Architecture Morphology and Histological Investigations of Pancreas in Golden Eagles (*Aquila Chrysaetos*)

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Abstract

The present study on the pancreas of golden eagle (*Aquila Chrysaetos*) revealed that it had a short, semi-wide, pale pinkish to white pinkish in colour, positioned between the limbs of duodenum loops and composed of two main lobes, dorsal and ventral lobes, that appeared extend from the origin of duodenal loop to one third length of the duodenal loop and another small lobe originated from the end of dorsal lobe towards the spleen which has been called splenic lobe. The lobes of pancreas were very short and not full the space between the two limbs of duodenum. Thus, there was a gap between the duodenal limbs. Histologically the pancreas of the golden eagle was covered by very thin layer of connective tissue capsule which formed from reticular, elastic and few collagenous fibers. The parancyma was mainly composed of exocrine glands. These glandular tissues were formed by triangular cells appeared in a single layer or observed as pyramidal shape. The endocrine gland of the pancreas showed that the islets of Langerhans were not numerous and observed as oval or circular in its appearance. Has two type of cells, the first one is alpha cells. Its nucleus has pale euchromatin. The second type was beta cells. This beta cells had dark hetrochromatin and large central nucleus. These cells were located in the peripheral of island of langerhans.

المنظومة الشكليائية ودراسة نسيجية لبنكرياس العقاب الذهبي (*Aquila Chrysaetos*)

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الخلاصة

أوضحت الدراسة الحالية للبنكرياس (المعثكلة) في العقاب الذهبي بأنه ذو تركيب قصير شبه عريض ومدبب ذو لون وردي شاحب إلى وردي مبيض يقع بين طرفي ألاثني عشر ويتكون من فصين رئيسيين وهو الفص الظهري والفص البطني والذي يظهر بأنه يمتد من منشأ طرفي الاثني عشر حتى يصل إلى الثلث الأول منه بالإضافة إلى وجود فص صغير ينشأ من نهاية الفص الظهري باتجاه الطحال ويدعى بالفص الطحالي. وجد بان فصوص البنكرياس صغيرة جدا ولا تملأ الفراغ الموجود بين طرفي الاثني عشر لذا يلاحظ وجود فراغ بين أنبوبي الاثني عشر. نسيجيا يحاط البنكرياس في العقاب الذهبي بمحفظة رقيقة جدا من النسيج الضام تتكون من ألياف شبكية ومرنة وقليل من الألياف الغراوية. متن البنكرياس وجد بأنه يتكون من نسيج من الغدد ذات الإفراز الخارجي وتكون خلايا النسيج مثلثة الشكل وذو طبقة واحدة أو اهرامية الشكل بينما تكون الغدد ذات الإفراز الداخلي والمتمثلة بجزيرات لانكرهانز تظهر بأعداد قليلة مقارنة مع باقي الطيور حيث تكون هذه الجزيرات بيضوية أو دائرية الشكل في شكلها الخارجي ومحتوية على نوعين من الخلايا. النوع الأول يدعى بخلايا الفا ويظهر بأنه صغير الحجم ومحتوي على صبغة الكروماتين الفاتحة في داخل النواة بالمقارنة مع النوع الثاني والذي يدعى بخلايا بيتا حيث يمتلك صبغة الكروماتين المغاير ونواة كبيرة مركزية الموقع وتقع خلايا هذا النوع في محيط جزيرات لانكرهانز.

Introduction

The avian pancreas is located on the right side of the abdominal cavity. Positioned between the descending and the ascending duodenal loops (1). It is composed of two main lobes, dorsal and ventral, which extend from the apex of the duodenal loop to the point where the pancreatic ducts enter the distal duodenum (2). The pancreas in bird has a double function as an organ with both exocrine and endocrine cell types. It is very well characterized, and composed of exocrine tissue that secrete digestive enzymes into a many of ducts for delivery into duodenum (3). Some reports mentioned that the pancreatic lobes of avian species consisted of four lobes: spleenic, third, dorsal and ventral (4, 5). Many researchers have shown concern for the anatomical, histological and endocrinological structure of the pancreas lobes, existence of various hormone producing cells was demonstrated in the pancreas of avian species including chicken (6) and in other birds (7). In duck (8) and in quails (9). However there were scantly researches on the pancreas of golden eagle showed the distribution of endocrine cells so the current study focused on the morphologic studies of the pancreas especially investigated on acinar and islet cells, with less attention given to its duct epithelium and we choice this type of these birds were charactericed by fleshy nutrient and differed from others birds that previously studied which includes goose, duck, pigeon, chicken. Moreover there is no information yet available on histo-morphological details of golden eagle pancreas.

Materials and Methods

Six birds of golden eagles (*Aquila Chrysaetos*), (male 4 and female 2), (Fig. 1), were shot in the afternoon in north east Baquba city in February. The body weight of each bird was estimated by aspiring balance. Dissection was begun immediately after the animal was killed. The viscera were not damaged. All measurements were taken at the same location from the lateral to the medial side of each pancreatic lobe. The pancreas were dissected from the loops of duodenum and weighed, then transverse parallel interrupted sections were taken at equal intervals along the length of each lobe and immediately placed into the fixative 10% formalin solution for 24h to ensure optimum fixation (10). Pancreas were processed routinely through a series of alcohol solutions and transferred to xylole and finally into paraffin wax. Transverse serial sections were taken at 5 µm thickness. The sections were stained with Haematoxylin and Eosin (H&E) and Periodic Acid Schiff reagent (PAS).

Results and Discussion

The pancreas of golden eagle (*Aquila Chrysaetos*) is a short, semi-wide, lobulated gland that located under the right side of the abdominal wall, and situated between the two rams of the duodenal loop and has pale pinkish to white pinkish colored (Fig. 2). This result disagree with (2) in captive bustards whom they found that the pancreas was a pale-yellow organ with a finely lobulated surface situated between 2 limbs of the duodenum and it was frequently hidden by fat. It consisted of 2 lobes lying dorsally (lobus pancreatic dorsalis), and ventrally (lobus pancreatis ventralis) and well developed interlobar connections made it difficult to distinguish between the 2 lobes in most of the birds examined. As a result of this study the table showed the average body weight of golden eagles is 1992gm and average weight of whole pancreas is 4.073gm. The average weights of the dorsal and ventral lobes are 2.085, 1.576 cm respectively while the average length of the dorsal lobe is 4.333cm and the ventral lobe is 3.588 cm. The pancreas is attached tightly by mesentray and blood vessels positioned between the limbs of duodenum loops which composed of two main lobes, dorsal and ventral lobes, that appeared extend from the origin of duodenal loop to one third length of the duodenal loop and another small lobe originated from the end of dorsal lobe towards the

splenic lobe. The lobes of pancreas were very short and not full the space between the two limbs of duodenum so, there was a gap between the duodenal limbs (Fig. 3 and 4). This results disagreement with the (3) in Goose, who said that the ventral lobe is divided into the ventral lobe proper and the third lobe on the basis of the latter's independent form. However, (11) reported in their research that the pancreas of ducks has two lobes, the dorsal lobe is divided into three distinct segments or sublobes. In the current study the ventral lobe is thicker than the dorsal lobe and has a duodenal impression on either sides of dorsal surface (Fig. 4). This coincides with (12) on the pancreas of indigenous ducks that the ventral lobe is thickest one and has a duodenal impression at its both sides of the dorsal surface but disagreement with (12) that the pancreas consists of four lobes and the dorsal lobe is more longer than the ventral, splenic and accessory lobe. On the other hand (13) noted that the *mynah* pancreas had no splenic lobe, but many other birds as duck, chicken and goose have four lobes and splenic segment is attached to the dorsal lobe while the third lobe in mynah, as in chicken was a part of the ventral lobe (14). The pancreas of the golden eagle was covered by very thin layer of connective tissue capsule which formed from reticular, elastic and few collagenous fibers. The capsule sent septa extend to divide the gland into lobules and continues to diffuse between the acinar glands (Fig. 5). This result is in agreement with (15) on the pancreatic capsule in steppe buzzard and rock dove and (16) in goose but in contrast with (12) in duck who found that the pancreatic capsule somewhat a thin connective tissue and bundles of collagen fibers are most abundant and widespread distribution in capsule. The paranchyma was mainly composed of exocrine glands. These glandular tissues were formed by triangular cells appeared in a single layer or observed as pyramidal shape (Fig. 6, 7) this result enhanced by (16) in goose who found that the bizonal character of acinar cells could be attributed to the presence of mitochondria and zymogen granules in basal and apical portion and showed the cytoplasm with acidophilic zymogenic granules and small centroacinar cells without granules were projected in the lumen of the acinus. In the endocrine glands of the pancreas showed that the islets of Langerhans were not numerous and observed oval or circular in its apperance (Fig. 5, 6). The islands of langerhans in pancreatic golden eagles has two type of cells, the first one is alpha cells. It has small cell with pale euchromatin in the nucleus and observed more than the second type which was beta cells. Beta cells had dark hetrochromatin and large central nucleus and less than the alpha cells and located in the peripheral of island of langerhans (Fig. 8). This results disagreement with many other researchers (12, 17, 18) whom they showed that there are three different types of islets have been observed in birds, primarily studies of the white-crowned sparrow (*Zonotrichia leucophrys gambelii*), the mallard (*Anas platyrhynchos*) and the chicken (*Gallus gallus*). They include, dark-staining islets consisting of α- and δ-cells and a few isolated β-cells; light-staining islets consisting of pericapillary β-cells with a thin layer of δ-cells at the periphery; and mixed islets consisting of α-, δ- and β-cells. However, in the present study, mixed cells were not noticed in the golden eagle pancreas. (Fig. 7, 8) This finding is in parallel with the results of (3). Who said that the mixed cells were delineated from surrounding secretory acini by delicate collagenous fibres. According to suggestions by (19) on chicken and other birds that feed on grains and seed, they need more enzymatic activity to compensate for their lack of teeth and hydrolytic enzymes in their saliva. The pancreas of golden eagle suggest that the type of food has correlation with the presence of different type of cells in pancreatic islend because this birds eat one type of food which is meat and other birds eat two or more kind of food so they adapted for metabolism of these food. The results of the histological study of the pancreas showed difference with

the findings of (4) or (20) when they described the pancreatic exocrine and endocrine tissues. The exocrine glands consisted of tall columnar epithelial tissues that had acidophilic zymogen granules on their apical surface and the endocrine consists of three type pancreatic ilants cells. The epithelium lining of the intercalated ducts and intralobuler ducts were surrounded by connective tissue fibers with few elastic fibers. In addition to this, the smooth muscle fibers were surrounding both the main pancreatic duct and interlobular ducts (Fig. 9), which was thicker in the main duct with outer circular and inner longitudinal arrangements, and connective tissue fibers were showed collagen fibers with few elastic fibers in between these muscle bundles. This results Externally to these smooth muscle fibers, there were connective tissues of the tunica adventitia. In addition, the intralobular ducts (Fig. 10, 11) were lined with a simple cuboidal epithelium reach interlobular ducts and lined with low columnar epithelium. These facts agreed with finding of (12) in local breed ducks in which the intercalated ducts extends as intralobular duct and lined by a single layer of cuboidal epithelium which possess rounded nuclei situated near the base of these cells and the intralobular ducts are tributaries of larger interlobular ducts lined by simple columnar epithelium. The connective tissue layers surrounding the epithelium in intralobular ducts were thinner than interlobular ducts. In the present study, the main excretory ducts were lined by stratified columnar epithelium. Thus, with the exception of this finding, the results on the golden eagle pancreas were in agreement with those of previous studies (4). These ducts have inner longitudinal and outer circular muscle layers surrounded by the externally connective tissue (Fig. 12, 13). The nerve fibers enter the parenchyma of glands along connective tissues as thick bundles consist of neuron axon which form perivascular plexuses. From these fibers some are detached were run into exocrine parenchyma and the disposition of nervous fibers observed as perivascular plexuses in exocrine tissue which that appeared as specific plexuses contained a rich anastomosing fibers and the cells have round or avoid nuclei (Fig. 14, 15). This results enhanced with (21) in duck which found that the nerve fibers can be found in intrapancreatic ganglia, in interlobular connective tissue and among acini in duck pancreas.

Table (1) Showed the Measurements of the weight, length of the pancreas traits in mature golden eagles (n=6)

Traits	Mean ± S.D	Std. Error
Body weight of golden eagle (gm)	1992 ± 90.03	367.4375
Pancreas weight (gm)	4.073± 0.61	0.2529
Dorsal lobe weight (gm)	2.085 ± 0.31	0.1290
Ventral lobe weight (gm)	1.576 ± 0.24	0.9072
Length of dorsal lobe (cm)	4.333 ± 0.25	0.1054
Length of ventral lobe (cm)	3.588 ± 0.25	0.1024

Fig. (1) Golden Eagles (*Aquila Chrysaetos*)

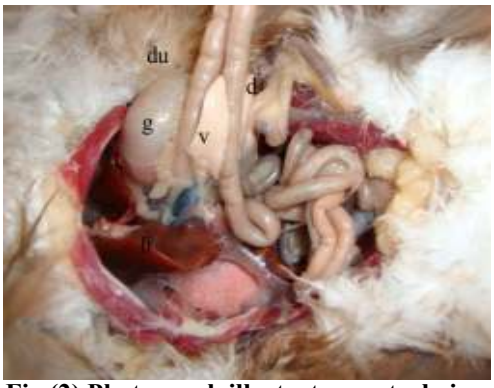

Fig (2) Photograph illustrates ventral view anatomical position. v. ventral lobe, d. dorsa lobe du. Duodenum li. Liver g. gizzard

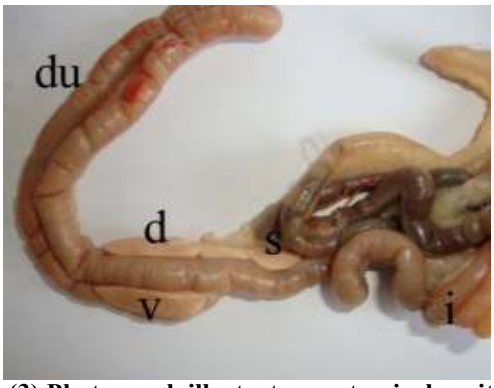

Fig. (3) Photograph illustrates anatomical position, shape and color of pancreas. du.duodenum, d.dorsal, v. ventral, s, splenic lobe and i. intestine

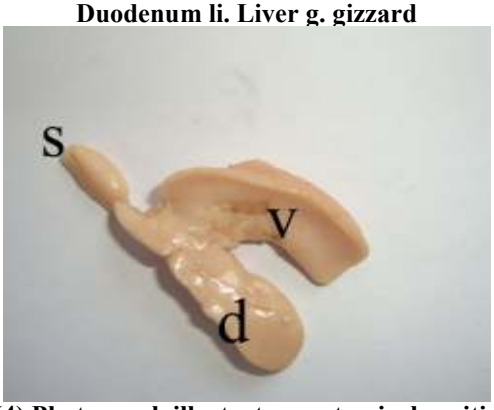

Fig. (4) Photograph illustrates anatomical position of pancreas, d.dorsal, v. ventral, s, splenic lobe

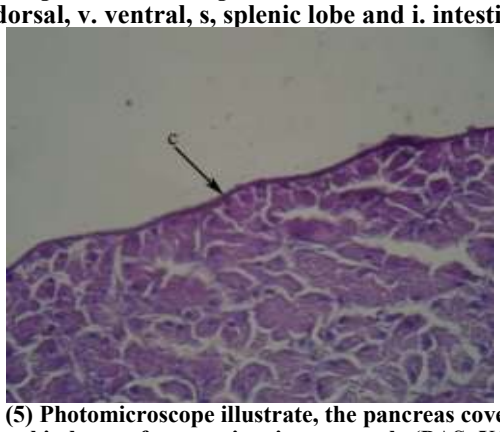

Fig. (5) Photomicroscope illustrate, the pancreas covered by a thin layer of connective tissue capsule (PAS, X10)

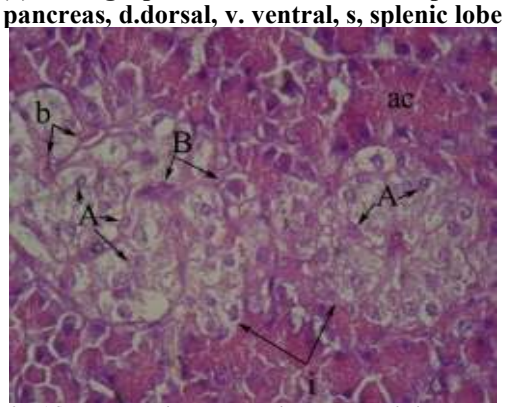

Fig (6) Photomicroscope illustrate, i. island of langerhans contain A. alpha cells B. beta cells and b. blood vessles ac acinar cells(H&E, X40)

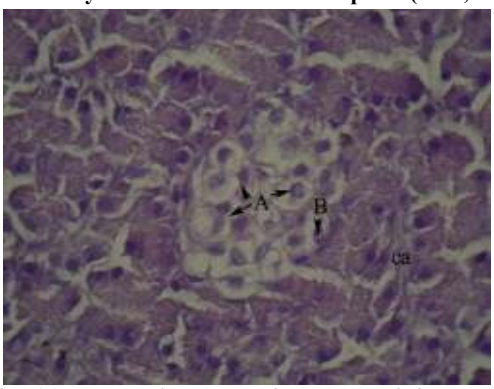

Fig. (7) Photomicroscope illustrate, i. island of langerhans contain A. alpha cells B. beta cells ca. centro acinar cells (PAS, X40)

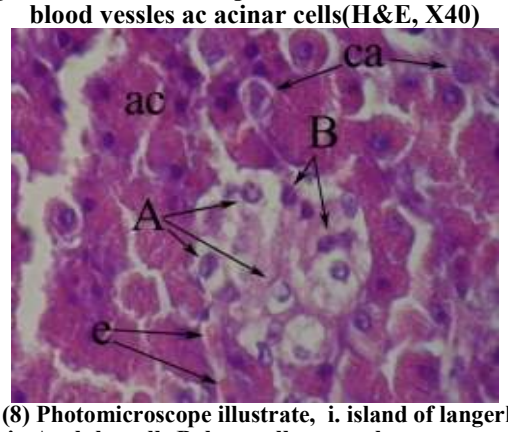

Fig. (8) Photomicroscope illustrate, i. island of langerhans contain A. alpha cells B. beta cells, e. erythrocyte ac. centro acinar cells and ac. Acinar cells (H&E, X40)

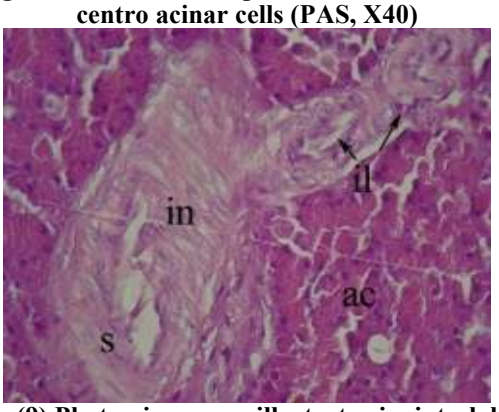

Fig. (9) Photomicroscope illustrate, in. interlober duct, il. Interlobular ductules, s, smooth mscles and ac. acinar cells (H&E, X10)

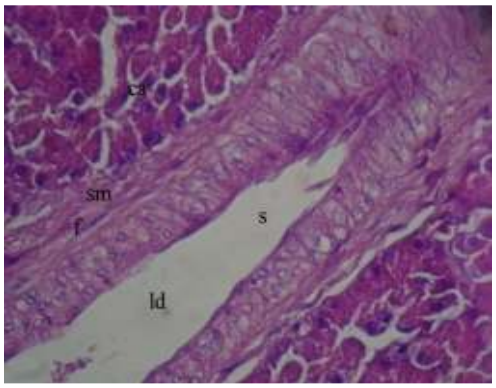

Fig. (10) Photomicroscope illustrate, id.interloberduct, s.,pseudostratified, collumenar epithelium cells sm, smooth mscles and ca. centroacinar cells and f. fibroblast. (H&E, X40)

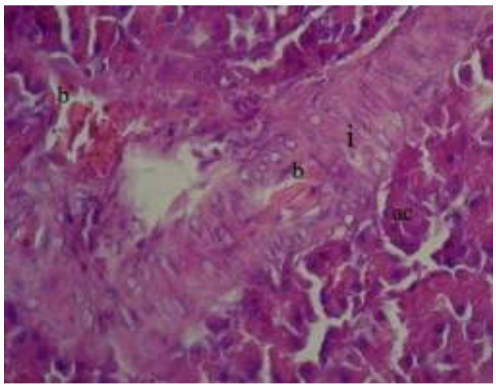

Fig.(11) Photomicroscope illustrate, i. interlobular duct, b. blood vessels and ac. acinar cells (H&E, X10)

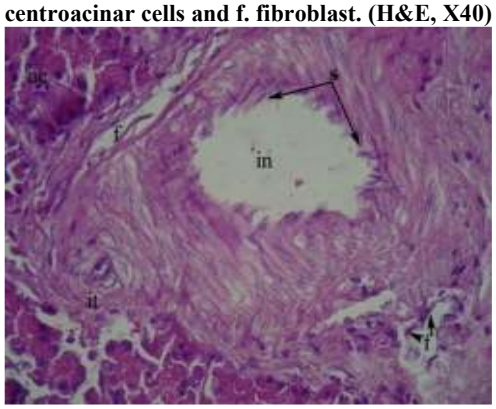

Fig. (12) Photomicroscope illustrate, in. interlober duct, il. Interlobular ductules, s, pseudostratified columnar epithelium f. fibroblast and ac. acinar cells (H&E, X10)

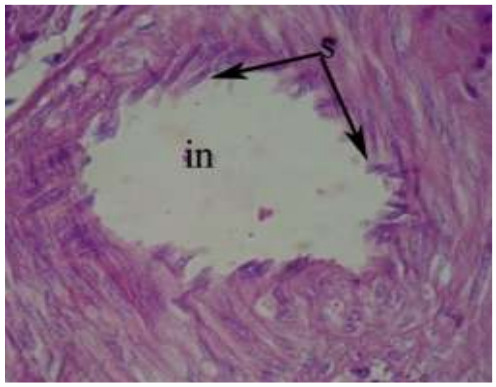

Fig. (13) Photomicroscope illustrate, in. interlober duct, s, pseudostratified columnar epithelium (H&E, X40)

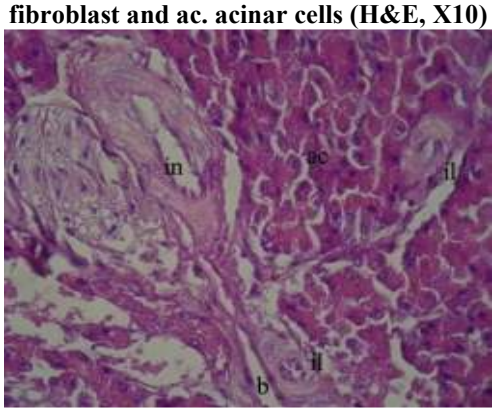

Fig. (14) Photomicroscope illustrate, in. interlober duct, n. nerve fiber, b. blood vessels, il. Interlobular, ac. Acinar cells (H&E,X40)

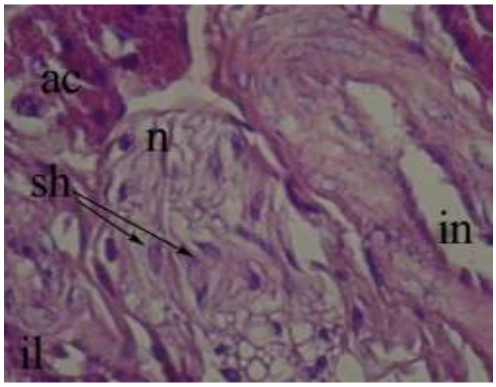

Fig. (15) Photomicroscope illustrate, in. interlober duct, n. nerve fiber, sh. Shwan cells, il. Interlobular, ac. Acinar cells (H&E, X40).

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