

## **Histoarchitecture Of Skin In Guinea Pig**

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### **Abstract**

The study aims to described the histological structure of skin in guinea pig an differentiation between thick and thin skin of different body regions , utilizing of (10) cutaneous specimens were taking from (6) anatomical regions including most of body which are abdomen , back, nose , ear , palmer pad and plantar pad. As the results revealed that the epidermis was thin in (ear ,abdomen and back) it composed of four secondary layers including from lower to upper: stratum Basale, Stratum Spinosum, Stratum Granulosum, and Stratum Corneum, while it was thick epidermis in nose, plantar pad , the palmer pad ,which characterized by presence of Stratum Lucidum beside the previous four layers. The study revealed a marked variation in the thickness of epidermis of the different skin regions: the thickest epidermis was in plantar pad (43.2)  $\mu\text{m}$ , on the contrary, the epidermis of ear region was found to be the thinnest 31.6  $\mu\text{m}$ .it was also observed a direct relation between the whole thickness of the epidermis and the thickness of the Stratum corneum in all of the studied skin regions. Also we notice that the dermis composed of two essential layers. The superficial thin papillary layer which is located directly under the basement membrane and it's formed of loose and relatively cellular connective tissue and it included dermal papillae which is formed because the waves of basement membrane in different degree in anatomical regions and deep thick reticular layer which consists thick collagen fibers bundles that run parallel to the skin surface. The highest thickness of the dermis was observed in the plantar pad (36)  $\mu\text{m}$ , while it is reduced in the abdomen skin to (4)  $\mu\text{m}$ , the thickness of the other regions ranging between those two extremes .The study also clear the presence of carbohydrates in dermis more than epidermis as well as the epidermis – dermal junction is delicate in thin skin while dens in thick skin.

### **الملاحق النسيجية للجلد في خنزير غينيا**

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### **الخلاصة :-**

تهدف الدراسة الى وصف البنين النسيجي لجلد خنزير غينيا والتميز بين الجلد السميك والرقيق في مناطق الجسم المختلفة. أجريت الدراسة على (10) خنازير غينيا بالغة وسليمة سريريا حيث أخذت العينات من ستة مناطق مختلفة شملت معظم جسم الحيوان وهي البطن، الظهر، الأنف، الإذن، راحة اليد وأخمص القدم. حيث أظهرت نتائج الدراسة النسيجية أن البشرة كانت رقيقة في الإذن ، البطن والظهر تتكون من أربع طبقات ثانوية من الأدنى إلى الأعلى: الطبقة القاعدية ، الطبقة الشبكية ، الطبقة

الحبيبية ، والطبقة القرنية ، بينما كانت البشرة سمكية في الأنف، و راحة اليد و أخمص القدم ،والتي تتميز بوجود الطبقة الشفافة اضافة الى الطبقات الاربعة السابقة تتكون من نفس الطبقات الأربعة أعلاه بالاضافه إلى الطبقة الشفافة . حدوث تغير ملحوظ في سمك البشرة في مناطق الجلد المختلفة لاسيما في منطقة اخمص القدم حيث كان السمك (43.2) ملمايكرون على عكس منطقة الاذن حيث كانت رقيقة وبسمك (31.6) ملمايكرون . كما لاحظنا وجود علاقة طردية بين السمك الكلي للبشرة وسمك الطبقة القرنية في جميع مناطق الجلد المدروسة . كما لاحظنا أن الأدمة تتكون من طبقتين الأساسية . الطبقة الرقيقة الحليمية السطحية الذي تقع مباشرة تحت الغشاء القاعدي وتتألف من النسيج الضام والخلوي نسبيا وأنها شملت الحليمات الجلدية التي تتشكل بسبب موجات من الغشاء القاعدي بدرجات مختلفة في المناطق التشريحية . و طبقة شبكية عميقة و سمكية والتي تتألف أساسا من حزم الألياف الكولاجين الموازية لسطح الجلد . إن أعلى سمك الأدمة في منطقة اخمص القدم والتي وصلت إلى (36) ميكرون، بينما انخفضت بشكل ملحوظ في جلد البطن إلى (4) ميكرون، في حين السمك في المناطق الأخرى تراوح ما بين هذين النقيضين؛ كما كشفت الدراسة عن وجود الكربوهيدرات في الأدمة أكثر من البشرة كذلك فإن الارتباط البشري الادمي رقيقا في مناطق الجلد الرقيقة بينما عكس ذلك تماما في مناطق الجلد السمكية حيث يكون الارتباط البشري الادمي سميكاً .

## Introduction

The external lining of the body consist of skin and its varied specializations, skin is the largest organ of body in mammals, it covers the entire body surface and account(15-20%) of body weight(1,2) , it's also continuous with the epithelial lining of alimentary canal, urogenital system conjunctive of eye and ear (3,4) . Skin protect the individual from external environment and bacteria ,regulate the temperature of body, produce vitamin(D) and store  $H_2O$ , salts and carbohydrate and bacteria(5) .The skin consider as a large sensitive organ in body for produce the special receptors of temperature ,pain and pressure, it's also active immune system by langerhans cells (2,3,5) . its composed of two portions the : the epidermis and dermis (6,7), epidermis is the outer layer which is ectodermic in origin , it is stratified seumous epithelium contain several types of cells (8,9) and composed of layers which are : startum basale , startum granulosum , startum lucidum and startum corneum (9,10) .While dermis is the underlying thicker layer which is mesodermal in origin and consist of dense irregular connective tissue, it can usually be separated into: papillary and reticular layers (11). Skin classify according to the thickness of epidermis to thick and thin skin (7,8,9) .To recognize this area and cells in skin and detect the normal skin from the abnormal which occur in disease which

effect the skin ,compare between thick and thin skin, to detected of histological structure of guinea pig skin in different regions, also for finding of (CHO) in skin layer ,we design this results

Key word: skin , guinea pigs , dermis , epidermis, thin &thick skin

## Material and method

Skin specimens were collected from six area of adult guinea pigs includes (back , abdomen , nose , ear, palmar pad and plantar pad ), this where taken from (10) animals after Suring of lacking from skin diseases , after anesthesia of animal and shaving the hair by ointment for (5-10 min) .The specimens fixed in (10%) formalin for (48h) then were prepare the slides By routine methods (12) :- Washing and dehydration :- the species washing by water for 3hour , put in alcohol (50%,70%,80%,90% and 100%) twice for each concentration for 2hours .Clearing , infiltration and embedding .Staining by H&E stain and PAS stain (to detect carbohydrates) Examination by microscope by forces ( 10,20,40) .Histological measurement by: calibrated ocular micrometer after correspond with calibrated stage micrometer (13) .Measurement of thickness are : corinum layer , epidermis, total skin , papillary layer ,reticular layer and total dermis. The results analyses statically by mean (M) and stander error (SE) .

### Result and discussion :

Histological study of guinea pig's skin showed that it consists of two main layers: the epidermis and dermis as well as skin accessories, a hair follicles ,sebaceous glands, sweat glands of skin fig (1&2).This agreement with what were said by (7,8,9).

#### Epidermis:

The epidermis was observed consists of four layers, from inside to outside: the basal layer , spinousum layer , granular layer and corneum layer fig. (3.A) ,this results accordance with findings of (3,7,9). It was observed that regions of the ear ,palmar pads ,planter pads and nose with a thick skin ,while back and abdomen were of a thin skin ,this corresponds with descriptive observation conducted in previous studies on several types of rodents (3,10,11).Also the regions of thick skin were seen composed of five layers by presence of lucidum layer in addition to the previous layers, Fig.(3A,4A,7),this result is similar to other researchers (14,15) . **Basal layer** was appear as one row of generated layer in all studied areas it was made up of a row of vertical cells with elongated dark color nuclei based on the basement membrane ,this cells existed melanin in basal cell and nearby cells of all areas studies (Fig.2).they were focused and appeared clearly in skin of nose in order to give the skin color and this protect it from the impact of UV and match so with what was said by (15,16).It showed positive PAS reaction (Fig.1),also showed varies undulation depending on the regions studied in the thick-skin areas were low hair density such as planter ,ear and nose (Fig.3A,4B,6A,7). In the high density areas such as back and abdomen was observed few degree of undulation this membrane(Fig.1,5A),this agreement with (10,11). **spinousum layer** in all anatomic regions studied was made up of several layers of multiple polygonal cells consisted

in most areas of three rows of spherical or oval nuclei,cells was observed increase in the number of these rows increased skin thickness as the number of cellular rows arrived in eight rows in the regions of the palmer pad , plantar pad , ear and the nose is flatter near the surface of the skin fig. (3A,4A, 6A and 7) also observed the presence of melanin granules between the spinousum layer cells in some areas, like ear, nose region fig.(6A and7).This result accordance with(17) in albino guinea pigs **Granular layer** was observed that it consists of a single row of cells in the most anatomical areas of the ear fig. (6 A), while the raw numbers were increasing dramatically, reaching (2-4) rows in the skin of nose these cells characterized as rhombic shape in the vicinity of the layer overlying layers It contains cytoplasm with keratohyline granules which differed depending on the thickness of various anatomical regions fig.(7).This is similar to the pointed of (18) in mouse and guinea pig

**lucidum layer** appeared in the epidermis skin of ear, palmer and planter as well as the nose fig. (6A,3A,4B &7) are consisted of discredited cells to cell components have not been discriminated cell borders where as the nuclei was clear, many of the gaps observed instead of nuclei .Its also contrasts the installation of skin in different anatomical region of the same species of animals ,this were confirmed by (19) in his study of fetal growth and development of engineering building cell in white mice .

On the other hand ,the results suggests that the dermal-epidermal junction was delicate in a thin skin of back and abdomen, while was dense in thick skin of palmer and planter pads, because the large ripple membrane basilar membrane to increase the number of dermal papillae which are intertwined with wedges between papilla and this link or entanglement leads to increased surface area required for the

exchange of oxygen and nutrients and waste products between the dermis and the epidermis, and this was confirmed by (3) has already pointed out (20) in his study of the skin Rat varying degree of ripple basement membrane in the skin ear, back, abdomen, which results in pegs the growth of papilla and confirmed other studies such as studying (21) on the skin epiderm of golden hamsters .The results showed that the layer thickness of the stratum corneum significantly varies depending on the areas studied (Table 1) as the highest thickness have appeared on the skin of planter pads ( 16) Mm and less thickness in the skin of the ear and reached (0.72) Mm, ranged thickness of the stratum corneum in the rest areas between those two values , this corresponding with previous study on mouse and guinea pig (17,18) also Points table (1) to the difference in the total skin thickness in the anatomical regions studied, reaching the top of its thickness in the skin of the plantar pads and reached (43.2) Mm and less thickness in the ear and reached (31.6) Mm and include the thickness of the rest areas between those two values. this corresponding with previous study on rat (19).

#### **Dermis :-**

dermis of guinea pig is composed of dense irregular connective tissue contain mainly collagen fibers with less elastic fibers, reticular fibers , also noticed the presence of hair follicles ,sebaceous glands and sweat glands which were seen taking strong positive PAS reaction (fig 3B) as well as an erector muscle associated with hair follicles (Fig.3B,4A,5B,6B).this results agree with (14,21) It was noticed that this layer rich in blood vascular with neurological processing .Separated the dermis from mediated basement membrane, consisting of non-cellular layer fig. (1,3B&C , 4A&C , 5B and 6B &C). similar finding were observed by

(3,6,22).Dermis contain two main emerged layers : the superficial papillary layer close to the skin dermal papillae and deep reticular layer(Fig.1,3B and C,4A and C,5B and 6B and C). ,the same results founded by (14,21,22). Papillary layer appeared composed of small-sized collagen fibers , while the elastic fibers in small groups emerged in size and scattered and divided between collagen fiber . It was notice the presence of fibroblasts and mast cells(Fig 5A) . These results agree with what was said by (1,3,8) .while the reticular layer appeared deeper and thicker ,this accordance (23) in guinea pig and (6,7) in other animals .it's also more intense than papillary layer according to contain collagen fibers as well as elastic and reticular fibers in less degree which adds hardness, strength and flexibility to that layer, also due to presence of primary and secondary hair follicles ,sebaceous and sweat glands (Fig.3B,4A,C) .This have already other studies have pointed to the same observations by (25) in mouse . Collagen fibers appeared as high density compact packages of thick collagen fibers in nose ,back, palmer and planter pads (Fig.2,3B,4A,7)this agreed with (6,7,23). The measurement of papillary ,reticular layers and total dermis thickness of studied regions were displayed in table (2) which referred that the higher thickness was (12)  $\mu$  in planter pad while the less one was (10.04)  $\mu$  in abdomen .differing numbers of dermal papillae in the regions was observed as they were numerous and very developer in palmer pad, Fig(4A,C) while were lower in the rest thin areas as abdomen ,Fig(5B),this accordance with (2,3,24) .So the study indicated appositive relationship between the thickness of papillary layer and thickness of skin where it was the highest thickness in nose and palmer pad ,its corresponding with (24) in guinea pig.

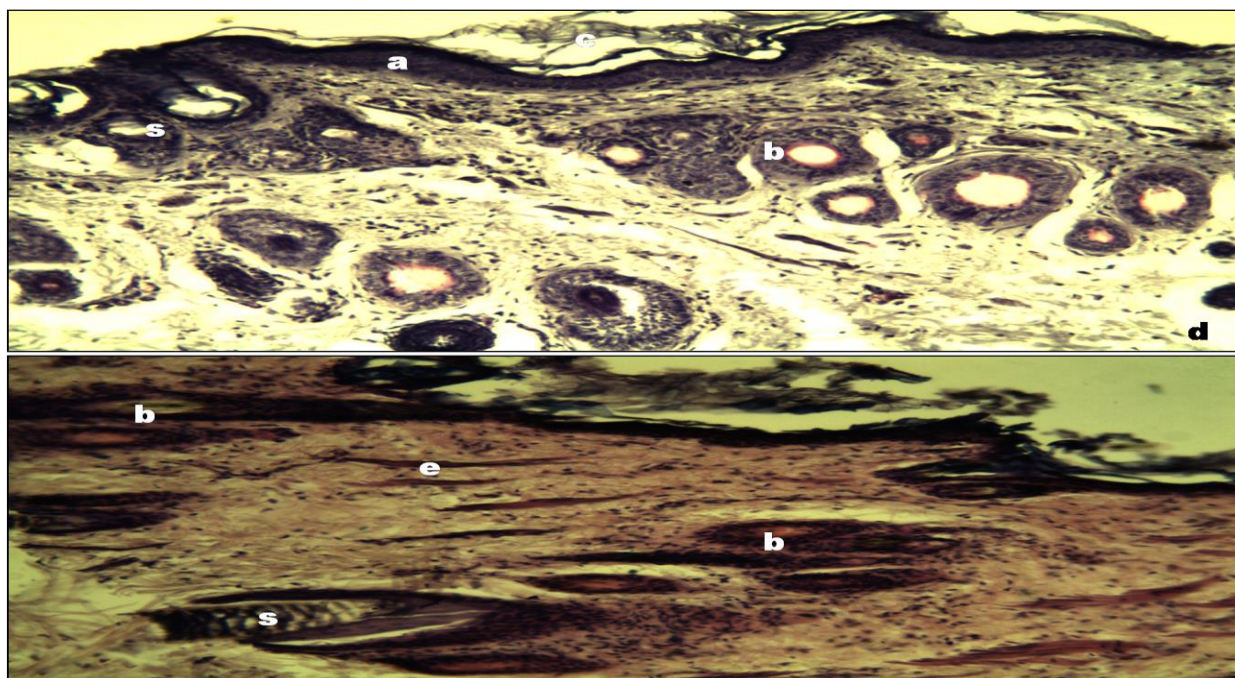


Fig.(1):- A photomicrograph of the back skin showing; the different layers of the epidermis.: the sebaceous gland alveoli (s) are surrounded by arrector pilli muscle (e) and open directly into the hair follicle(b). sweat gland (d) and epithelium (a) as well as corium layer (c) (PAS stain x 200).

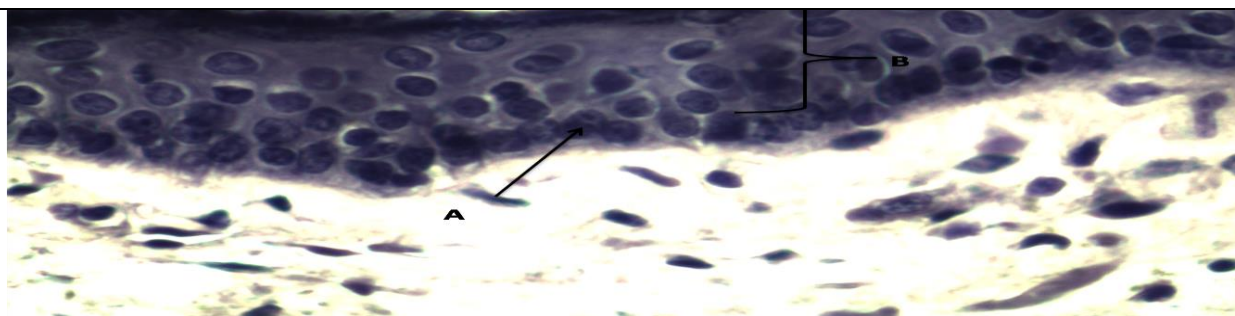


Fig.(2):- A photomicrograph of the back skin showing; basal layer (A) , spinousum layer (B) , granular layer (C) and corinum layer (D) (PAS stain x 400).



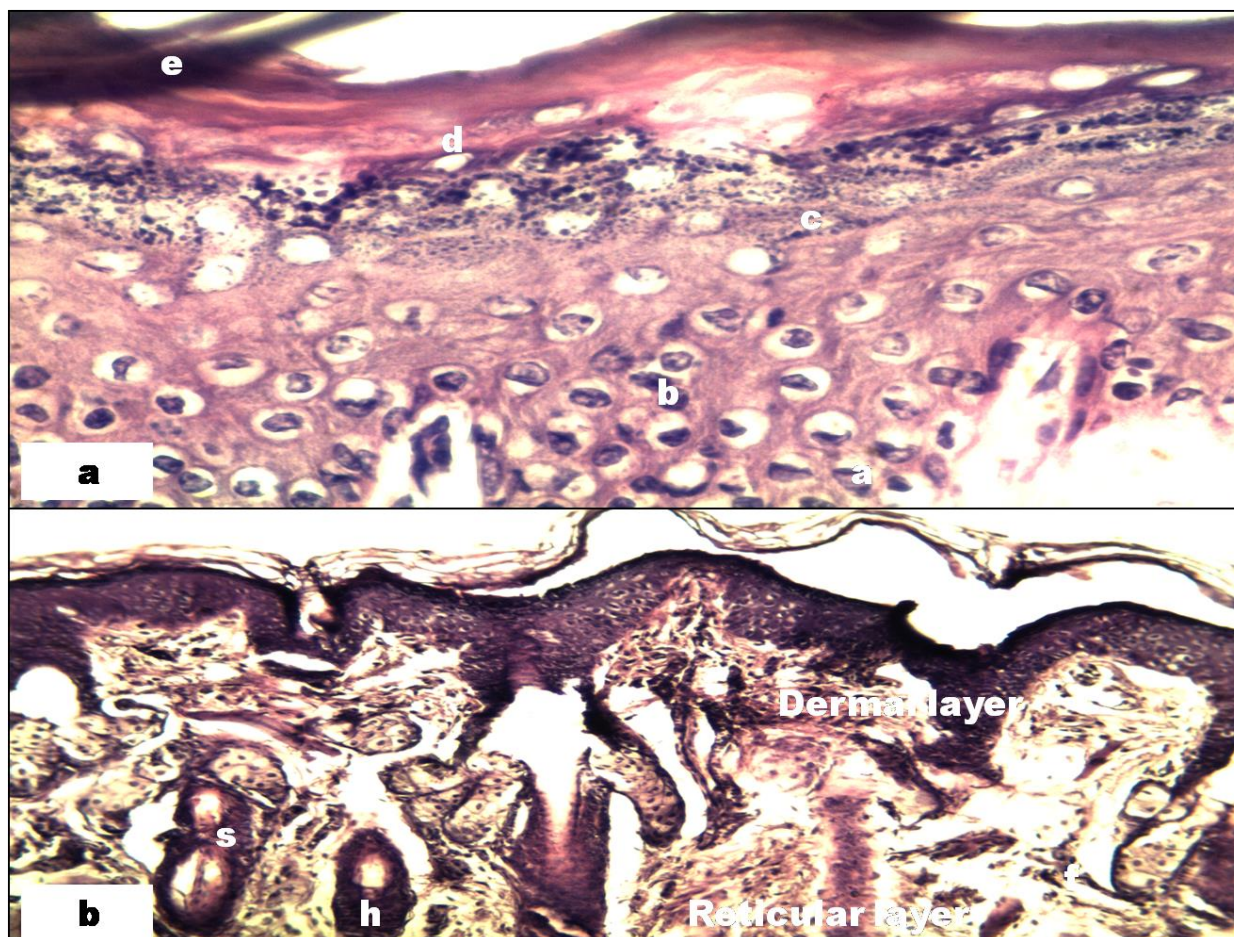


Fig.(3):- A - A photomicrograph of the palmar pad skin showing; basal layer (a) , spinousum layer (b) , granular layer (c) , lucidum layer (d) and corinum layer (e) (H & E stain x 200)

B- A photomicrograph of the palmar pad skin showing;. Dermal layer , Reticular layer , hair follicle (h) , sebaceous gland (s) ,sweat gland (f) (PAS stain x200)

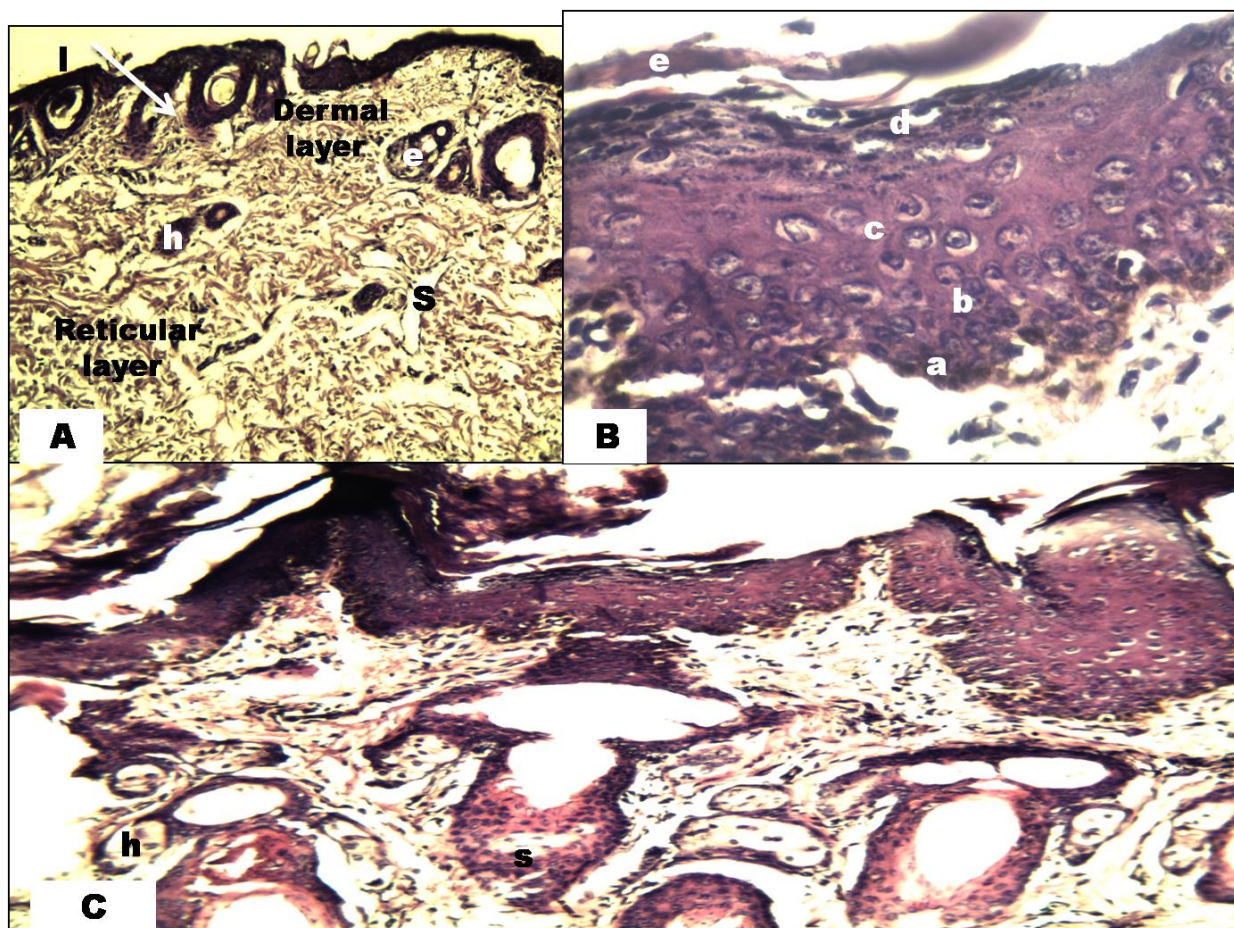


Fig.(4):- A- A photomicrograph of the planter pad skin showing; inter papilla folds(I) , dermal layer , reticular layer . hair follicle (h) , sweat gland (s) and sebaceous gland (e) (PAS stain x 100).

B- A photomicrograph of the planter pad skin showing : basal layer (a), spinousum layer (b) ,granular layer (c) ,lucidum layer (d) and corinum layer (e) (H&E stain x 400).

C- A photomicrograph of the planter pad skin showing : hair follicle (h) and sebaceous gland (s) (H&E stain x 400).



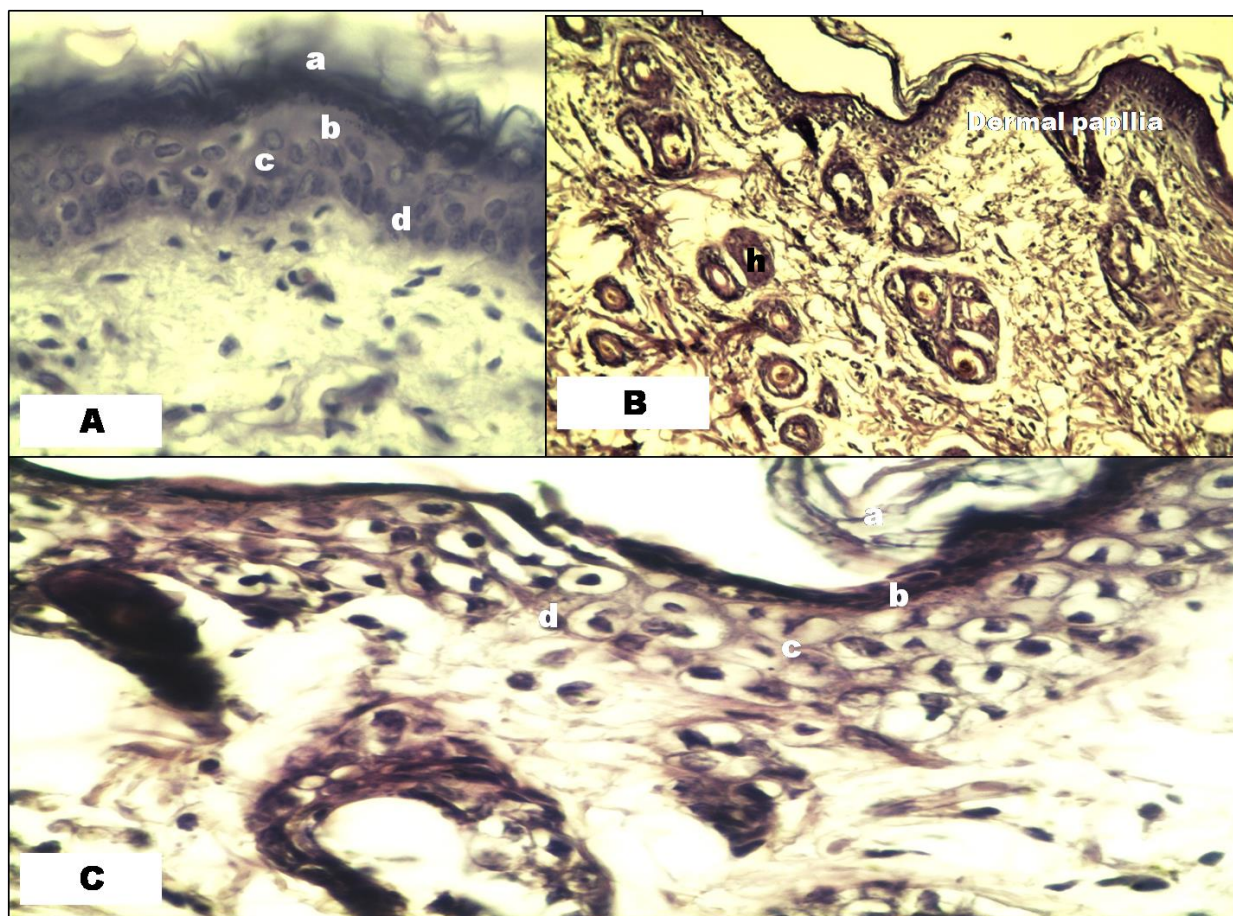


Fig.(5):-A- A photomicrograph of the abdomen skin showing; corium layer(a) , granular layer (b) , spiunusum layer (c) and basal layer (d) . (PAS stain x 400).

B- photomicrograph of the abdomen skin showing; dermal papilla, the low number of papilla . and hair follicle (h)(PAS stain x 200).

c- A photomicrograph of the abdomen skin showing; corium layer(a) , granular layer (b) , spiunusum layer (c) and basal layer (d) . (PAS stain x 400).



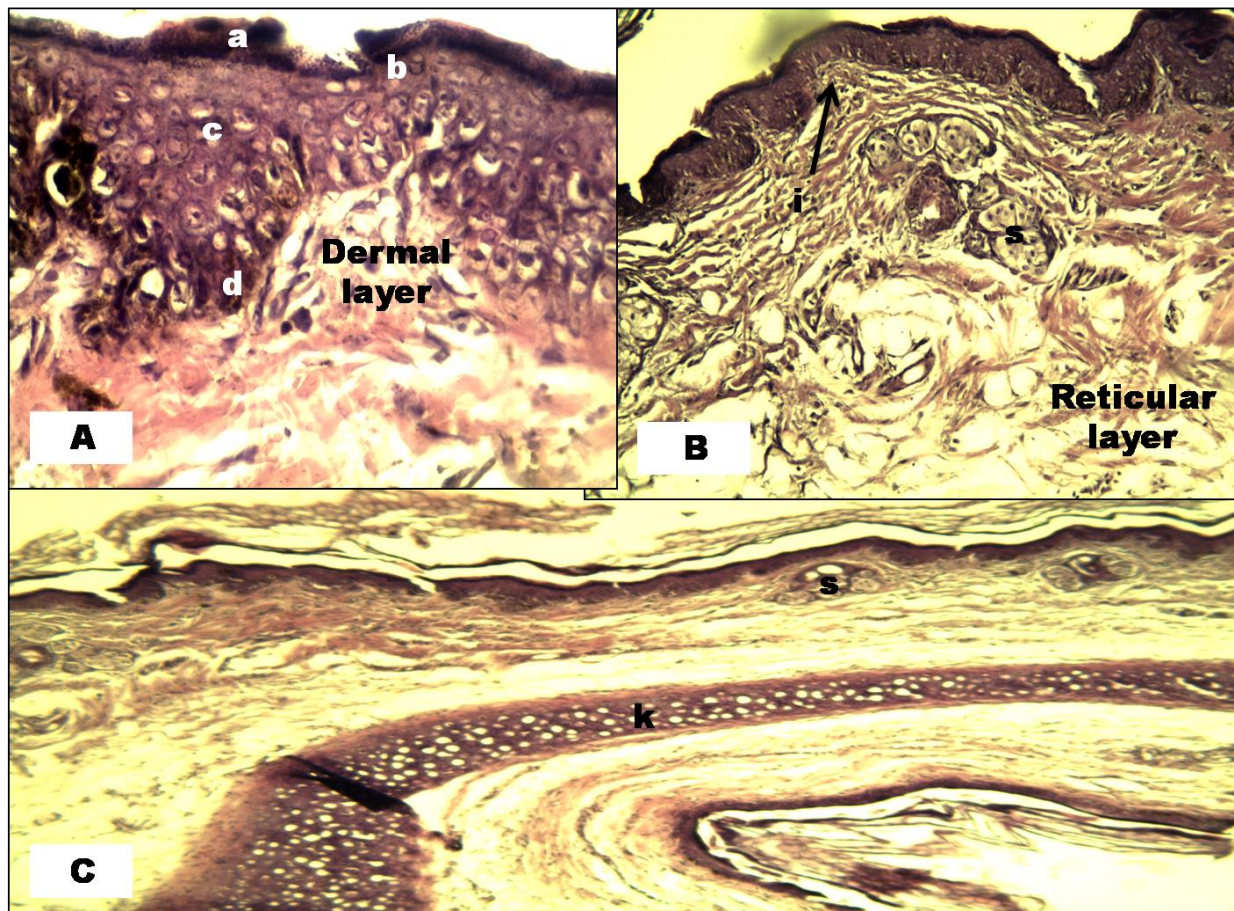


Fig.(6):- A- A photomicrograph of the ear skin showing; corium layer (a), granular layer (b), spinous layer (c), basal layer (d) and dermal layer (PAS stain x 200).

B- A photomicrograph of the ear skin showing; interdermal papilla (i), sebaceous gland (s) and reticular layer (PAS stain x 200).

C- A photomicrograph of the ear skin showing sebaceous gland (s) and hyaline cartilage (k) (PAS stain x 200).

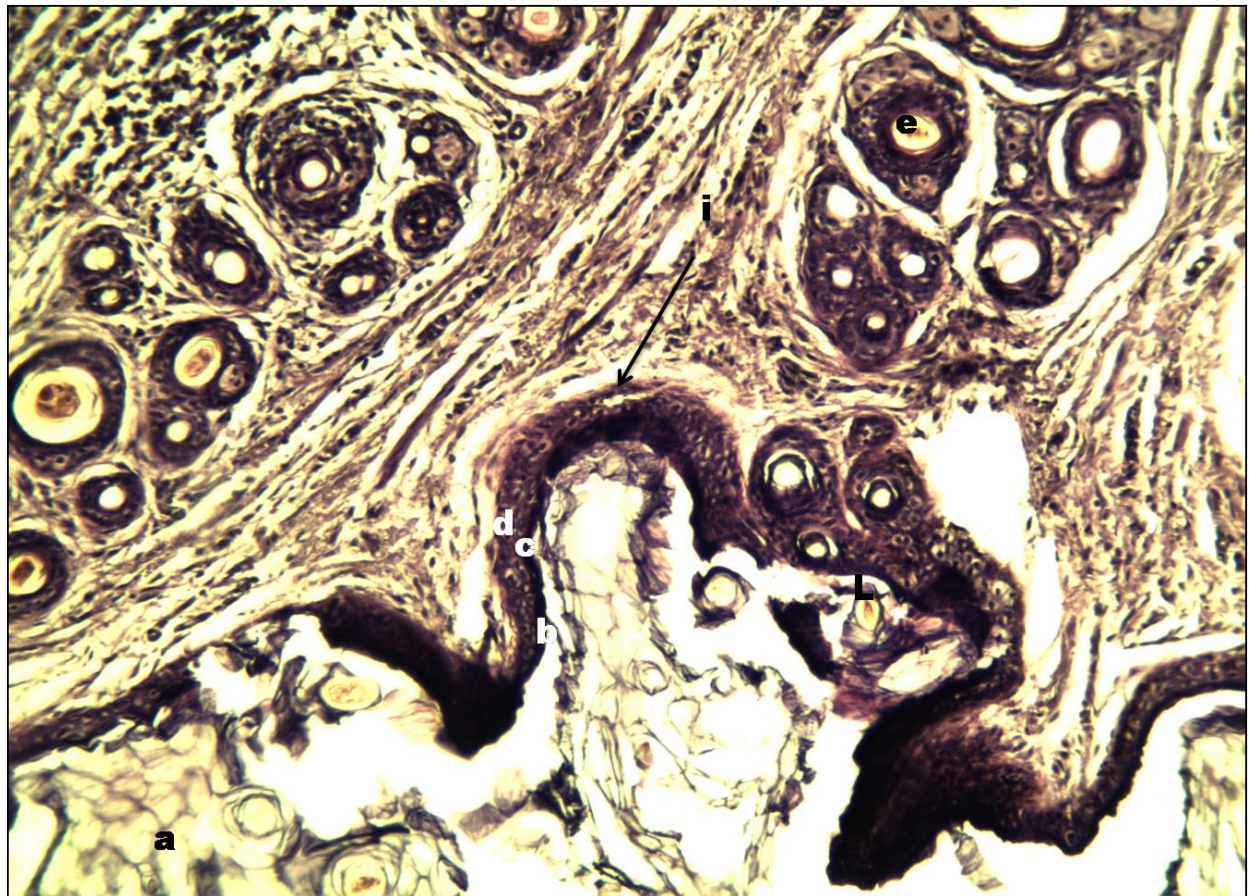


Fig.(7):- A photomicrograph of the nose skin showing; corium layer (a) and lucidum layer (L), granular layer(b), spinosum layer (c), basal layer(d), hair follicle (e) and dermal papilla (i) (PAS stain x 200).



**Table .1 shows the layer thickness of the corinum and the thickness of the total epidermis and the total thickness in different areas of the skin of guinea pig using a measurement unit (micrometer) .( $\pm$ SE  $\bar{X}$ )**

<b>Anatomical region</b>						
	<b>Planter hind limb</b>	<b>Palmar fore limb</b>	<b>nose</b>	<b>Back</b>	<b>Abdomen</b>	<b>Ear</b>
<b>Thickness</b>						
<b>Corinum layer</b>	<b>16<math>\pm</math>0,7</b>	<b>5.6<math>\pm</math>0.18</b>	<b>2.08<math>\pm</math>0.04</b>	<b>2<math>\pm</math>0.25</b>	<b>1.2<math>\pm</math>0.07</b>	<b>0.72<math>\pm</math>0.03</b>
<b>epidermis</b>	<b>17.2<math>\pm</math>0.37</b>	<b>7.6<math>\pm</math>0.004</b>	<b>4.4<math>\pm</math>0.08</b>	<b>3.36<math>\pm</math>0.04</b>	<b>2.32<math>\pm</math>0.29</b>	<b>2.16<math>\pm</math>0.04</b>
<b>Total skin</b>	<b>43.2<math>\pm</math>0.37</b>	<b>38.6<math>\pm</math>0.24</b>	<b>35.2<math>\pm</math>1.77</b>	<b>34<math>\pm</math>0.34</b>	<b>33.8<math>\pm</math>1.15</b>	<b>31.6<math>\pm</math>0.50</b>



Table .2 shows the layer thickness of the papillary and the thickness of the reticular layer and the total dermis thickness in different areas of the skin of guinea pig using a measurement unit (micrometer) .( $\pm$ SE  $\bar{X}$ )

Anatomical region  Thickness	hindlimb	fore limb	nose	Back	Ear	Abdomen
Papillary layer	12.4 $\pm$ 0.06	10 $\pm$ 0.37	8 $\pm$ 0.3	3.68 $\pm$ 0.03	1.52 $\pm$ 0.37	1.04 $\pm$ 0.24
Reticular layer	24.6 $\pm$ 0.4	22.6 $\pm$ 0.39	20 $\pm$ 0.44	7.12 $\pm$ 0.22	3.28 $\pm$ 0.04	2.96 $\pm$ 0.04
Total dermis	36 $\pm$ 0.31	34.4 $\pm$ 0.24	30 $\pm$ 2.7	10.8 $\pm$ 0.22	4.8 $\pm$ 0.08	4 $\pm$ 0.04

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