

**The Histological structure and Biometric in Adrenal gland  
of Buffalo *Bubalus bubalis* at South of Iraq**

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**Abstract**

The study aimed to reveal the histological investigation of structural and components and determined the biometric measurements of adrenal glands in buffalo. The study has been performed on six pairs of buffalo's glands of both sexes which were collected from slaughter house in Al-Nasiriya city. Results have shown structural features of components of gland which were typical connective tissue capsule and cortex which consist of zona glomerulosa, zona fasciculate contained two types of cells and zona reticularis which is interfering with medulla cells. As well as biometric measurement have been reported the thickness ratio of the components of the glands, capsule, cortex (zona glomerulosa, zona fasciculate and zona reticularis) and medulla thickness which were 8.27%, 56.95% 15.56% ; 27.48%; 13.90%, 34.76%) respectively. The study has been concluded that cortex form more half of the gland and medulla formed one third of gland as well as zona fasciculate was width zone and subdivided in to two parts, zona reticularis was narrowest zone .The present study is first reported of adrenal glands in buffalo at south of Iraq.

**Keywords:** Buffalo, adrenal gland, Biometric measurements, Coretx, Medulla .

## **Introduction**

The adrenal gland is composed of two distinct portions which are outer cortex (mesodermal origin) and inner medulla (neuro-ectodermal origin)(Bank,1993 and Delman,1993).The adrenal cortex is subdivided into three distinct zones of epithelial (Junqueira *et al.*,1995 )whereas Bacha and Wood ,(1990) mentioned that cortex is subdivided into four zones of epithelial cells. The cortex has three zones, which are not sharply separated from each other. The zona glomerulosa is outer zone which its cells are arranged in ovoid groups (Colby *et al.*,1992).These cells in carnivores and horse are arranged into arcs due to called zona arcuata (Tanyolac,1993 ; Prasad &Shinha,1981).Sinusoidal capillaries are present among cells of zona glomerulosa (Difiore,1981). The zona fasciculate, the widest zone of adrenal cortex arc consist of radially arranged cords of cuboidal or columnar cells(Karadag *et al.*,1995).These cells characterized with vacuolated appearance and the presence of high proportion lipid droplet (Temur *et al.*,2007). The zona reticularis consist of cells disposed as freely anastomosing cords. The cells are rough the same in morphologic features as the cells of the zona fasciculate, but their nuclei and cytoplasm have darker staining (Junqueira *et al.*, 1995 and Tanylac, 1993). Medulla consist of chromaffin cells which are arranged in groups.thier cytoplasm is relatively clear and have brown granules which represented epinephrine and nor epinephrine (Steven & Lowe, 1991; Dellman, 1993). There are two types of chromaffin and granules of epinephrine cells which are smaller and dense compared to epinephrine cells (Gude *et al.*, 1982). Also medulla contained sympathetic ganglion cells arranged singly in groups. They have characteristic vesicular nucleus, sinusoidal capillaries are present in medulla which drain into medullary veins (Difiore, 1981). The neither cells secreting nor epinephrine have peripheral location while those secreting epinephrine are central (Williams and Warwick, 1995). There are collagen fibrils and fibroblasts in the stroma of the medulla and rarely macrophages (Delman, 1993). Innervations of adrenal medulla is sympathetic where as there is no parasympathetic innervations also adrenal glands have more autonomous innervations than the other gland (Petorak, 1984).This study

aims to describe of histological exploration and determined of parameter of adrenal gland in buffalo due to the seldom investigations which is concerning within this field.

## **Material Methods**

In this study, twelve adrenal glands were collected from six adult buffaloes (female and male). The buffaloes were slaughter within abattoir in Al-Nassiryia province. The specimens have been taken and kept within clean container. For light microscope examination, 10% formalin has used to fix the tissue. After fixation, the specimens have been prepared to make histological sections and stained with routine haematoxylin and eosin according to (Luna, 1965). Then routine histological sectioning has been performed in Al-Nassiryia hospital. Biometric measurements were determined by ocular micrometer for component zones of glands. The biometric measurements include the following parameters: 1- The height of capsules. 2- The height of aructa zones of cortex (zona glomerularis, zona fasciculate and zona reticularius). 3- The height of medulla by ocular lens micrometer. Photographs were taken with digital camera has been done in Education Faculty for Pure Sciences, Thi-Qar university.

## **Results**

The present study revealed that adrenal glands consist of cortex and medulla. Cortex was covered by typical capsule of dense collagenous tissue (**Fig.1**). The study reported that the thickness mean of capsule which attained to (250) micrometer. The cortex composed of three distinct zones which distinguished with light microscopically investigation as well as cortex formed 56.95% of gland. The first zone was zona glomerularis which their cells arranged into circular clusters with irregular organization. Also their nuclei were longitudinal –a round shape with slightly dark stain (**Fig, 1,2, 3**). The thickness of this zone was reported about (470) micrometer, which was formed 15.56% of cortex. The second zone was appeared which zona fasciculate that can be differentiated into two types of cells. First type lies on the upper part of the zone which arranged into columns cords and each column has two

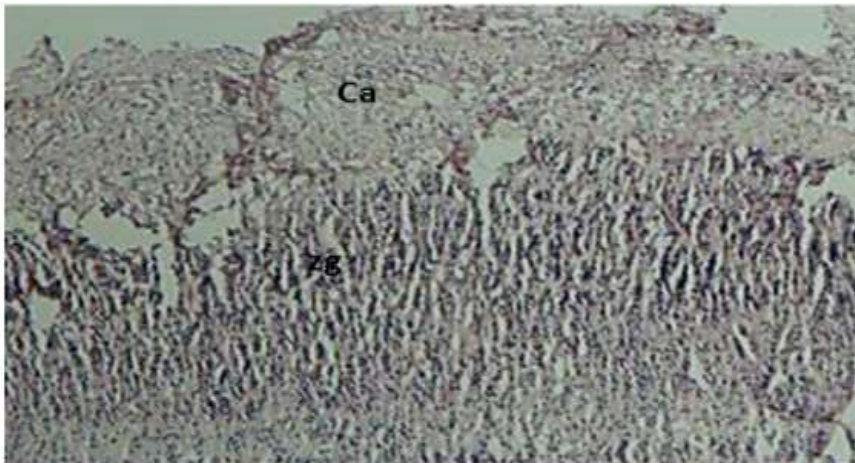
cells width, they were very closed together. Their nuclei are round and dark stain. So that they appeared also central in position and surrounded with little amount of cytoplasm with slightly dark stain mean while lower part of this zone ,cells arranged into columns cords which oriented in radial directions, each columns has contained one cells in width therefore, cells appeared distance regular array cords. These cells contained nuclei in lateral position and the cytoplasm take relatively light stain and sometimes appear as vacuoles. Foamy cells were present between the cells of this part of zone which appeared as vacuolated cells. Sinusoidal capillaries were abundant of cells (**Fig.4, 5**).The mean of thickness was reported about (830) micrometer which formed 27.48% of cortex. The third zone was observed that zona reticularis,this zone was difficult separated from medulla as well as close interfering and surrounding with cells of medulla. The cells were appeared anatomizing form which oriented in different directions, their nuclei central position as well as took dark stain. These cells are irregular arranged which appeared as reticular organization (**Fig 6, 7**). The mean of this zona thickness (420 micrometer) which formed 13.90% of cortex. Medulla represent the internal position of gland which surrounded with cells of cortex also formed 34.76% from gland. Medulla mainly composed from two types cells. First type cells were peripheral position and the other cells were central position ,these two types cells arranged in circular groups so as somewhat closely similar to each other which difficult to distinguish, exception. That the difference was in peripheral cells were light stain where as cells in central took dark stain. Also in medulla can be observed sympathetic ganglion cells which arranged in groups between medullary cells, they have vesicular nucleus (**Fig 6, 8, 9**).Medulla characterized by the present of abundant sinusoidal capillaries which found between two types of medulla. in addition the present of highly blood vessels in a various size, as well as capsule thickness was reported about 8.27% from whole gland.

**Biometric Measurements of Adrenal Gland Components and Ratio**

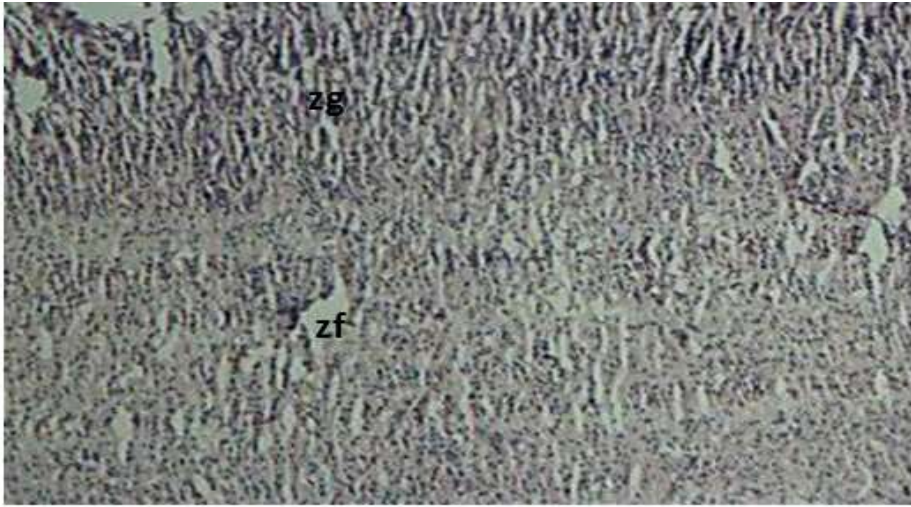
<b>Structural</b>	<b>Thickness- micrometer-</b>	<b>Ratio of thickness for gland %</b>
Capsule	250 <sup>+</sup>	8.27
Cortex	1720 <sup>+</sup>	56.95
Zona glomerulosa	470 <sup>+</sup>	15.56
Zona fasciculate	830 <sup>+</sup>	27.48
Zona reticularis	420 <sup>+</sup>	13.90
Medulla	1050 <sup>+</sup>	34.76

**Biometric Measurements of Cortex Adrenal Gland Components and Ratio**

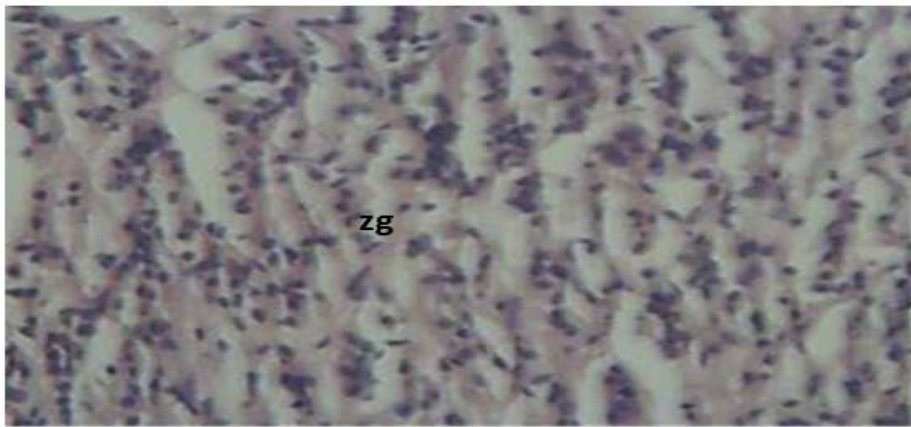
<b>Structural</b>	<b>Thickness- micrometer</b>	<b>Ratio of thickness for cortex gland %</b>
Zona glomerulosa	470 <sup>+</sup>	27.32
Zona fasciculate	830 <sup>+</sup>	48.25
Zona reticularis	420 <sup>+</sup>	24.41



**Fig (1):** Transverse section of capsule ( ca ) and zona glomerulosa (zg) adrenal gland (100 x). H&E staining

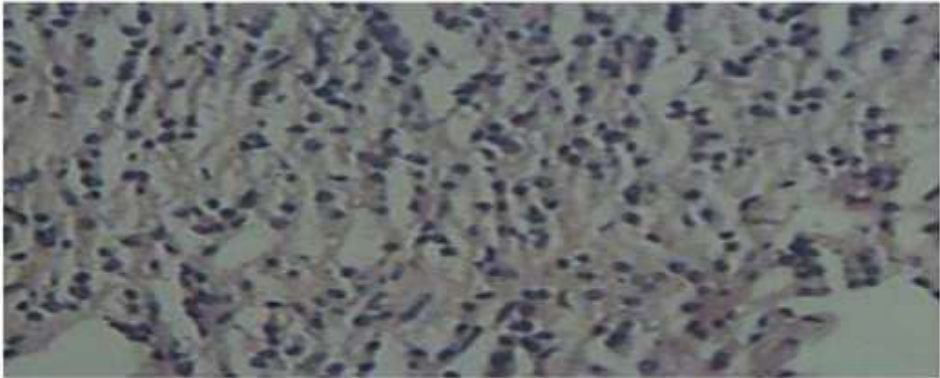


**Fig (2):** Transverse section of zona glomerulosa (zg) and zona fasciculata (zf) adrenal gland (100 x). H&E stain

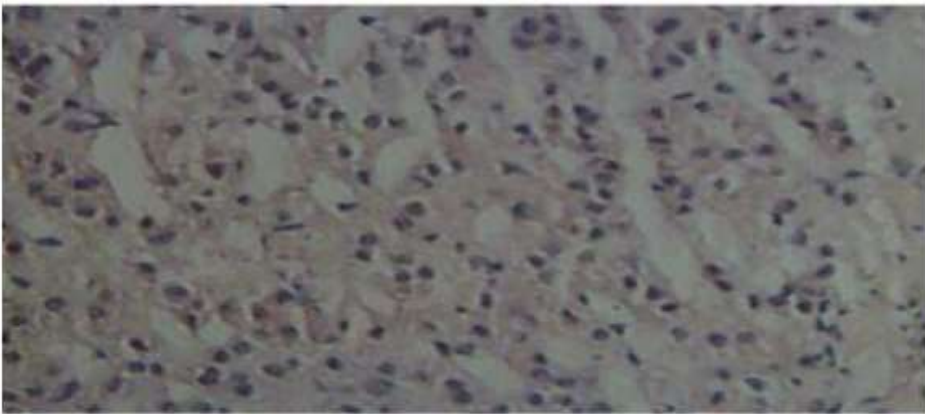


**Fig (3):** Transverse section of zona glomerulosa (zg) adrenal gland (400 x) H&E staining.

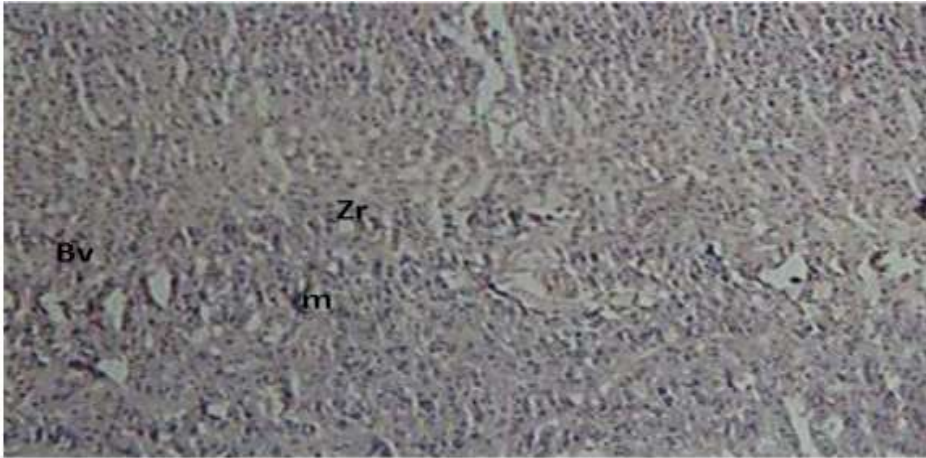




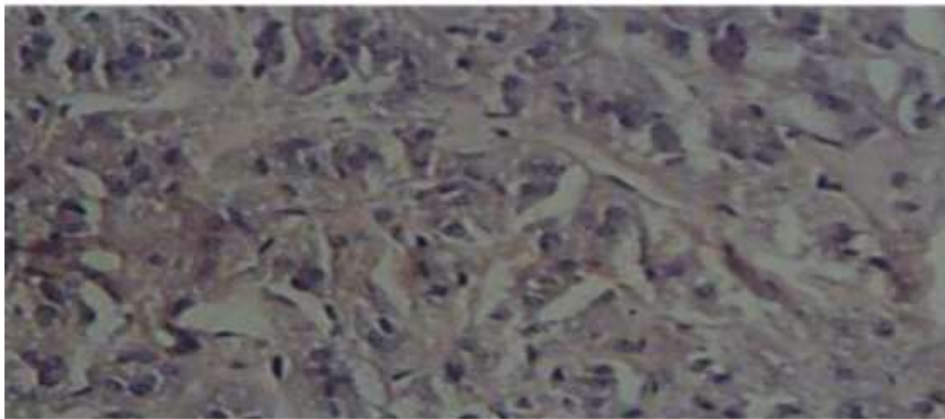
**Fig (4):** Transverse section of first layer of fasciculate zona adrenal gland (400 x). H&E staining.



**Fig (5):** Transverse section of second layer of fasciculate zona adrenal gland H&E staining (400x).

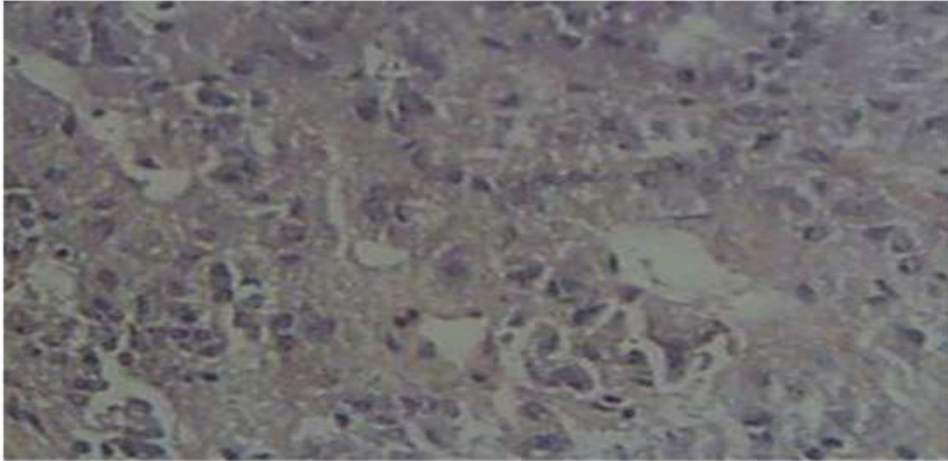


**Fig (6):** Transverse section of first layer of zona reticularis (zr) and medulla adrenal gland, bv=blood vessel (100 x). H&E staining.

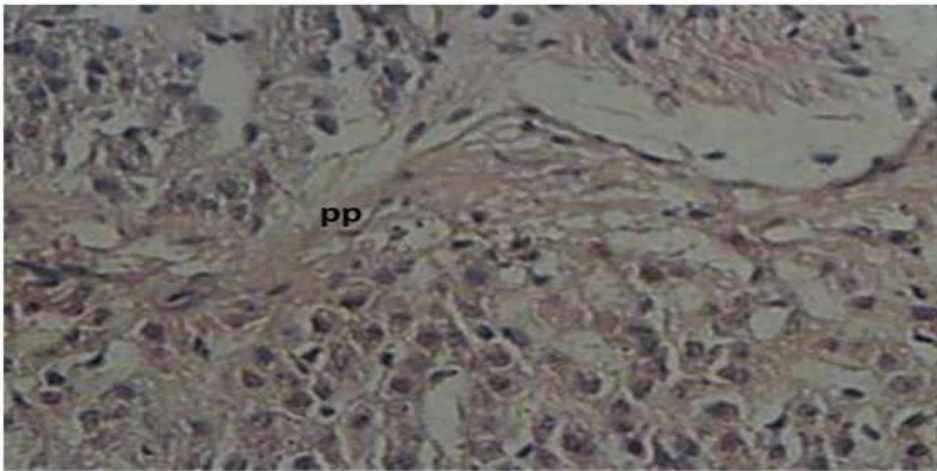


**Fig (7):** Transverse section of of reticularis zona adrenal gland (400 x). H&E staining.





**Fig (8):** Transverse section of first layer of medulla adrenal gland showed types cells arranged in circular groups (400 x). H&E staining.



**Fig (9):** Transverse section of second layer of medulla adrenal gland showed types cells were peripheral position (400 x). H&E staining.

## **Discussion**

The current study has demonstrated the histological exploration of glands which were rather complete agreement with that mentioned by (Gartner and Hiatt, 2000) in monkey and (Bacha and Wood, 1993) which referred that the glands have collagenous connective tissue capsule which blood

vessels and nerves pass through it. Also cortical cells, immediately deep into capsule, zona glomerularis cells are arranged in irregular array forming more or less around clusters. While the results have revealed that there are slightly differences with in zona fasciculate cells in their organization and structural aspects. However, the same authors mentioned that cells of zona fasciculate were larger than of zona glomerulosa that compliance with this study. As well as the results provided subdivision to zona fasciculate cells due to the differentiation of cells in upper part and lower part of this zone. Hence, The considerable division provided cortex further zone that this study confirmed that cortex composed from four zones institute of three zones which is full agreement with (Bacha and Wood, 1990). Many authors referred to foamy appearance present in zona fasciculate cells due to the numerous lipid droplet that were extracted during processing (Tanyola, 1993 and Gartner and Hiatt, 2000) that complete similarity with present study description. The differentiation of zona fasciculate cells into two types attributed to these cells secreted two different materials or hormones as well as it regarded largest zones of cortex. As concerning of zona reticularis cells appeared closely interfering with medullary cells due to the similarity in size between these cells therefore, difficult recognition between them beside that irregular arrangement of zona reticularis cells which surrounded medulla cells that it is different from (Gartner and Hiatt, 2000) mentioned that medullary cells were larger than zona reticularis cells. On other hand similar to description by (Junqueira *et al.*, 1995) which mentioned zona reticularis were freely anastomosing and roughly the same in morphological features at the cells of zona fasciculate, but their nuclei and cytoplasm have darker staining. As the current study was completely complain with (coupland and weakley, 1968; Delman, 1993 and Tanyolac, 1993) that they demonstrated large veins are characteristics of medulla. Medulla cells consist of two types which are similar to each other in size therefore, difficult to distinguished between their structural features that it is attributed to peripheral and central cells which secreted epinephrine and nor epinephrine (Delman, 1993; Steven and Lowe, 1991). The results pointed out that medulla description was similar to previous studies (Jureck *et al.*, 1978 and Karadag *et al.*, 1995). As concerning of biometric

study, the results have been reported that capsule thickness was (250 micrometer) more thick than capsule thickness (25 micrometer) in porcupine (Yilmaz and Girgin, 2005), also cortex appeared more thick and low ratio 1720 micrometer as comparison with cortex in porcupine (1491 micrometer) which is formed 73% as well as the three zones thickness of cortex have reported high measurements than thickness of three zones of cortex in porcupine which were (135).(990) and (366) micrometer respectively. While the results have shown that zona glomerularis was formed 15.56 % which was narrow than zona fasciculate which is formed 27.48 % whereas wider than zona reticularis which is formed 13.90 % that is slightly differences with three zones ratio in porcupine, zona glomerulosa was narrow than zona fasciculate and zona reticularis whatever zona fasciculate was widest in this animal (Yilmaz and Girgin, 2005). Results of this study individual that zona fasciculate appeared **48.25%** of cortex and 27.48% of the gland which is provided different ratio as comparison with previous studies zona fasciculate formed 60% of cortex (Tanyolac, 1993) and 70% of cortex in rabbit (Karaolag *et al.*, 1995). According to (Junqueira *et al.*, 1995) the zona fasciculate in human is 65% of the gland. The present results identified that medulla formed one of third of gland which is different with (Junqueira *et al.*, 1995) is 13% of the human gland where as adrenal gland formed quarter of gland in goat (Jamdar and Ema, 1982) as well as in porcupine (Yilmaz and Girgin, 2005).

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### **الخلاصه**

هدفت الدراسه الحاليه الى دراسه المكونات النسيجييه والتركيبيه والقياسات البايومترية للغده الادريناليه في الجاموس والتي تضمنت الدراسه سته ازواج من الغده الادريناليه ولكلا الجنسين والتي جمعت من مركز ذبح الماشيه في الناصريه. نتائج الدراسه الحاليه ان الغده تتالف من انسجه ضامه مولفه من محفظه وقشره مولفه من *Zona glomerulosa* , *Zona fasciculate* , *Zona Reticulate* . القياسات البايومترية بينت ان نسبه السمك لمكونات الغده الادريناليه حيث ان القشره شكلت اكثر من نصف الغده والقشره شكلت ثلث الغده.