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FURTHER CONTRIBUTION ON THE PANCREAS OF THE CICHLID FISH , TILAPIA NILOTICA L.

BY

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ABSTRACT

The pancreas and islets of Langerhans of both larval stages(5.3 , 6.7 and 11 mm in length)and adult specimens of 18 - 20 cm long Tilapia nilotica L. were examined . The pancreatic tissue is scattered in the form of patches all over the peritoneal cavity , near the liver , the gastric caecum and between the loops of the intestine . These pancreatic patches invade the liver of adult specimens . The intrahepatic pancreas is entirely formed of zymogenous tissue . The islets of Langerhans are found in two forms : the scattered microscopic patches , and the well defined Brockman body , both have the same histological structure . According to the shape and the staining ability , three types of islet cells namely α -, β - and γ - cells are recognised.

Considerable changes in the proportion of these cell types were observed in small and large specimens due to the different types of food ingested.

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INTRODUCTION

Weber [16] was the first to discover the pancreas in teleosts , however, its occurence in teleosts is generally remained doubtful until Stannius [15] who proved its presence in this group of fish .

A detailed review of the previous work done on the pancreas of teleosts has been given by Al-Hussaini and Rizkalla [2] . rennie [10 , 11] found an encapsulated principal islet of large size in many teleosts besides the epithelial islets which are widely spread in the pancreatic tissue . MacLeod [9] described the production of insulin by the cells of islets of Langerhans in teleosts, he noted also that the fish show hyperglycaemia after the removal of the principal islets . Jackson [8] was the first to work out the cytological structure of the islet groups in fishes, and he differentiated two kinds of cells namely , α - and β - cells in the islets of Raja. Moreover, Bowie [3] described a third type of cells (γ - cells) in the islet of the teleost, Naomaenis sp. Clausen [4] and Schmidt and Liener [14] described four types of cells namely A-, B-, C-, and D-cells in the islets of some elasmobranchs and teleosts. Al-Hussaini and Rizkalla [12] described α- , B- and γ - cells in the islets of Clarias lazera .

The present work is an extensive study of the pancreas

and islets of Langerhans at different stages of development of the Nile fish , Tilapia nilotica L., using a special technique to differentiate the different cells of the islets, also this investigation aims to study the effect of growth on the distribution of the different cells of the islets.

MATERIAL AND METHODS

Females of Tilapia nilotica , incubating their frys inside its buccopharyngeal cavities, were collected from El-Gharbia water streams during 1987,using a special technique in order to prevent the fish from repelling these frys. The material were fixed in 10% neutral formalin. Serial transverse and frontal paraffin sections of 6 μ thick of the whole larvae (5.3mm., 6.7mm. and 11 mm. length), and serial sections of the liver of adult were used in this study. Sections were stained with Ehrlich haematoxylin-eosin, Mallory's triple stain and Herlant method (1968).

OBSERVATIONS

The pancreatic tissue begins to appear at 5.3mm stage. The examination of serial sections through the whole small specimens of Tilapia showed that the pancreatic tissue is in the form of pancreas diffusum and juxtahepaticum i.e. scattering all over the peritoneal cavity, near the liver and gastric caecum, between the loops of the intestine and around the blood vessels. In the large specimens of

Tilapia it was found that the pancreatic elements penetrate, also , into the liver. Accordingly, the pancreas of the large fish may be described as pancreas diffusum and intrahepaticum.

In the prepared sections, the pancreatic tissue consists of two distinct parts; the zymogenous acini and the islets of Langerhans. The latter are found as numerous and lightly-staining areas, being mostly rounded, oval and rarely prismatic. These patches are closely surrounded by the irregularly arranged pancreatic alveoli. The light staining of the islets is due to the eosinophilic character of its cells, and thus they are sharply demarcated from the surrounding zymogenous tissue.

I. The zymogenous tissue :

The zymogenous tissue is abundantly scattered inside the liver of large specimens, surrounding the blood vessels, and also in the adipose tissues. The acini show in most patches no appearance as duct formation, (fig.1). They, however, rarely from acini. In an acinus, the cells appear to be pyramidal in shape with their narrow ends lying towards the lumen which is so narrow that it can be hardly seen. The cytoplasm is rich in zymogenous granules of large size and takes a dark stain. The nucleus is rounded, clear, with one, but rarely two nucleoli,and occupies a large space at the base or the broad part of the cell. The chromatin granules are scattered

throughout the nucleoplasm of these zymogenous cells.

II. The islet tissue:

The islet elements are not enveloped by a connective tissue capsule, however, the islet and the zymogenous tissues are found, in the small specimens of Tilapia, in close contact with each other outside the tissues of the liver (fig.2). In large specimens, the islet tissues are found on the surface of the liver as spots or nodules, where the zymogenous elements are embedded in it (fig. 3).

The islet tissues in Tilapia are arranged in two groups: one in the form of scattered patches, and the other in the form of a compact, well defined mass, generally known as the Brockman body (principal islet). Histologically the Brockman body is divided into a number of lobes of various sizes, which differ in shape in shape, from rounded to oval masses. There is no histological difference between them and the supplementary islets except that Brockman body has a definite capsule of connective tissue. Anatomically, it lies in the region of the caecum of the stomach or more accurately between the caecum and the gall-bladder, just anterior to the spleen (fig. 6).

Three types of cells were recognised in the islet tissue, namely α -, β - and δ - cells . These cells are well demonstrated by using Herlant's stain (1968).

The α- cells have mostly distinct cell limits and of elliptical or oval shape with oval nuclei.They stain a bright yellowish colour with a good contrast between them and those of the other two types of the islet cells (fig.2).

After the Herlant technique, β - cells take clear blue colour with clear outlines and centrally located nuclei. The cells are mostly of various shapes, being either polygonal, pear-shaped, conical or even irregular-shaped (fig.4)

γ - cells are large typical rounded cells with large central neuclei. These cells take a purple or violet colour using the same staining technique (fig. 5).

By examining the distribution and proportions of α -, β - and γ - cells in small and large specimens of Tilapia, it was found that in small specimens α- cells are exceeded β - cells, this in contrast to those encountered in the large fish . γ - cells, however, are few in number in both specimens. At the same time, α - and β - cells are never found together in the same bundle, while γ - cells may found together with each of them .

DISCUSSION

The study of the structure of the pancreas in Tilapia leads to the conclusion that the islet and zymogenous tissues

are distinct organs. The islets have no relation to the surrounding zymogenous tissue except that of contiguity. In the liver of the adult fish, the islets become separated from the zymogenous tissue and lie on the suface of it. Therefore, the intrahepatic pancreas of the adult is completely consisted of exocrine zymogenous cells. This is in contrast to the observation of Al-Hussaini and Rizkalla [2] on the same species , who described that the intrahepatic pancreas is fairly formed of islets of Langerhans. The islets were found to be embedded inside the liver of Labeo horie [6].

As found by Al-Hussaini and Rizkalla [2], the Brockman body of Tilapia is built up of a number of lobes, and has a definite capsule of a connective tissue. The cells of this principal islet are similar to those of the scattered patches of the islet tissue. Rizkalla [12] mentioned that the principal islet is not found in Clarias lazera .

After the Herlant method for staining, the islet tissue of Tilapia showed three types of cells, namely α -, β - and γ - cells. These various types of the islet cells could be identified not only by their staining properties, but also by their distinct structures. Accordingly, the different types of the islet cells are chemically and morphologically differ from each other. Jackson [8] differentiated only α -

and β - cells in the islets of elasmobranchs. However, Al-Hussaini and Rizkalla [2] failed to differentiate any types of these cells in Tilapia nilotica. In teleosts, [3] and [12] described α- , β - and γ - cells in the islets of Neomaenis sp. and Clàrias lazera respectively.

Concerning the proportions of α -, β - and γ - cells in small and large specimens of Tilapia, the number of α - and β - cells are differ greatly. The diet of the small Tilapia is absolutely proteinic material (yolk sac), the number of α- cells, therfore, is exceeded. On the other hand, large fish, which feed largely on microscopic plants and detritus, [1], has much carbohydrate materials in its diet, the β - cells were predominated. From all the above mentioned it may be concluded that the distribution of α - and β - cells, in small and large specimens of Tilapia, may be affected according to the type of the food ingested or due to the seasonal variations as described by Roberts [13] . Ghittino [5] reported that there is considrable change in islet size at spawning and senility and with dietary changes .

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ILLUSTRATION OF PHOTOMICROGRAPHS

Fig. 1- Photomicrograph of a section of the liver of adult Tilapia, showing the islet tissue on the surface of the liver. X 350.

Fig. 2- Photomicrograph of frontal section of 11 mm embyo, showing α - cells and the zymogenous tissue .

Fig. 3- Photomicrograph of a section of the liver of adult Tilapia , 19 cm long. showing the zymogenous tissue embedded in it . X 300.

Fig. 4- Photomicrograph of T.S. of 11 mm embryo, showing β - cells. X 350.

Fig. 5- Photomicrograph og T.S. of 5.3 mm embryo, showing γ - and β -cells. X 450 .

Fig. 6- Photomicrograph of frontal section of 6.7 mm embryo, showing the pricipal islet (Brockman body) . X 350

ZY: zymogenous tissue, L: liver, ISL : islets of Langerhans, A : α - cells , B : β - cells , C : γ -cells and B.V. : blood vessel .

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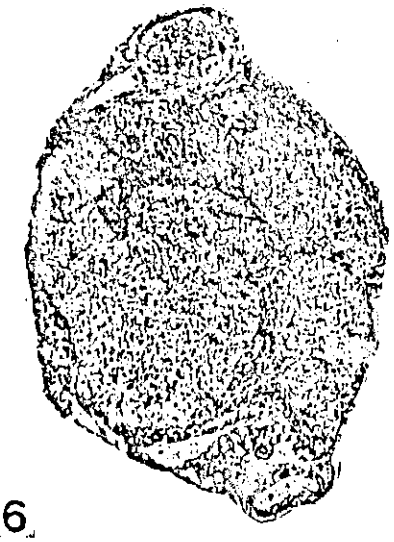

دراسات على بنكرياس الأسماك السيكليديه
(البلطى النيلى)

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ولقد اتضح انه تتغير نسبه وجود تلك الانواع المختلفه من جزر لانجرهانز فى الأجنه والاسماك اليافعة · ويعتقد ان ذلك التغيير يرجع الى الأختلاف فى طبيعه المواد الغذائية التى تعتمد عليه الأسماك فى مراحل العمر المختلفه ·