MORPHOLOGICAL CHARACTERIZATION OF THE PANCREATIC ISLETS IN *COTURNIX COTURNIX JAPONICA*

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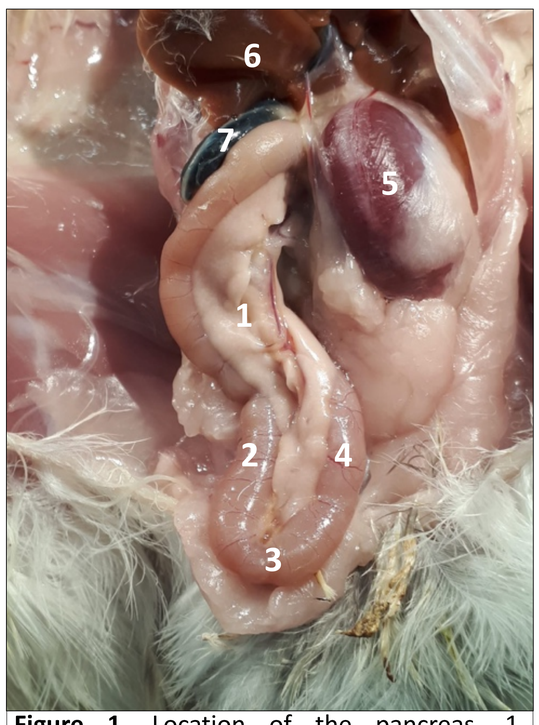

Figure 1. Location of the pancreas. 1. Duodenal lobe of the pancreas; 2. Descending part (duodenum); 3. Caudal duodenal flexure; 4. Ascending part (duodenum); 5. Muscular stomach; 6. Liver; 7. Gall bladder.

INTRODUCTION

Objectives: to contribute to the morphological characterization of the pancreatic islets of the Japanese quail. To estimate the size of the pancreas and its β cell mass, to study the distribution pattern of the β cells inside the islets and to determine the relative number and size of the pancreatic islets.

The pancreas is a mixed gland that is located on the right side of the abdominal cavity, on the mesenteric border of the duodenum. In most birds, consisted of four lobes: ventral, dorsal, third and splenic, together with the main pancreatic ducts leading to the ascending duodenal loop.

The exocrine tissue is formed by glandular acini that drain into a branched duct system. The endocrine component is organized into islets of different shapes and sizes. Whithin the islets, β cells produce insulin, α cells produce glucagon, δ cells produce somatostatin, PP cells synthesize pancreatic polypeptide and ε cells that produce ghrelin. Insulin is an hypoglycaemic hormone because it stimulates the uptake of glucose especially by hepatocytes, adipocytes and skeletal muscle cells, thus reducing its concentration in the blood.

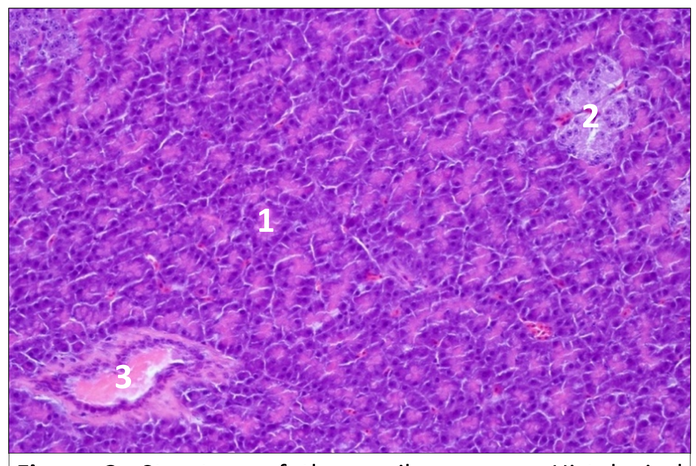

Figure 2. Structure of the quail pancreas. Histological section of pancreatic tissue. Hematoxylin-Eosin stain (200X). 1. Pancreatic acini; 2. Pancreatic islets; 3. Intralobular conduit.

MATERIALS & METHODS

Animals

- 12 quails (*Coturnix coturnix japonica)* of 5 weeks of age (6 males, 6 females).
- Blood glucose levels and body weight were determined at 5, 6 and 7 weeks of age.
- In 7 of the quails (3 males, 4 females) systematic morphometric study of the pancreas was performed.

Measurements

- Blood glucose measurement (glucometer Accu-Chek Aviva, Roche Diabetes Care).
- Hematoxylin-eosin staining in paraffin sections.
- Immunohistochemistry for the detection of insulin and β-cells using HRP and DAB system.
- Microscope (Nikon Eclipse E800) and ACT-1 software for image capture.
- *Point counting* morphometry

$$Tissue\ mass\ A = \frac{Dots\ on\ tissue\ A}{Dots\ on\ all\ tissues}\ x\ Pancreas\ weight$$

- Results were expressed a mean±SEM, and comparisons validated with Student's t test.

RESULTS & DISCUSSION

Table 1. Glycemia and body weight in males and females of Coturnix cortunix japonica at 5, 6 and 7 weeks of age.

	5 week		6 week		7 week	
	Glycemia (mg/dL)	Weight (g)	Glycemia (mg/dL)	Weight (g)	Glycemia (mg/dL)	Weight (g)
♂ N=6	231±12 N=5*	269±7 N=5*	222±8 N=6	265±6 N=6	221±8 N=6	258±4 N=6
♀ N=6	220±11 N=6	305±9 N=6	217±14 N=5*	313±11 N=6	220±6 N=6	343±12 N=6
Total N=12	225±8 N=11*	289±8 N=11*	220±8 N=11*	289±9 N=12	220±5 N=12	301±14 N=12

Unlike mammals, such as mice, rats and humans, quails, as in other birds, have much higher glucose ranges, which can almost double their blood glucose levels.

The weight of the duodenal lobe of the pancreas in females was more than double that observed in the males, 1.04 ± 0.52 g and 0.49 ± 0.29 g, respectively.

The weight of the pancreas, in relation to the body weight, is very different from the mouse, since its pancreas represents around 0.8% of the body weight, that is, more than triple that of the quail.

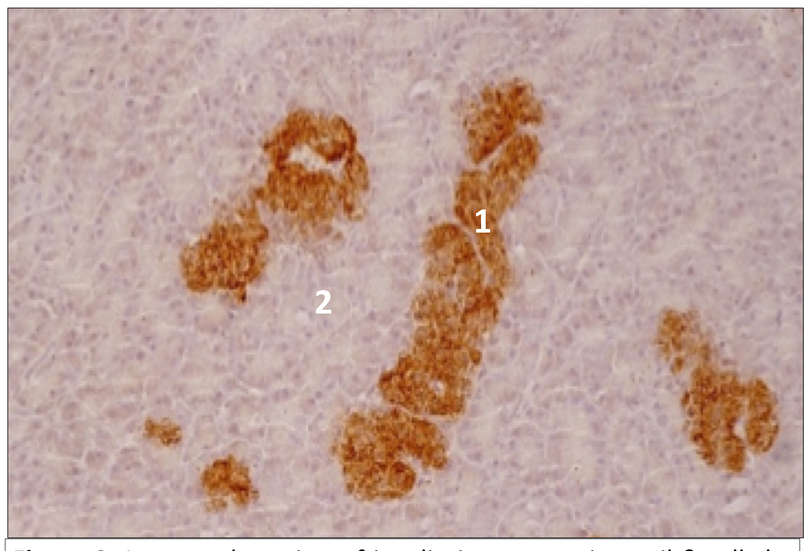

Figure 3. Immunodetection of insulin in pancreatic quail β cells by development with DAB. A) 200X. 1. β cells; 2. Pancreatic acinus.

The mass of β cells represents 1.30% and 0.64% of the total of the pancreas, in males and females respectively.

In the quail, the β cells are arranged irregularly within the islet. This pattern is very different from that observed in rats and mice, species in which the islets generally have a nucleus of cells surrounded by a mantle around non-β cells.

Table 2. Estimated mass of the β cells, exocrine tissue, ductal cells and other tissues (shown in percentages).

	β –Cell Mass (mg)	Exocrine Tissue Mass (mg)	Ductal Cell Mass (mg)	Other Tissues Mass (mg)
♂ N=3	6.39±0.64 (1.30%)	441.21±52.01 (89.17%)	11.97±0.99 (2.47%)	34.44±6.36 (7.06%)
♀ N=4	6.71±0.68 (0.64%)	997.67 ±62.82 (95.86%)	12.24±1.57 (1.20%)	23.63 ±1.63 (2.30%)
Total N=7	6.57±0.44 (0.92%)	759.19±118.96 (92.99%)	12.12±0.92 (1.75%)	28.26±3.36 (4.34%)

The percentage of β cells in male quail is significantly higher than females, being approximately 1.3%, This percentage is similar to that observed in male mice (0.5-1%)

Table 3. Distribution of the number of pancreatic islets according to their size (shown in percentages).

	Small islets (<50 μm)	Medium islets (50-149 μm)	Large islets (>150 μm)	Total
♂ N=3	492.67±141.13 (81.06%)	97.33±2.91 (18.32%)	3.67±0.88 (0,62%)	593.67±139.64 (100%)
♀ N=4	157.75±10.23 (68.09%)	73.75±12.40 (31.17%)	1.75±0.25 (0.74%)	233.25±17.23 (100%)
Total N=7	301.29±86.33 (73.65%)	83.86±8.24 (25.67%)	2.57±0.53 (0.69%)	387.71±90.40 (100%)

CONCLUSIONS

- Males and females presented similar and estable blood glucose levels throughout the follow-up.
- Body weight was 30% higher in females than in males.
- The pancreas weight in females was twice than in males, and represents 0.29% and 0.19% of the total body weight, respectively.
- The general structure of the quail pancreas is similar to that observed and reported in mammals.
- The percentage of β-cells relative to the total pancreas weight in males was twice than in females. Thus, a similar β-cell mass was observed in males and females.
- The morphology of the islets is irregular and their β cells are also irregularly distributed within the islet.
- Then number of islets observed is higher in males than in females, and the size distribution seems to be different in both.