Results

Group 1 (Control group):

Light microscopic examination of the rat pancreas of this group revealed thin unstained connective tissue septa dividing the organ into many small lobules of variable size and shape (Figs 1,2). Within the lobules, the pancreas was formed of predominant exocrine part; the pancreatic acini and duct system. The endocrine part (the islets of Langerhans) were present inbetween the exocrine part (fig.2).

The pancreatic acini appeared rounded or oval in shape. They were lined with pyramidal cells arranged around a narrow acinar lumen. The acinar cells were seen to have basal rounded nuclei. The supranuclear portions of the cells were packed with acidophilic zymogen granules, while the basal portions of the cells were basophilic cytoplasm (figs 1,2,3).

Interlobular ducts were observed mainly in the interlobular septa and lined by cubical or low columnar cells. Occasional intralobular ducts lined by flat or low cubical cells were seen (Figs 1,2).

The islets of Langerhans appeared as pale pink oval or rounded areas inside the pancreatic lobules. They contained blood sinusoids traversing between the endocrine cells. They appeared to be formed of groups of cells arranged in circular groups. It was observed that A cells known by their dark nuclei. While B-cells with pale nuclei (Fig. 4).

By Masson's Trichrome stain, minimal connective tissue appeared in the capsule, septa and around the pancreatic acini. More

connective tissue was found around the blood vessels. The islets of Langerhans were incompletely surrounded by fine fibers of connective tissue that also appeared around the blood capillaries and among the endocrine cells of the islets (figs 5,6).

By electron microscopy the pancreatic acinar cells were roughly pyramidal in shape. Their nuclei were basal in position and rounded in shape. The mitochondria were seen around the nucleus. The apical part of the cells contained a number of rounded, electron–dense, smooth membrane – bounded zymogen granules that vary in size. The cells were mostly filled with the rough endoplasmic reticulum. Junctional complexes were located where adjoining cells meet. The luminal cell membrane formed microvilli (figs 7,8, 9, 10).

Two characteristic types of cells were identified in the islets; B and A cells. B-cell was known by being the most abundant cell found in the endocrine pancreas. The B-cell had a nucleus with abundant chromatin. Its cytoplasm was filled with numerous specific granules. The core of the granule was electron-dense and highly pleomorphic (rounded or oval). A wide clear space was seen between the core and the membrane sac of the granule (Fig. 11).

A – cell had a heterochromatic nucleus and electron dense rounded granules (Fig 12).

Group II (Sodium Fluoride treated group):

Light microscopic examination of the rat pancreas of this group revealed loss of normal acinar architecture and appearance of many cytoplasmic vacuoles which were variable in sizes (Fig, 15,16).

Congestion of blood vessels were also seen. Some areas showed extravasation of blood cells inbetween the interlobular connective tissue and acinar cells (Figs 13,14).

In the islets of Langerhans, there were structural changes in the form of cytoplasmic vacuoles. (fig. 15)

By Masson Trichrome stain, focal condensation of connective tissue appeared around the pancreatic acini and the blood vessels (Figs 17, 18).

Electron microscopic examination of acinar cells in this group revealed that some acinar cells showed autophagosomes which have numbers of vacuoles inside them (fig. 19).

Some acinar cells showed mitochondrial vacuolation with ill-defined cristae, interruption of some of rough endoplasmic reticulum cisternae which become dilated and changed into sacs. The number of zymogen granules were decreased (fig. 20).

Multiple vesicles of variable size & shape were seen in the cytoplasm of some acinar cells. The large vesicles showed membranous structures and amorphous materials (figs 21, 22).

Considerable changes in the islets of Langerhans were observed. B-cell had decreased number of their secretory granules and other granules were vacuolated (fig. 23).

A-cell also showed decreased number of their secretory granules. (fig. 24)

Group III (Treated with fluoride and vitamins)

Light microscopic examination of the rat pancreas of this group revealed regression of most of the previously mentioned histological findings in Group II (Sodium fluoride treated group).

The acini were more or less regular in shape (Preserved lobular architecture with the apical acidophilia (Zymogen granules). (figs 25, 26).

The islets of langerhan's appeared intact except congestion of some of its blood vessels. (fig. 27).

By Masson's Trichrome stain, the connective tissue were more condensed around the blood vessels and less amount inbetween the acini. The islet of Langerhans was surrounded by less amount of connective tissue (Figs 28, 29).

Electron microscopic examination of this group showed nearly normal acinar cells expect of small vesicles in the cytoplasm (fig. 30).

Cells of islets of langerhans also appeared normal with their specific granules except of vacuolation of some of B-cell granules and moderate amount of dense granules in A-cells (figs 31, 32).

Fig. 1: A photomicrograph of longitudinal section of an adult control rat pancreas showing: Pancreatic lobules consisting of closely packed acini (A) of different sizes and shapes separated by unstained interlobular connective tissue (CT) that contains pancreatic ducts (D) & blood vessels (BV).

(HX&E x 40)

Fig. 2: A photomicrograph of longitudinal section of an adult control rat pancreas showing: An islet of Langerhans (I) surrounded by pancreatic acini (A). Notice the intralobular ducts (arrow) that are lined by flat cells.

(HX&Ex 100)

Fig 3: A photomicrograph of longitudinal section of an adult control rat pancreas showing: The cells lining pancreatic acini. Each cell is pyramidal in shape with basal deeply stained nucleus (N). some cells have double nuclei (nl, n2).. Notice the apical part of the acinar cell contains zymogen granules (Z).

(HX&E x 400)

Fig. 4: A photomicrograph of longitudinal section of an adult control rat pancreas showing: The structure of an islet of Langerhans consisting of cells arranged in circular groups and variable in sizes. The A-cells (A) have oval and dark nuclei. B-cells (B) have rounded and pale nuclei. Notice the blood capillaries (bc) embedded in between the cells.

(HX&E x 400)

Fig. 5: A photomicrograph of longitudinal section of an adult control rat pancreas showing: More connective tissue (CT) around blood vessels (BV) and minimal connective tissue (ct) are seen between the pancreatic acini (A).

(Masson's Trichrome x 200)

Fig. 6: A photomicrograph of longitudinal section of an adult control rat pancreas showing: General capsule (C) surrounding the periphery of the islet of Largerhans and minimal connective tissue (ct) inbetween the cells. Notice A-cells (A), B-cells (B) and blood capillaries (bc) of the islet.

(Masson's Trichrome x 400)

Fig. 7: An electron photomicrograph of an adult control rat pancreas showing: Acinar cells containing rounded nucleus (N) with peripheral heterochromatin (H). The nucleus is surrounded by rough endoplasmic reticulum (rER). Also its cytoplasm contains many different sizes of zymogen granules (Z). Notice the lumen (L) of the acinus.

(E.M. x 6000)

Fig. 8: An electron photomicrograph of an adult control rat pancreas showing: Many zymogen granules (Z) surrounding an acinar lumen (L).Notice the fusion of two granules (arrow). Notice the presence of microvilli (V) projecting into the acinar lumen.

(E.M.x 10,000)

Fig. 9: An electron photomicrograph of an adult control rat pancreas showing: The junctional complexes (J) between the cells of pancreatic acinus The cytoplasm contains closely packed cisternae of rough endoplasmic reticulum (rER) and mitochondria (M). and heterochromatic nucleus (N).

(E.M.x 10,000)

Fig. 10: An electron photomicrograph of an adult control rat pancreas showing: Part of acinar cell with rounded heterochromatic nucules (N) which is surrounded by intact mitochondria (M). Notice the presence of zymogen granules (Z) and cisternae of rough endoplasmic reticulum (rER).

(E.M.x 10,000)

Fig. 11: An electron photomicrograph of an adult control rat pancreas showing: B-cells of islet of Langerhans with its heterochromatic nucleus (N) and characteristic granules (arrow). The core of the granules is pleomorphic and a wide clear space is noted between the core and the outer limiting membrane of the granule.

(E.M. x 6000)

Fig. 12: An electron photomicrograph of an adult control rat pancreas showing: A-cell of islet of Langerhans with its heterochromatic nucleus (N) and characteristic granules with rounded dense cores (arrows).

(E. M. x 10.000)

Fig. 13: A photomicrograph of longitudinal section of an adult rat pancreas treated with sodium fluoride showing: Congestion of blood vessels (BV) with blood cells (BC) inside them. Notice the pancreatic acini (A) and inter lobular duct (D).

(HX&Exl00)

Fig 14. A photomicrograph of longitudinal section of an adult rat pancreas treated with sodium fluoride showing: Extravasations (EX) of blood in the interlobular spaces (S). Notice intact pancreatic acini (A).

(HX&Ex100)

Fig 15: A photomicrograph of longitudinal section of an adult rat pancreas treated with sodium fluoride showing: vacuolations (Va) with different sizes in the acini & islet of Langerhans.

(HX&Ex100)

Fig.16: A photomicrograph of longitudinal section of an adult rat pancreas treated with sodium fluoride showing: complete loss of normal architecture of pancreatic acini (A). Notice many cytoplaymic vacuoles (Va) of variable sizes.

(HX& E × 400)

Fig. 17: A photomicrograph of longitudinal section of an adult rat pancreas treated with sodium fluoride showing: focal condensation of connective tissue (CT) inbetween acini (A) and around the congested blood vessels (BV).

(Masson's Trichrome x 100)

Fig. 18: A photomicrograph of longitudinal section of an adult rat pancreas treated with sodium fluoride showing: condensation of connective tissue (CT) and congestion of blood vessels (BV). Many vacuoles (Va) appear in the acinar cells.

(Masson's Trichrome x 200)

Fig. 19: An electron photomicrograph of an adult rat pancreas treated with sodium fluoride showing: The basal part of an acinar cell containing double nuclei (n1, n2) and autophagosomes (arrow) which have numbers of vacuoles inside them. Notice some zymogen granules (Z), basement membrane (bm) and blood capillary (bc) in the interstitium.

(E.M. x 6000)

Fig. 20: An electron photomicropraph of an adult rat pancreas treated with sodium fluoride showing: pyramidal acinar cell containing rounded basal heterochromatic nucleus (N), well defined rough endoplasmic reticulum (rER). Some cisternae of ER are circular in their forms (Arrow). Some mitochondira (M) are intact, while others are vacuolated(m). Notice less number of zymogen granules (z). Also notice centroacinar cell (c) with elongated nucleus (en)

(E.M. x 6000)

Fig. 21: An electron photomicrograph of an adult rat pancreas treated with sodium fluoride showing: An acinar cell with oval heterochromatic nucleus (N). Its cytoplasm contains rough endoplasmic reticulum (rER) and multiple vesicles (Ve). Notice the basement membrane (bm).

(E.M. x 6000)

Fig. 22: An electron photomicrograph of an adult rat pancreas treated with sodium fluoride showing: an acinar cell with two heterochromatic nuclei (N). Notice small and large sized vesicles (Ve). Notice the large vesicles having membranous structures and amorphous materials.

(E.M. 10.000)

Fig. 23: An electron photomicrograph of an adult rat pancreas treated with sodium fluoride showing: parts of two B-cell of islet of Langerhans with heterochromatic nuclei (N) and characteristic granules. Some granules are normal with central dense core separated from their limiting membrane by clear space (arrow), while other granules are vacuolated (Va).

(E.M. x 10.000)

Fig. 24: An electron photomicrograph of an adult rat pancreas treated with sodium fluoride showing: A-cell with its oval heterochromatic nucleus (N) & its characteristic dense granules (arrows). Notice less number of the granules (when compared with control in fig.12)

(E. M.x 10.000)

Fig. 25: A photomicrograph of longitudinal section of an adult rat pancreas treated with sodium fluoride and vitamins showing: the pancreatic acini (A) and islet of Langerhans (I) are intact.

(HX&E x 200)

Fig. 26: A photomicrograph of longitudinal section of an adult rat pancreas treated with sodium fluoride and vitamins showing: the architecture of pancreatic acini are apparently normal with basal nuclei (N) and apical zymogen granules (Z). Few cells contain vacuoles (V)

(HXE, x400)

Fig. 27: A photomicrograph of longitudinal section of an adult rat pancreas treated with sodium fluoride and vitamins showing: Dark (A) and light (B) cells of Langerhans. Notice some blood vessels (BV) are congested with RBCs

(HX&E x400)

Fig. 28: A photomicrograph of longitudinal section of an adult rat pancreas treated with sodium fluoride and vitamins showing: The connective tissue (CT) is more condensed around the blood vessels (BV) and less amount inbetween the acini (A)

(Masson's Trichrome x 200)

Fig. 29: A photomicrograph of longitudinal section of an adult rat pancreas treated with sodium fluoride and vitamins showing: Moderate amount of connective tissue (CT) around the blood vessels (BV), and few amount of connective tissue inbetween the acini. Some acini show complete degeneration (d), while others are vacuolated (Va). Notice the islet of langerhans (I) is intact.

(Masson's Trichrome x 200)

Fig. 30: An electron photomicrograph of an adult rat pancreas treated with sodium fluoride and vitamins showing: pyramidal acinar cell with double nuclei (N1, N_2). Its cytoplasm contains rough endoplasmic reticulum (rER), many zymogen granules (Z). Notice some vesicles (Ve).

(E. M. x 3000)

Fig. (31): An electron photomicrograph of an adult rat pancreas treated with sodium fluoride and vitamins showing: B cell of islet of Langerhans with heterochromatic nucleus (N) and its characteristic granules. Each granule has a dense core separated from the surrounding membrane by a light zone (arrow). Notice some granules are vacuolated (Va).

(E. M. x 10.000)

Fig. 32: An electron photomicrograph of an adult rat pancreas treated with sodium fluoride and vitamins showing: A-cell of islet of Langerhans with oval nucleus (N) and moderate amount of electron dense granules (arrow).

(E. M. x 10.000)