Histological changes of mice skin under Protein energy malnutrition.

By,

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(التغيرات التركيبية لجلد الفئران تحت تأثير نقص البروتين)

الخلاصة:

دراسة أنجزت علىجلد الفئران ، هذة الدراسة خططت لمعرفة إمكانية تأثير نقص البروتين على التركيب النسيجي لطبقات الجلد المختلفة .

تم اخذ عينات من منطقة البطن من جلد (٢٠) فأر ابيض من سلالة BALB/C تتراوح أعمارهم بين (٨-١٢) أسبوع كانت هذه الفئران معرضة لتغذية فيها نقص حاد في البروتين لمدة ٤ اشهر لغرض معرفة تأثير نقص البروتين على التركيب النسيجي للجلد . وكذلك تم اخذ عينات أخرى من منطقة البطن ايظا من (٥) فئران من نفس السلالة والجنس كانت تتغذى على غذاء طبيعي بوجود البروتين .

بعد أجراء الطرق الروتينية للعينات من أعداد الشرائح النسجية وصبغها بصبغات مختلفة أظهرت النتائج تغيرات متعددة على تركيبة الجلد النسيجية في الفئران المعرضة إلى سوء التغذية , من هذه التغيرات تضخم في الطبقة الخارجية المتقرنة للجلد وكذلك تضخم في الطبقة الحبيبية وانتشار وتراكم صبغة الميلانين في الطبقة القاعدية وبينت النتائج أيضا فقدان كبير في شعر الجلد وتقصف في حويصلات الشعر , وتجمع كبير في الألياف الكولاجينية في منطقة البشرة . لم تظهر أي تغيرات في الغدد العرقية والغدد الدهنية تحت مستوى المجهر الضوئي .

Abstract.

A study was performed on the effect of protein malnutrition on the mice skin. This study was planned to assess the possible effect of protein Malnutrition on the histological structure of different layers of mice skin. Skin taken from the abdomen of twenty young albino mice aged (8-12) weeks with protein energy malnutrition (PEM) exhibiting skin histological changes.

Additional pieces of skin from the abdomen of another 5 sex matched control mice where subjected to biopsy under local anesthesia, paraffin sections were made and stain with haematoxyline and eosin and also for collagen, elastic fibers and mucopolysaccharides, and examined by light microscopy. The results apparently show a variable degree of exaggeration of stratum cornium, with atrophy of stratum granulosum and prickle cells layers was observed. A considerable amount of melanin was found in the basal layer in all cases , there was accumulation of collagen and associated with crowding of elastic fibers. Hemorrhagic areas where observed.

The epidermal appendages , hair shafts, hair follicles exhibited atrophy. Sweat glands , sebaceous glands did not show any changes.

Introduction.

Malnutrition is still a major problem, affecting several organs of the individual body (1)&(4) . Malnutrition defines by several authors as cellular imbalance between the supply of nutrients and energy and the body demand for them (2), to ensure growth, maintenance and specific function (3).

Protein energy malnutrition the most widespread nutritional deficiency disorder of mankind and many other species (2).

Although protein energy malnutrition affects virtually every organ system (4) , therefore this article primarily focuses on its cutaneous manifestations, and because the skin is one of the largest organ of the body which is significantly affecting by protein energy malnutrition (5). Abteillung & Johann (1988) . Observed that animal with protein energy malnutrition have deficiencies of vitamines,essential fatty acids and trace Elements, all of which may contribute to the several changes that occurred to the after protein energy malnutrition.

Materials and methods.

Skin specimens were taken from the abdomen of (20) young albino mice aged (8-12) weeks after local anesthesia. These mice were exposed to protein energy malnutrition (7) for four months as shown in table 1. Specimens were fixed in 10% formalin and embedded with paraffin . Sections in about (3-5) microns in thickness were cut and stained with different dyes like haematoxylin and eosin , Massontrichom and Periodic acid Schif reagent, to demonstrate; collagen fibers, elastic fibers ,melanin pigment and mucopolysaccharide, and examined by light microscope.
Specimens from (5) control animals fed on normal diet were also Prepared by the same way and examined with the light microscopy.

Group 1. (5 in No.); Control ,fed on normal diet.
Group 2. (20 in No.); Experimental animals, fed on special formula diet as in table 1. Ref. (7).

Table -1- The percentage composition of the diet (%).

	Control	Experimental
Casein	20	2.5
Starch	65	82.5
Cellulose	4	4
Corn oil	4.5	4.5
Salt mix.	4.5	4.5
Vitamins mix	2.5	2

Results.

Results have shown some significance histological changes in the structure of the layers of the skin tissues under investigation ,such as hypertrophy of stratum corneum (Fig 1),with atrophy of stratum granulosum and prickle cell layer (Fig 2).The results also show aggregation of large amount of melanin in the basal layer in all samples (Fig 3),there was also accumulation of collagen fibers as a mass associated with crowding elastic fibers, in some areas of the dermis (Fig 4). Apparent reduction in the proportion of hair follicles was also observed (Fig 5), the 20th mice which have been examined presented with acute diffused and total hair loss of scalp and other parts of the body, after protein energy malnutrition ,hair follicles were found abnormal exhibiting sever atrophy and shaft constriction (Fig 6), most of the hairs examined appear without pigment consistent with the lack of melanin production during the development cycle (Fig 6). Many more broken hairs were found.

Large hemorrhagic areas in the dermal papillary layer also seen(Fig7&8) with invasion of some macrophages cells between them. No changes were observed in skin appendages like sweat glands, and sebaceous glands in the present study under the light microscope level (Fig .9) . In comparison to the control mice fed on normal free diet .(Fig 10. A.B.C.)

Disscution.

Reducing the protein energy intake in mice to a very low level(7) than that of the control group, led to severe malnutrition with the characteristic histological changes of the skin, like hair follicles, atrophy, hairs loss, hemorrhagic areas, atrophy of stratum granulosum, accumulation of melanin and many other changes, when compare to control mice fed on normal diet. The results however, agreed with the findings obtained by Kaggwa. (1986) who showed that restricting the protein diet in rat causing several histological and pathological changes to the skin.

Our findings however agreed with similar findings in human children (9&10). In Squirrel monkey fed on low protein diet (11). Prendiville. (1992) suggested that hypoproteinemia, occurs more often

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under condition of protein restriction than protein energy malnutrition. Mclaren, etal(1987)(10) suggested that protein malnutrition in human and many other animals like rodents (8), and Avian (12) is consistently associated with lower concentration of serum albumin which causes these changes(8). Others however emphasized that the skin of malnourished mice contained lower amount of protein and DNA per surface area of the skin than that of the control animals . Nevertheless only protein concentration was lower in malnourished group than that observed
in the control group , these results suggest that overall process of protein and DNA synthesis in skin, the skin of malnourished mice are impaired causing skin atrophy, hair loss ,hemorrhage, which might be due to a reduction in the number of cells (cell death) , rather than a reduction in cells size.
It is also possible that mice may be adapted to protein energy malnutrition in which protein synthesis rate would decrease.
It could be also explained that mucocutaneous changes occur in some severe cases causes vitamins deficiency state which can also causes skin necrosis (5&6).

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Explanation of the fingers;

Fig .1. Show hypertrophy of stratum cornium (c) (X 742).

Fig.2. Show stratum cornium © with atrophy of stratum (G) and Prickle cell layer (P) (X742).

Fig.3. Shows basal layer (B) with large accumulation of melanin (X. 742).

Fig .4. Show accumulation of collagen fibers (F) in same areas of The dermis. (X 742).

Fig .5. Shows atrophy of hair shafts (SH) and shaft constriction without pigment. (X742) .

Fig. 6. Shows sever atrophy of hair shafts (SH) and shaft constriction without pigment (X 742).

Fig.(7.& 8) . Shows large haemorrhagic areas (arrows) and invasion of some M acrophages cells (m) (X 371).

Fig. 9. Shows no effect of (PEM) on sebaceous glands (S) (X 742).

Fig. 10(A,B,C): Shows skin under normal diet (control)

A: Skin from scalp with large proportions of hair follicles (H) (X 185)

B: Skin from abdomen with normal layers, corneum (C) Prickle cells (P) (X 185).

C: High magnification of abdominal skin , stratum corneum (C) ,Prickle Cells (P) and basal layer (B) (X 320).

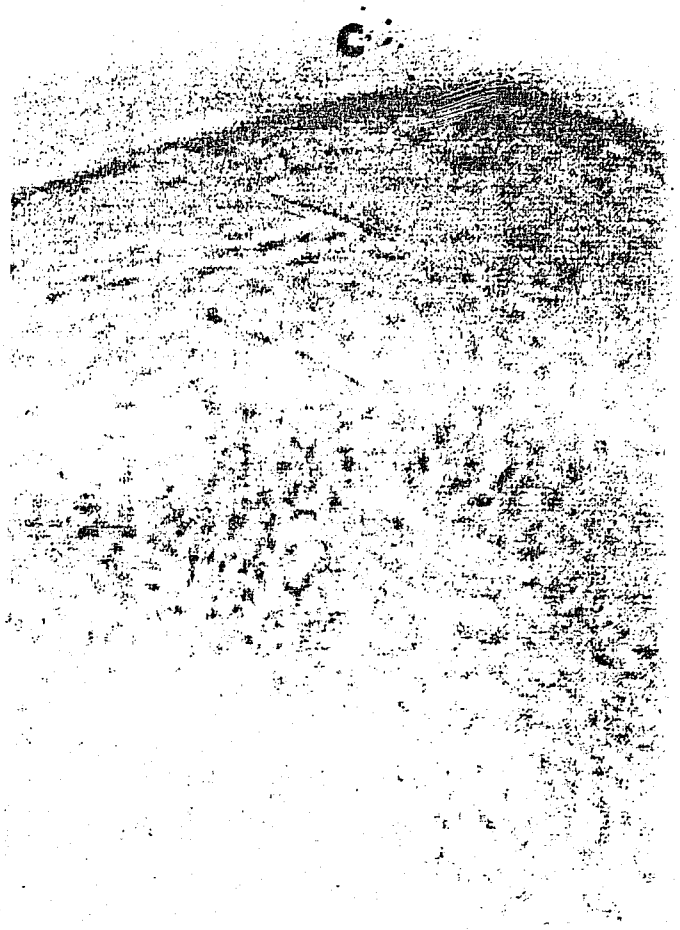


Fig.1: Shows hypertrophy of stratum corneum(c)(X 742)

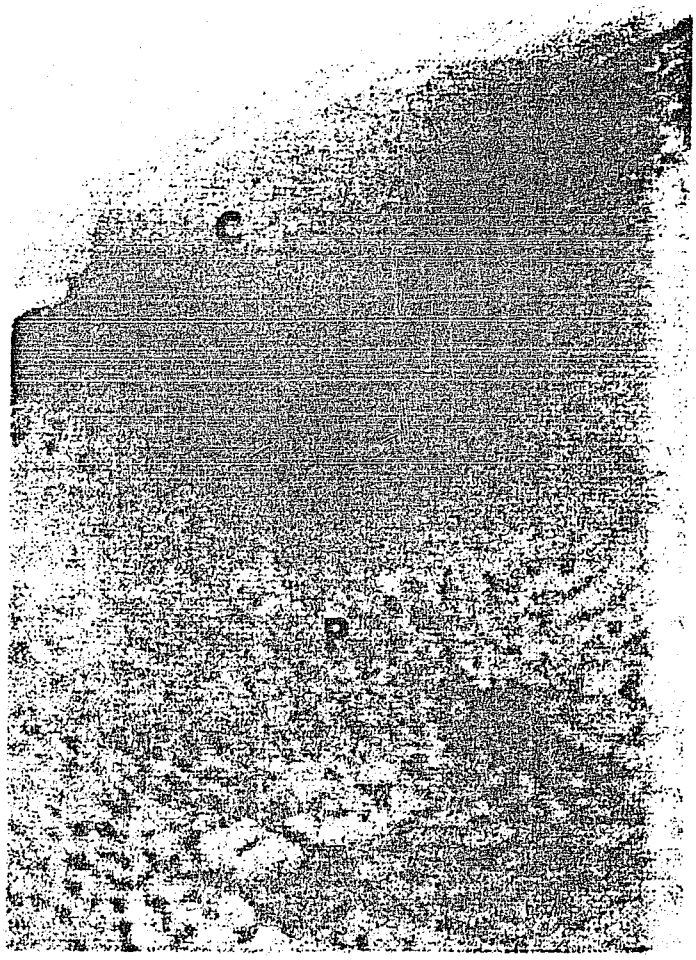


Fig.2: Shows stratum corneum(c), atrophy of stratum granulosum (G) and prickle cells layer (p)(X 742)

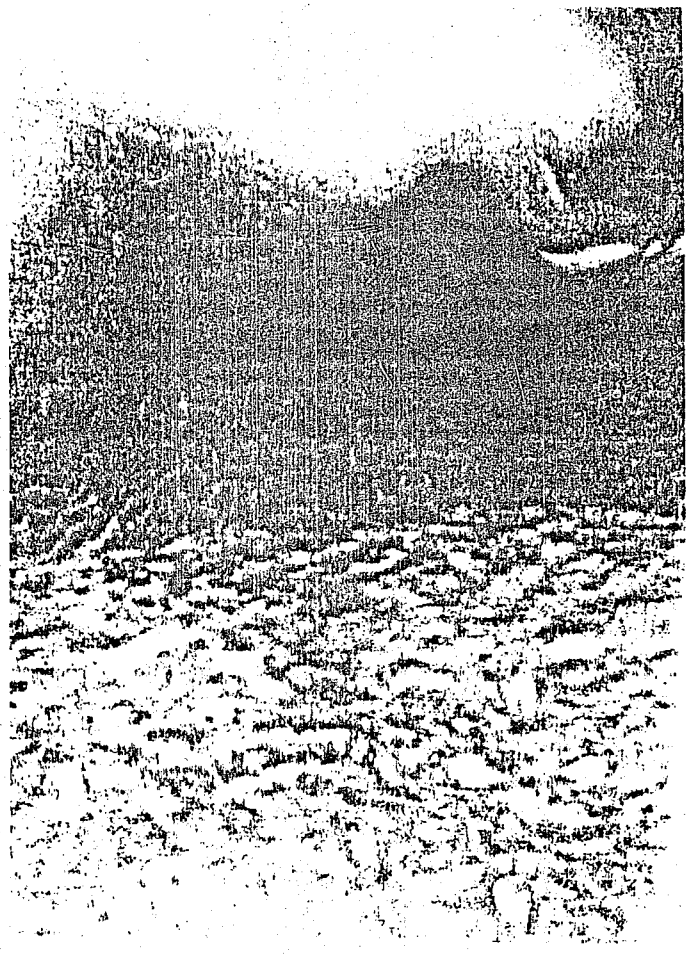


Fig.3: Shows basal layer (B) with large accumulation of melanin (X 742)

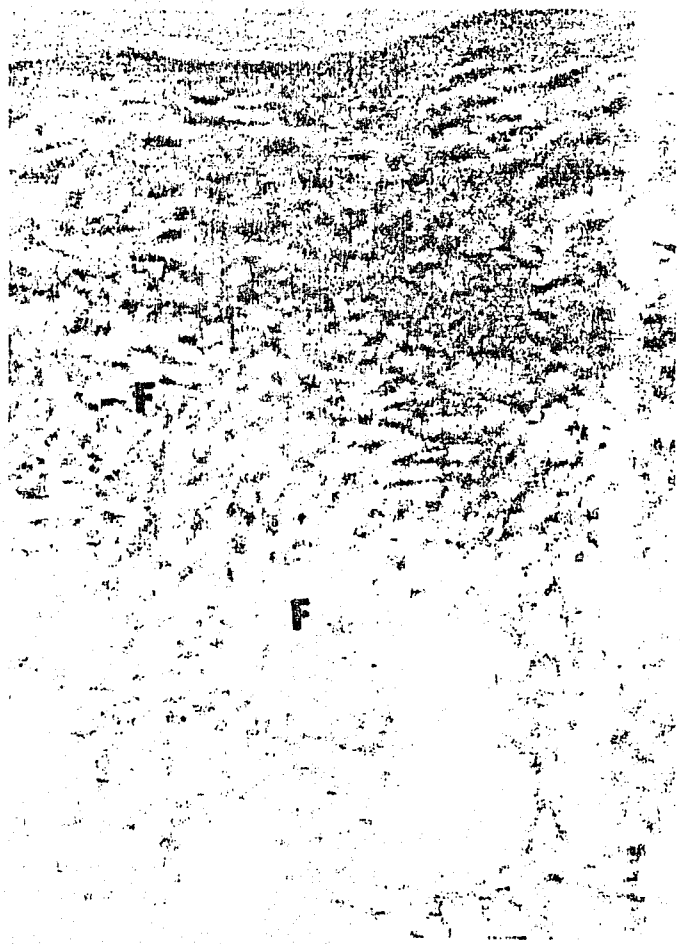


Fig.4: Shows accumulation of collagen fibers (F) in same areas of the dermis (X 742)

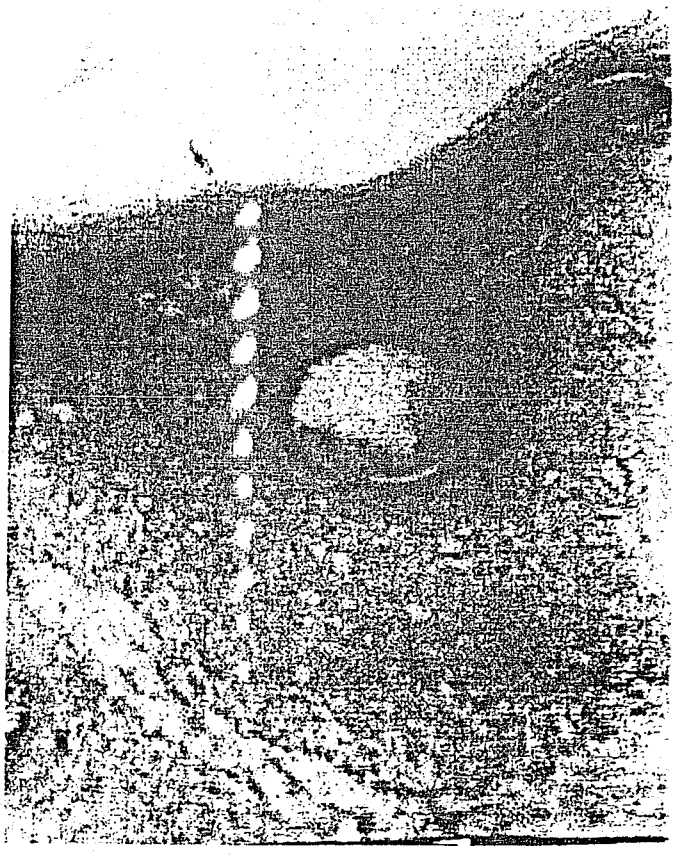


Fig.5: Shows skin with great reduction in the proportion of hair follicles (X 371)

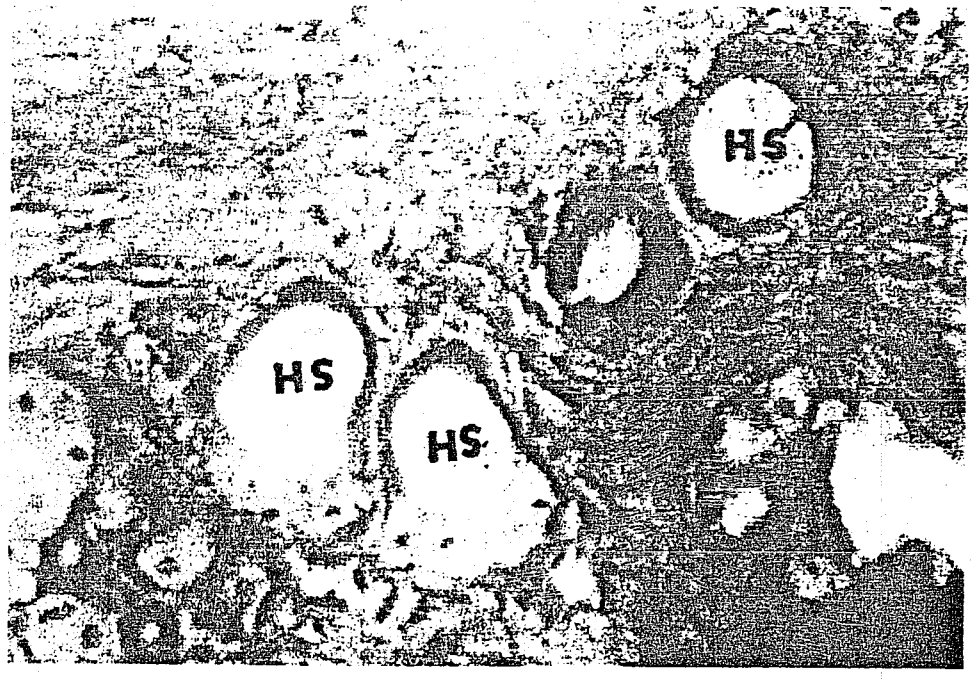


Fig.6: Shows severe atrophy of hair shafts (SH) and shaft constriction without pigment (X 742)

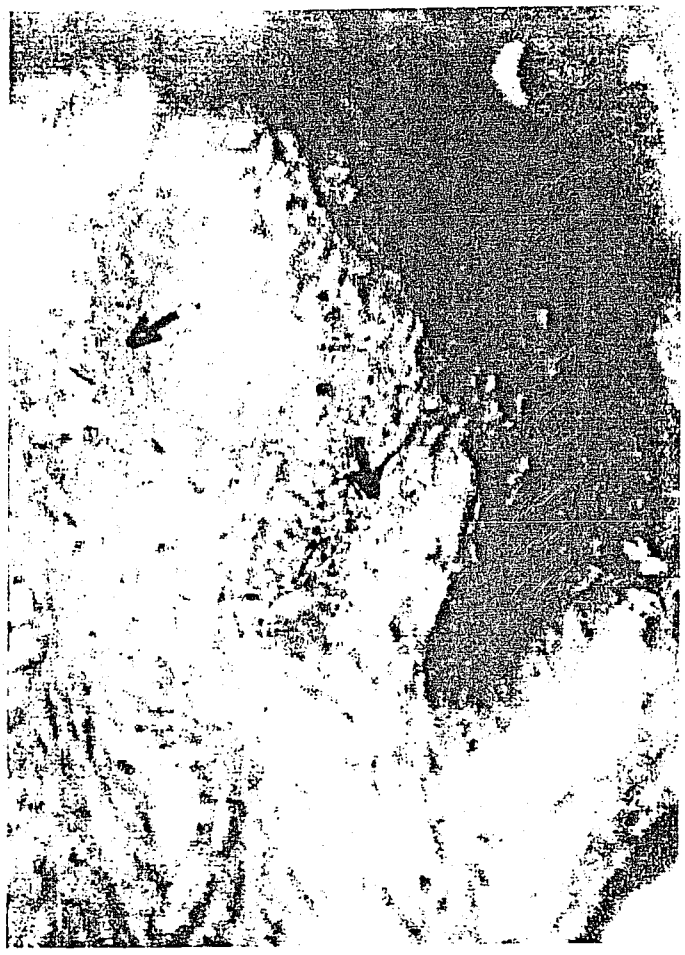


Fig. 7

Fig.8

Fig.(7 & 8) : Shows large haemorrhagic areas (arrows) and invasion of some macrophages cells (m)(X 371)

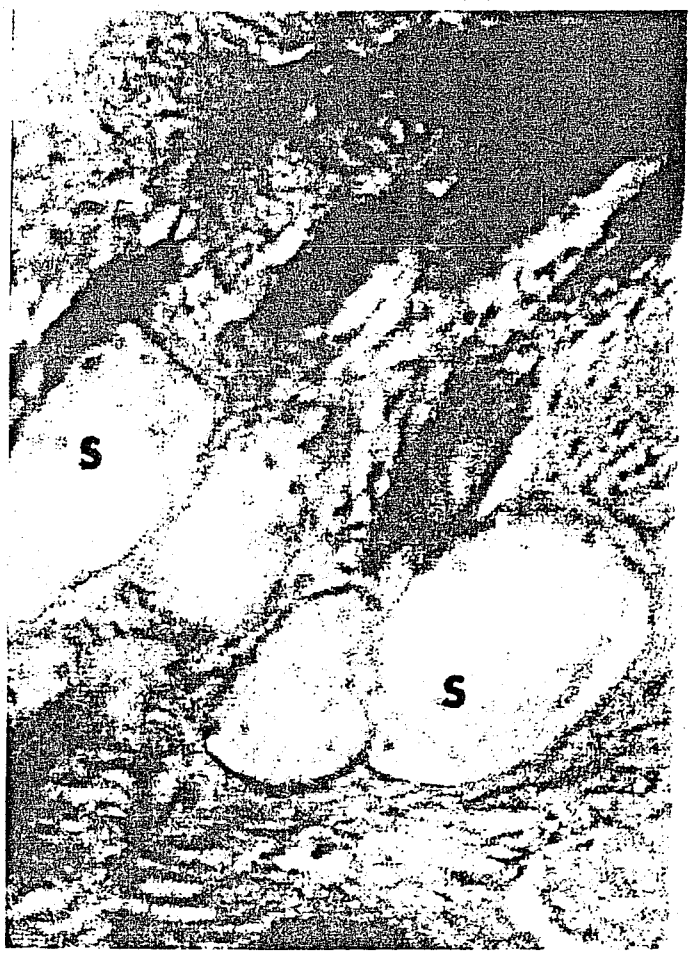
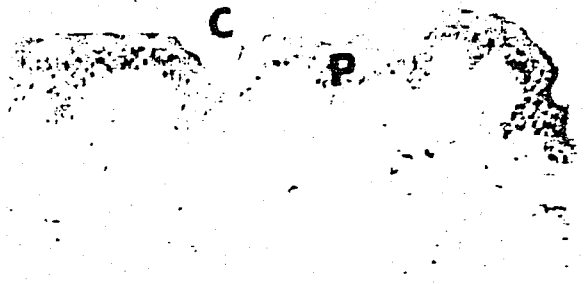


Fig.9: Shows no effect of (PEM) on sebaceous glands (S) (X 742)

(A)



(B)

(C)

Fig.10 (A,B,C): Shows skin under normal diet (control)
A: Skin from scalp with large proportions of hair follicles (H) (X 185)
B: Skin from abdomen with normal layers, corneum (C) prickle cells (P) (X 185)
C: High magnification of abdominal skin, stratum corneum (C), Prickle cells (P) and basal layer (B) (X 320)