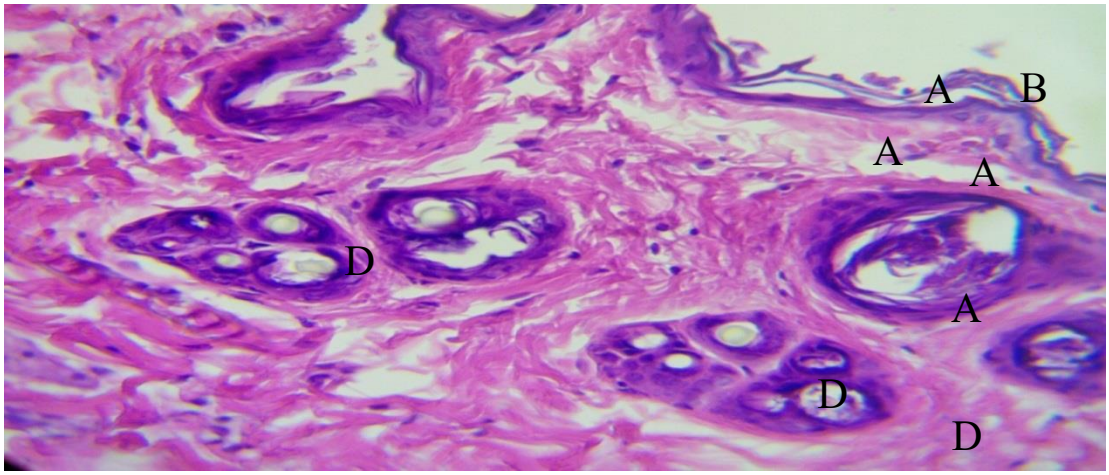

Figure 8: histological section of DORS rabbit skin of 1 year (A) Skin epidermis with indistinct keratinized epithelial cell rows (A) Keratin ribbons (B) Dehiscence of loose connective tissue beneath the epidermis (C) Aggregates of hair follicles and sweat glands (D) (H2E X40)

- **DORS. 1 year (B)**

The skin of the back contained an epidermis whose cells were indicated by a row of spiny cells, some of which were not distinct, with a row of dark-colored keratin cells on the surface of the skin. The dermis contained a number of groups of sweat glands and hair follicles associated with the sebaceous glands, and around it were infiltrated white blood cells. The sweat of the dermis contained a nerve bundle composed of myelinated nerve fibers surrounded by bundles of loose colloidal fibers (Figure 9)

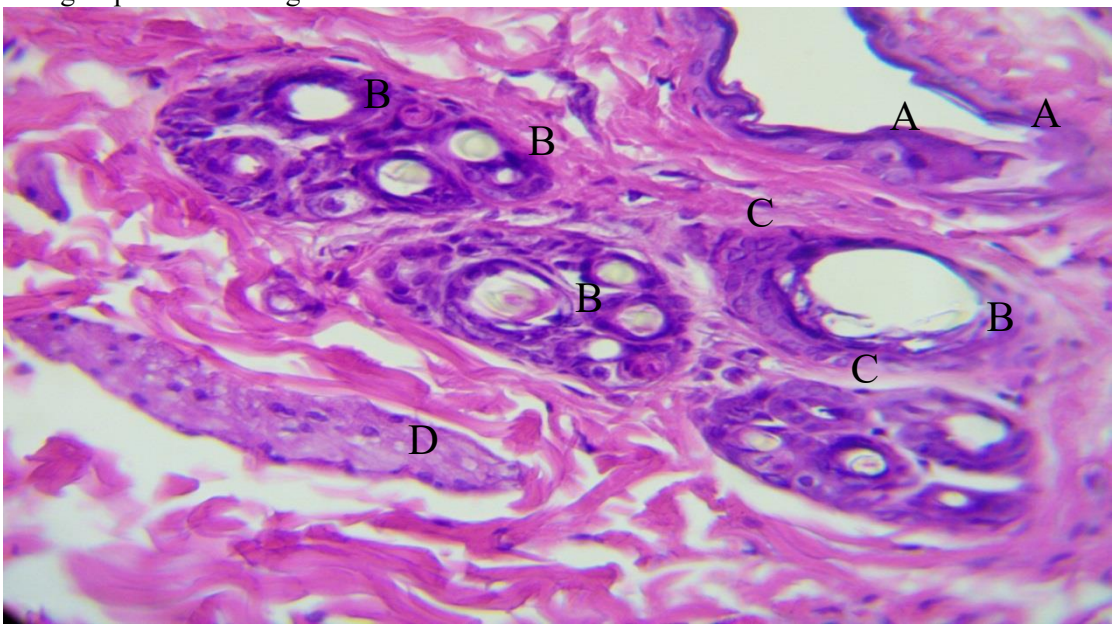

Figure 9: histological section of DORS rabbit skin of 1 year (B) Skin epidermis with undifferentiated, dark-pigmented acanthotic cells (A) Aggregates of sweat glands and hair follicles (B) Macrophage cells (C) Nerve bundle (D) (H2E X40).

- **DORS. 2 year (A)**

The skin's epidermis appeared as a narrow band with atrophic, undifferentiated cells and cells on its surface the hyaline keratin is dark in pigment and covered with loose keratin filaments. The subepidermal dermis bundles appeared composed of dense connective tissue surrounding a group of hair follicles and surrounded by white blood cells. The deep dermis layer contains loose bundles of colloidal fibers (Figure 10)

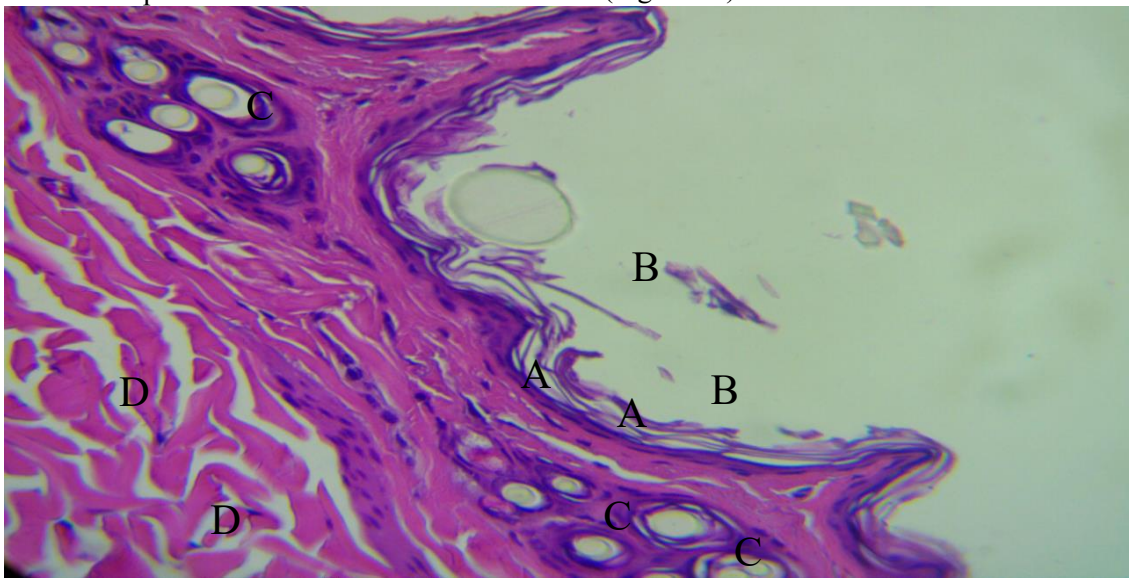

Figure 10: histological section of DORS rabbit skin of 2 year (D) The narrow skin epidermis is covered with dark-pigmented hyaline granulosa cells (A) and on its surface are loose keratin filaments (B) Aggregates of hair follicles (C) in the upper part of the dermis Loose colloidal fiber bundles (D) (H2E X40).

- **DORS. 1 year (B)**

The deep layer of the dermis contains bundles of colloidal fibers and some hair follicles surrounded by white blood cells (Figure 11)

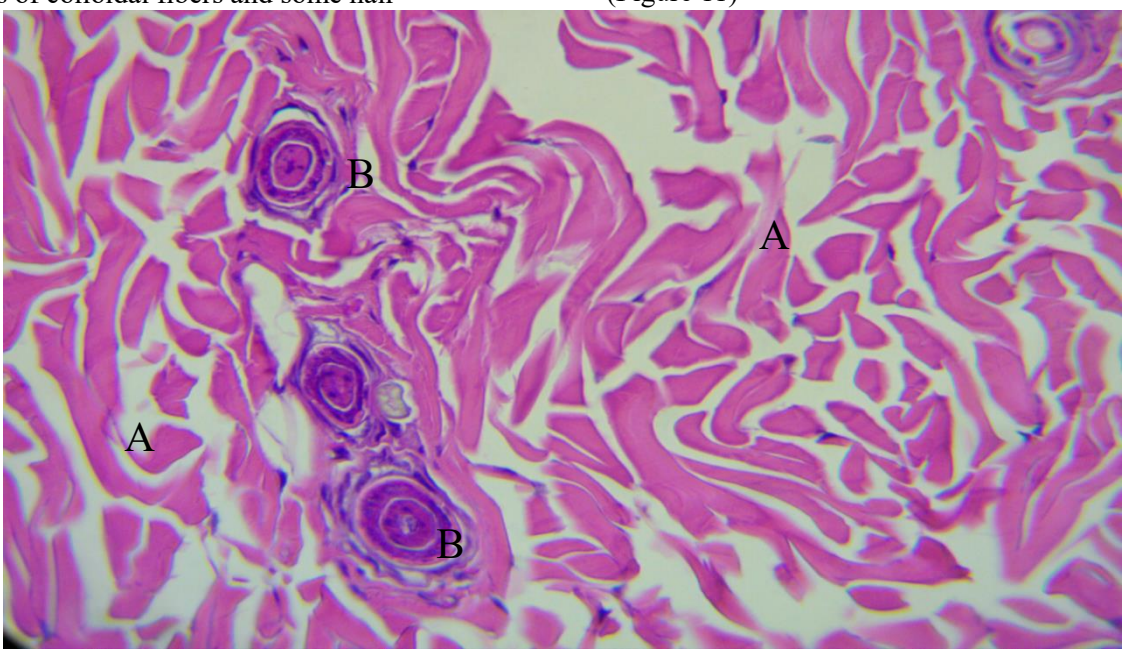

Figure 11: histological section of DORS rabbit skin of 2 year (B) The deep layer of the dermis containing the colloidal fiber bundles (A) Hair follicles (B) (H2E X40).

- **DORS. 3 year (A)**

The epidermis of the skin appeared in the form of a dark band. Its epithelial cells were degenerated and indistinguishable, with the presence of numerous keratin filaments outside the epidermis. The dermis of the skin contained hair follicles in which the cortex and medulla were degenerated and appeared in the form of wide gaps surrounded by a fascia of colloidal fibres. Around them, bundles of loose colloidal fibers were also found in some areas (Figure 12)

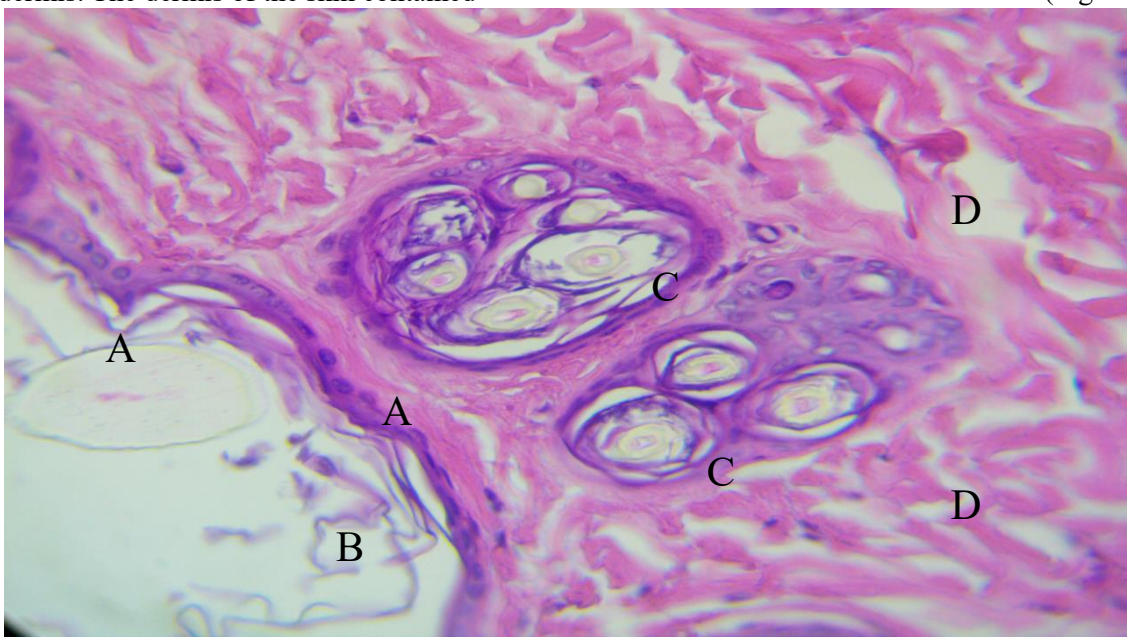

Figure 12: histological section of DORS rabbit skin of 3 year (A) Narrow skin epidermis and indistinguishability of its degenerated cells (A) Keratin filaments (B) Degeneration of hair follicles (C) in the dermis Disintegration of colloidal fiber bundles in the dermis (D) (H2E X40).

- **DORS. 3 year (B)**

The deep layer of the dermis contains loose bundles of colloidal fibers, some of which are small and short, surrounding a number of hair follicles and sweat glands, with infiltration of white blood cells around the clusters of follicles and glands (Figure 13)

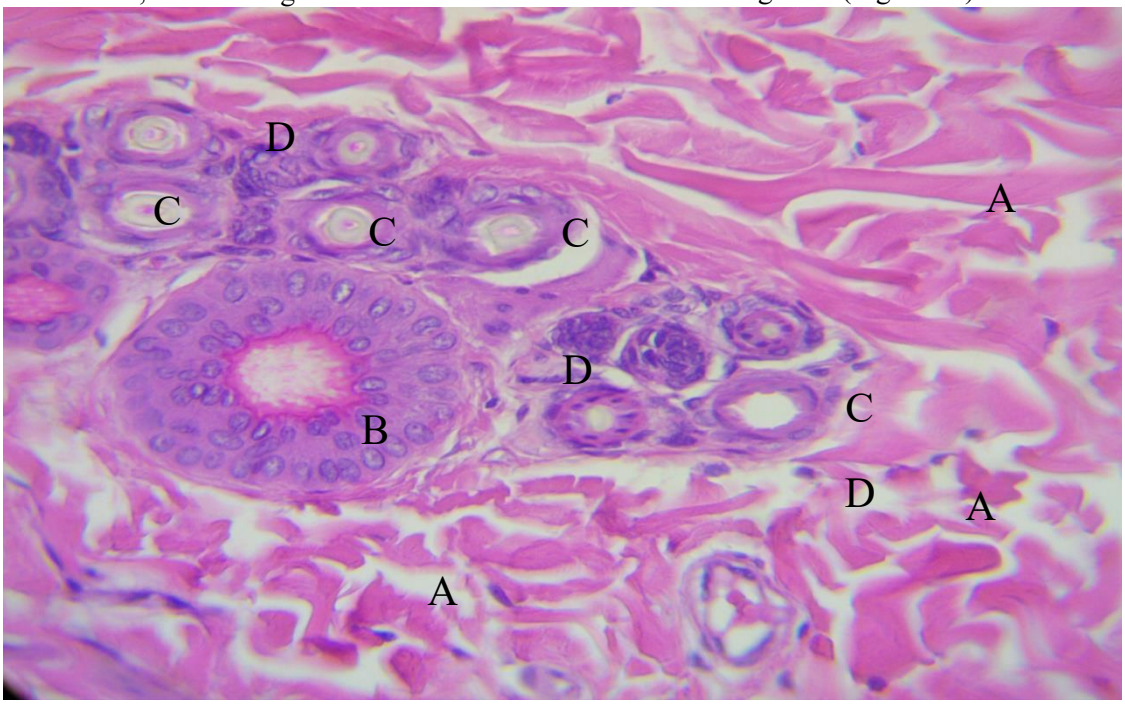

Figure 13: histological section of DORS rabbit skin of 3 year (B) The deep layer of the dermis containing bundles of loose colloidal fibers (A) Hair follicles (B) Sweat glands (C) White blood cells and macrophages (D) (H2E X40).

- **DORS. 8 Months (A)**

The epidermis of the skin appeared in a very sinuous form and in the form of a band composed of squamous epithelial cells. The epidermis overlapped with the superficial part of the dermis, forming the human papillae - the dermis containing connective tissue fibers surrounding groups of hair follicles. In some areas of the dermis, disintegration of numbers of bundles of colloidal fibers forming the dermis tissue was found (Figure 14)

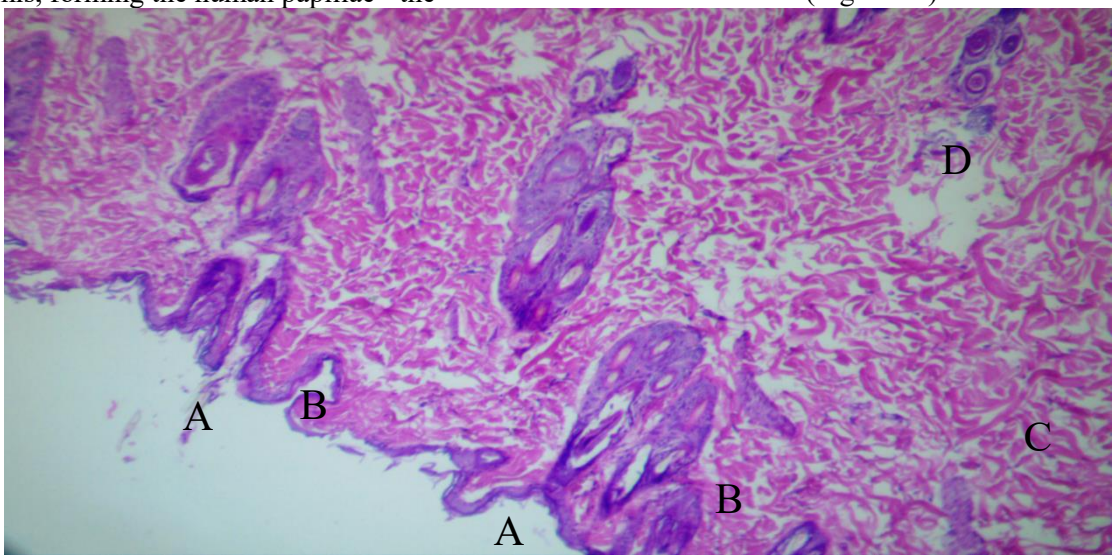

Figure 14: histological section of DORS rabbit skin of 8 month (A) Ragged skin with many folds (A) Hair follicles continuous with the surface of the epidermis (B) Bundles of connective tissue fibers in the dermis (C) Subdermis layer (D) (H2E X40).

- **DORS. 8 Months (B)**

The skin epidermis contained small spiny cells based on a row of basal cells settled on the basement membrane, in addition to the presence of a row of dark-pigmented granular cells at the surface of the epidermis surrounded by rows of keratin filaments. There was an infiltration of numerous white blood cells and macrophages in the dermis around the ten follicles and the sebaceous glands surrounding them (Figure 15)

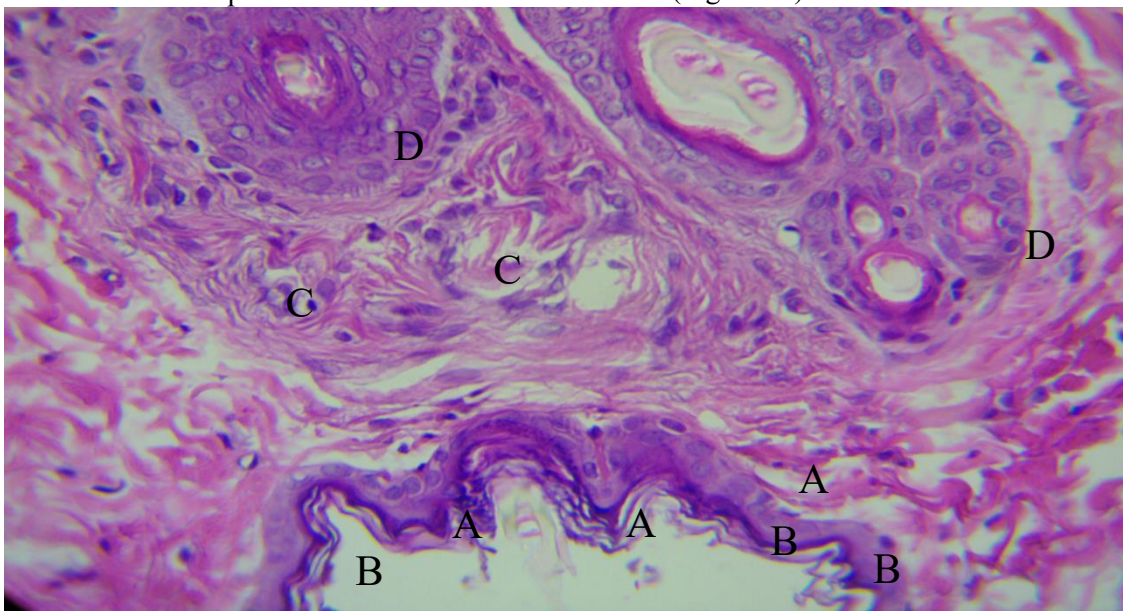

Figure 15: histological section of DORS rabbit skin of 8 month (B) Skin epidermis, which contains a row of spiny cells resting on a row of basal cells resting on the basement membrane with an outer row of dark-colored granulosa cells (A) Keratin (B) Infiltrating white blood cells and macrophages (C) Hair follicles (D) (H2E X40).

3.1. Statistical analysis results

- **Skin Belly: One-way ANOVA: Skin 2 Mon., 2 Month, 4 Month, 6 Month, 8 Month, 1 Years, 2**

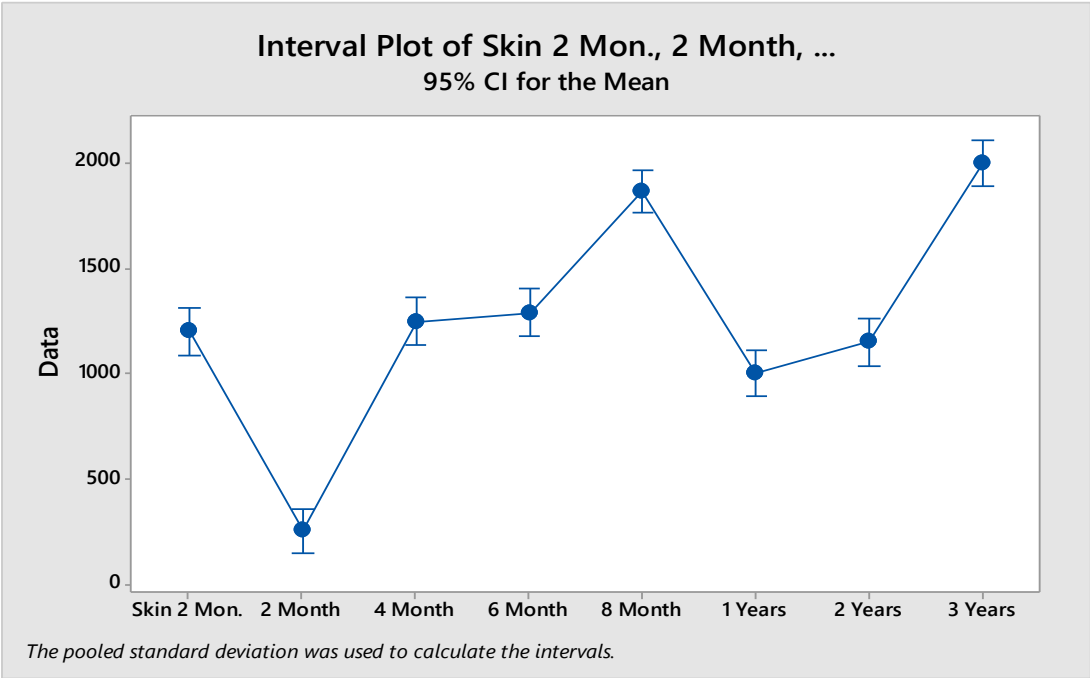

Figure 16: Skin Belly: One-way ANOVA: Skin 2 Mon., 2 Month, 4 Month, 6 Month, 8 Month, 1 Years, 2

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Factor	7	13495604	1927943	106.40	0.00004
Error	42	760998	18119		
Total	49	14256602			

Factor	N	Mean	StDev	95% CI
Skin 2 Mon.	6	1200.0 de	70.7	(1089.1, 1310.9)
2 Month	7	750.7 g	6.73	(148.04, 353.39)
4 Month	6	1250.0 cd	7.07	(1139.10, 1360.90)
6 Month	6	1291.7 c	66.5	(1180.8, 1402.6)
8 Month	7	1868.0 b	32.6	(1765, 1971)
1 Years	6	1000.0 f	70.7	(889.1, 1110.9)
2 Years	6	1150.0 e	70.7	(1039.1, 1260.9)
3 Years	6	2000.0 a	70.7	(1889.1, 2110.9)
Pooled StDev =		134.607		

•Hair Follicales Belly: One-way ANOVA: Skin 2 Mon., 2 Month, 4 Month, 6 Month, 8 Month, 1 Years, 2

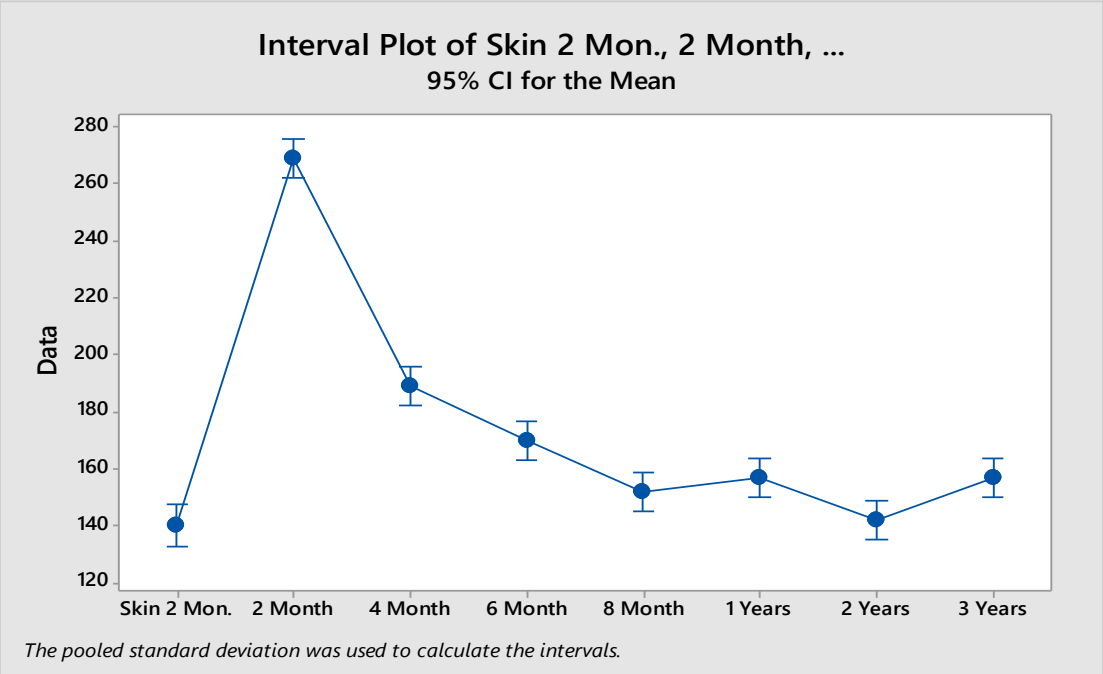

Figure 17: Hair Follicales Belly: One-way ANOVA: Skin 2 Mon., 2 Month, 4 Month, 6 Month, 8 Month, 1 Years, 2

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Factor	7	74181	10597.2	154.92	0.000002
Error	39	2668	68.4		
Total	46	76849			

Factor	N	Mean	StDev	95% CI
Skin 2 Mon.	5	140.00 e	15.81	(132.52, 147.48)
2 Month	6	269.17 a	3.76	(262.34, 276.00)
4 Month	6	189.17 b	8.01	(182.34, 196.00)
6 Month	6	170.00 c	7.07	(163.17, 176.83)
8 Month	6	151.67 d	6.83	(144.84, 158.50)
1 Years	6	157.00 d	1.414	(150.170, 163.830)
2 Years	6	141.83 e	12.34	(135.00, 148.66)
3 Years	6	157.00 d	2.098	(150.170, 163.830)
Pooled StDev =		8.27079		

- **Sebecous gland skin Dos: One-way ANOVA: Skin 2 Mon., 2 Month, 4 Month, 6 Month, 8 Month, 1 Years**

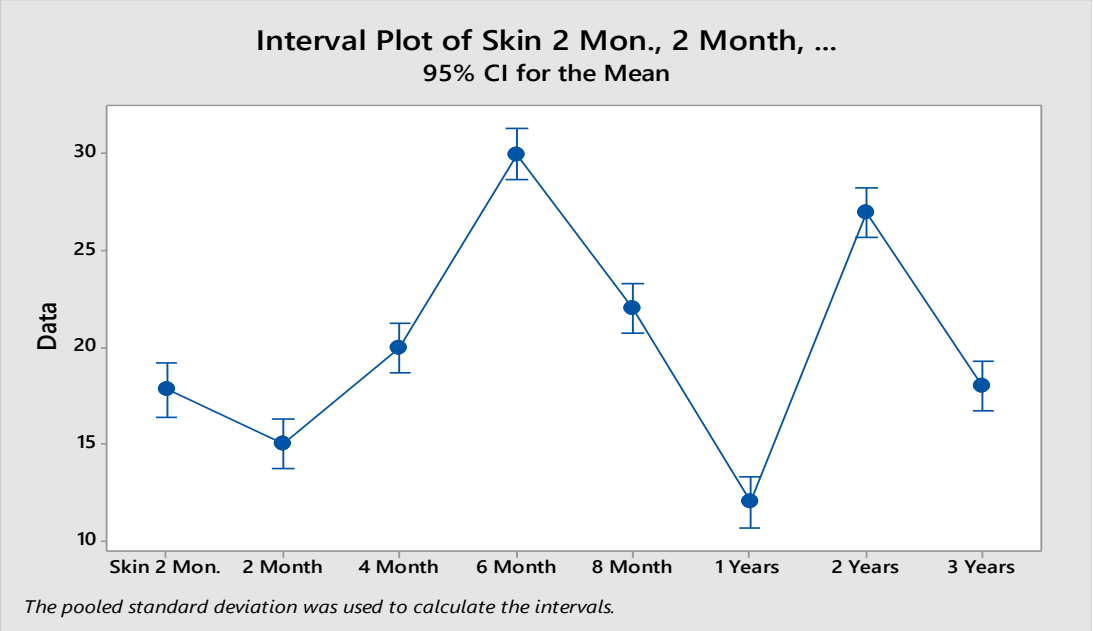

Figure 18: Sebecous gland skin Dos: One-way ANOVA: Skin 2 Mon., 2 Month, 4 Month, 6 Month, 8 Month, 1 Years

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Factor	7	1496.60	213.801	87.96	0.00006
Error	39	94.80	2.431		
Total	46	1591.40			

Factor	N	Mean	StDev	95% CI
Skin 2 Mon.	5	17.800 e	1.483	(16.390, 19.210)
2 Month	6	15.000 f	1.414	(13.713, 16.287)
4 Month	6	20.000 d	1.414	(18.713, 21.287)
6 Month	6	30.000 a	1.414	(28.713, 31.287)
8 Month	6	22.000 c	2.280	(20.713, 23.287)
1 Years	6	12.000 g	1.414	(10.713, 13.287)
2 Years	6	27.000 b	1.414	(25.713, 28.287)
3 Years	6	18.000 e	1.414	(16.713, 19.287)
Pooled StDev =		1.55909		

- **M.C Skin Dos: One-way ANOVA: Skin 2 Mon., 2 Month, 4 Month, 6 Month, 8 Month, 1 Years**

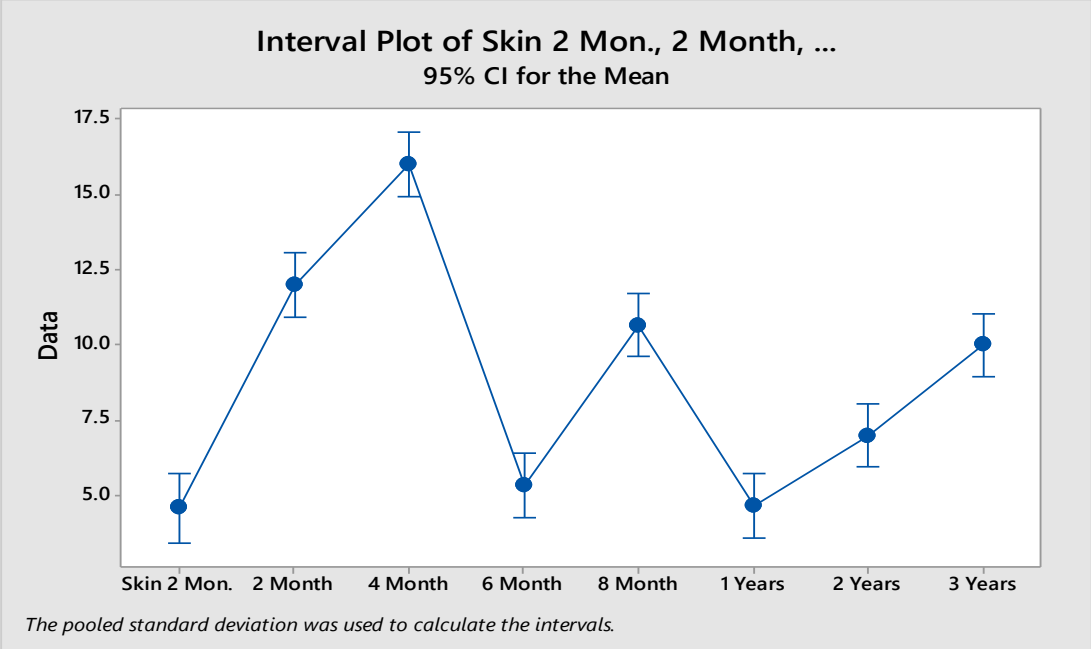

Figure 19: M.C Skin Dos: One-way ANOVA: Skin 2 Mon., 2 Month, 4 Month, 6 Month, 8 Month, 1 Years

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Factor	7	684.03	97.719	60.30	0.00003
Error	39	63.20	1.621		
Total	46	747.23			

Factor	N	Mean	StDev	95% CI
Skin 2 Mon.	5	4.600 e	1.140	(3.448, 5.752)
2 Month	6	12.000 b	1.414	(10.949, 13.051)
4 Month	6	16.000 a	1.414	(14.949, 17.051)
6 Month	6	5.333 e	1.033	(4.282, 6.385)
8 Month	6	10.667 c	1.033	(9.615, 11.718)
1 Years	6	4.667 e	1.211	(3.615, 5.718)
2 Years	6	7.000 d	1.414	(5.949, 8.051)
3 Years	6	10.000 c	1.414	(8.949, 11.051)
Pooled StDev =		1.27299		

4. Discussion of Results

The study aimed to analyze the histological changes in the skin of local rabbits with age using various staining techniques to examine the skin samples. The findings of this study are significant in understanding how aging affects skin composition and structure in domestic rabbits.

4.1. Epidermis Changes:

- 1 Year Old Rabbits: The epidermis in one-year-old rabbits showed several rows of epithelial cells, including basal row cells, spiny cells, and dark-colored hyaline granular cells. The presence of keratin filaments extending outward from the epidermis was also noted.
- 2 Year Old Rabbits: In two-year-old rabbits, the epidermis exhibited many folds and pale-colored epithelial cells surrounded by dark-colored granulosa cells. There were also loose keratin filaments on the epidermis surface.
- 3 Year Old Rabbits: The epidermis appeared as a narrow dark band with the loss of most epithelial cells. The presence of small-sized hair follicles was observed under the epidermis.

4.2. Dermis Changes:

- 1 Year Old Rabbits: The dermis was composed of bundles of colloidal fibers containing fibroblasts and groups of hair follicles surrounded by sebaceous glands.
- 2 Year Old Rabbits: The dermis showed infiltration of white blood cells and macrophages around hair follicles, indicating degeneration. The presence of colloidal fiber bundles was also observed.
- 3 Year Old Rabbits: The dermis was wide and composed of bundles of colloidal fibers extending into the subdermis layer

4.3. Subdermal Changes:

- 1 Year Old Rabbits: The subdermal layer contained colloidal fibers and some scattered white blood cells.
- 2 Year Old Rabbits: The subdermis showed infiltration by numerous leukocytes and macrophages around hair follicles and sebaceous glands.
- 3 Year Old Rabbits: The subdermis had widespread bundles of colloidal fibers and degenerated hair follicles.

4.4. Special Observations:

- Keratin Filaments: Across different ages, the presence of keratin filaments was a consistent finding, indicating their role in the skin's structural integrity.
- White Blood Cells and Macrophages: An increase in the infiltration of white blood cells and macrophages was noted in older rabbits, suggesting an inflammatory response associated with aging.
- Hair Follicles: Degeneration and changes in hair follicles' structure were prominent in older rabbits, reflecting aging's impact on hair follicle health.

5. Conclusions

1. **Aging Effects on Skin Composition**: Aging leads to significant changes in the skin composition of domestic rabbits, affecting both the epidermis and dermis layers. The structural integrity and cellular composition of the skin are altered with age.

2. **Increased Vascular Changes**: An increase in the size and number of blood vessels was observed in aging skin tissue, indicating changes in skin circulation that may affect tissue nutrition and regeneration capabilities.

3. **Inflammatory Responses**: The presence of inflammatory cells such as white blood cells and macrophages in older rabbits suggests an ongoing inflammatory process likely due to aging.

4. **Structural Degeneration**: Hair follicles showed signs of degeneration with age, and the epidermis exhibited reduced epithelial cells and increased keratin filaments, highlighting the degenerative changes in skin structure.

5. **Histological Techniques**: The use of routine and special staining techniques, such as Masson's trichrome stain, Harris's Hematoxylin, and Alcoholic Eosin, proved effective in analyzing and quantifying the histological changes in rabbit skin with age.

These findings underscore the importance of understanding aging processes in animal models, which can provide insights into similar changes in other mammals, including humans. The study highlights the complex interplay between structural integrity, cellular composition, and inflammatory responses in aging skin.

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تأثير الشيخوخة على خلايا الجلد في الأرانب المنزلية: دراسة نسيجية

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الملخص

تهدف هذه الدراسة إلى تحليل التغيرات النسيجية في جلد الأرانب المحلية مع تقدم العمر باستخدام صبغة للنسيج الضام. وقد تم استخدام مجموعة من تقنيات الصبغ النسيجي لفحص عينات الجلد المأخوذة من الأرانب في مراحل عمرية مختلفة. وتشمل هذه التقنيات الصبغ الروتيني (هيماتوكسيلين هاريس والإيوسين الكحولي). ومن خلال هذه التقنيات، تمكنا من تحليل وقياس التغيرات في تركيب الجلد، بما في ذلك الأدمة والبشرة والأنسجة الدهنية تحت الجلد. وأظهرت النتائج أن الشيخوخة تؤدي إلى تغييرات واضحة في تركيب الجلد، كما كشفت الدراسة عن تغييرات في بنية الأوعية الدموية في الجلد، حيث لوحظ زيادة في حجم وعدد الأوعية الدموية في أنسجة الجلد المتقدمة في العمر. وتعكس هذه التغييرات آثار الشيخوخة على الدورة الدموية في الجلد، مما قد يؤثر على تغذية أنسجة الجلد وقدرتها على التجدد.

الكلمات المفتاحية: هيماتوكسيلين هاريس ، الإيوسين الكحولي و الأرانب المحلية.