

GASTRIC FUNCTION IN DIABETES MELLITUS

THESIS

Submitted in Partial Fulfilment
For the Degree of
Master of Medicine

By

LAILA ZAGHLOUL ANIES

616.462

L. 2

Supervisors

Prof. Dr. AHMED GHAREEB

Chairman of Endocrine Unit and General Medicine

Dr. MOGHAZY ALI MAHGOUB Dr. MOHAMED AMIN FIKRY

Ass. Prof. Medicine

Ass Prof. Medicine

Dr. SALWA ABD EL-TAWAB

Ass. Prof. of Histology

Endocrine Unit - Medicine Department
Faculty of Medicine Ain Shams University
Cairo.

(1982)

GASTRIC FUNCTION IN DIABETES MELLITUS

THESIS

Submitted in Partial Fulfilment

For the Degree of

Master of Medicine

By

LAILA ZAGHLOUL ANIES

Supervisors

Prof. Dr. Ahmed Ghareeb

Chairman of Endocrine Unit and General Medicine

Dr. Moghazy Ali Mahgoub

Ass. Prof. of Medicine

Dr. Mohamed Amin Fikry

Ass. Prof. of Medicine

Dr. Salwa Abd El-Tawab

Ass. Prof. of Histology



Endocrine Unit- Medicine Department

Faculty of Medicine Ain Shams University

Cairo.

(1982)



ACKNOWLEDGEMENT

I wish to express my deep thanks and gratitude to Professor Dr. Ahmed Ghareeb , Chairman of the department of General Medicine, Ain Shams University for his valuable advice and his great help and guidance.

My sincere gratitude also extends to Dr. Moghazy Ali Mahgoub, Assistant Prof. of Medicine Ain Shams University, for his valuable supervision throughout the whole work.

I am also very grateful to Dr. Mohamed Amin Fikry, Assistant Prof. of Medicine Ain Shams University for his keen supervision and his helpful suggestions.

I am also very grateful to Dr. Salwa Abd El Tawab, Assistant Prof. of Histology ,Ain Shams University ,for her valuable advice and guidance.

I extend my most sincere thanks to Dr. Mobark Mohamed Hussien, Lecturer of tropical Medicine Ain Shams University for his great help and guidance.

C O N T E N T S

	Page
- INTRODUCTION.....	1
- AIM OF WORK.....	3
- ANATOMY OF THE STOMACH.....	4
- HISTOLOGY OF THE STOMACH.....	5
- PHYSIOLOGY OF THE STOMACH.....	9
- REVIEW OF LITERATURE.....	26
. Acute effects of diabetes mellitus on the stomach.....	26
. Chronic effects of diabetes mellitus on the stomach.....	29
-Motor abnormalities .	29
- Secretory abnormalities	37
- Gastric mucosa changes	46
- - PRACTICAL PART..	
A- Histopathological and histochemical studies.	53
Material and methods.....	54
Results.....	60
B- Gastric functions before and after histalog stimulation.....	72
Material and methods.....	72
Results.....	76
- DISCUSSION.....	80
- SUMMARY AND CONCLUSION.....	91
- REFERENCES.....	96
- ARABIC SUMMARY	

I N T R O D U C T I O N

Disturbances of the gastric function is more common in diabetics than in normal population.

A syndrome of episodic nausea, vomiting and gastric retention of food is generally designated as diabetic gastroparesis. Gastroparesis is a relatively uncommon but clinically troublesome disorder that develops in some patients with diabetes mellitus. Its pathogenesis remains obscure, but it may represent a neuropathic disorder. Clinically it is characterized by nausea and vomiting and radiologic or endoscopic (or both) evidence of gastric stasis in absence of mechanical obstruction.

A symptomatic gastroparesis has been recorded also.

Hypochlorhydria and achlorhydria are more common in diabetics than in normal population.

Chronic atrophic gastritis was histologically demonstrated in all cases of hypochlorhydria or achlorhydria.

Nutritional disturbances in the gastric mucosa caused by vascular lesions, vagal impairment, hormonal

disturbances and states of deficiency of iron or vitamins may be a contributing factors in the development of chronic atrophic gastritis in diabetes mellitus.

The medical treatment of severe gastrointestinal motor disturbances secondary to diabetic autonomic neuropathy is a very difficult problem.

AIM OF WORK

The aim of the work is to study the gastric function in diabetics compared with gastric histopathologic and histochemical backgrounds.

Anatomy of the stomach

The stomach is a dilated muscular and mucosal sac situated in the gastrointestinal tract between the oesophagus (cardiac end) and duodenum (pyloric end). It consists of an upper dome shaped portion called the fundus, a middle portion (the body) and a tapering caudal part referred to as the pyloric portion. It presents two curvatures, the greater curvature and the lesser curvature.

The greater curvature is directed toward the left and to it is attached the greater omentum.

The greater curvature forms an acute angle with the oesophagus called the cardiac notch. The lesser curvature constitutes the right border of the stomach and along this edge is attached the lesser omentum. Its lower third bends toward the duodenum beyond the angular notch. (Clemente, 1975).

Histology of the stomach

The stomach wall is composed of four layers; mucosa, submucosa, muscularis and serosa.

1- Mucosa:

The entire thickness of the mucous membrane of the stomach is occupied by the gastric glands which open on the surface by gastric pits.

The surface epithelium.

It is composed of tall columnar epithelial cells which are mucin secreting cells.

The gastric glands:-

Branched tubular in type.

Cardiac glands: The cells of the cardiac glands are mucus secreting cells.

Fundic glands: Each gland has three parts, a base neck, and upper isthmus which continues into the pits. Four cell types are present in the Fundic glands. In the isthmus, only surface epithelial cells and parietal cells are present. The main cell type in the neck is the mucous neck cell, between which are scattered parietal cells. The base is composed mainly of chief cells with some parietal and a few enterochromaffin cells.

Chief cells: Secrete enzymes e.g. pepsin.

Parietal cells: Secrete hydrochloric acid. They are also the site of intrinsic factor production.

Mucous neck cells: Produce acid mucopolysaccharides.

Enterochromaffin cells: Some of the cells produce serotonin and others probably produce gastrin hormone.

Pyloric glands: Produce mucin.

Lamina propria:

A meshwork of collagenous and reticular fibres and few fibroblasts and reticular cells. Scattered in the meshes are some lymphocytes, plasma cells, mast cells and white cells.

Muscularis mucosa :

It is composed of smooth muscles arranged into inner circular and outer longitudinal laminae. In some regions, a third external coat which is a circular lamina is present.

2. Submucosa:

A coat of fibroconnective tissue with collagenous, reticular and elastic fibres. Fibroblasts, macrophages, plasma cells, lymphocytes and some fat

cells are present. The submucosa also contains blood vessels, lymph vessels and peripheral nerves of the submucous nerve plexus.

3. Muscularis:

It is composed of three layers of smooth muscles. The outermost is longitudinal ,the middle layer is circular and the innermost layer is oblique.

4. Serosa:

A layer of loose areolar tissue in which vessels and nerves are present and covered by peritoneum (Leeson and Leeson, 1966).

A continuous layer of gastric mucosal cells creates a barrier between the gastric lumen and the mucosal interstitial space. This barrier is composed of the apical cell walls and of tight junctions between adjacent cells. The cell membrane is composed of a lipid bilayer with a protein core. Ionized materials are poorly absorbed but un-ionized lipid soluble substances are absorbed. This barrier maintains a concentration gradient between hydrogen ions in the lumen and sodium ions in the mucosa. The gastric mucosal cells are covered by a layer

of adherent mucus with weak neutralizing capacity. This mucus is not an effective barrier for permeation of electrolytes and water and adds little to the barrier formed by the cell walls and intercellular tight junctions (Walsh, 1973).

Physiology of the stomach

The stomach has four basic functions.

- 1) secretion
- 2) Motility
- 3) Reservoir function
- 4) Antibacterial barrier (Spiro,1977).

Gastric secretion:

The cells of the gastric glands secrete about 3000 mL/d of gastric juice. This juice contains a variety of substances.

Cations :	Na^+ , K^+ , Mg^{2+} , H^+ (pH
	Approximately 1.0)
Anions:	Cl^- , HPO_4^{2-} , SO_4^{2-}
Pepsins	I - III
Gelatinase.	
Mucus	
Intrinsic factor	
Water	

Contents of normal gastric juice, fasting state,
(Ganong, 1981).

Hydrochloric acid secretion:

The parietal cells secrete an electrolytic solution containing 160 millimols of hydrochloric acid per liter , isotonic with the body fluids. Its pH is approximately 0.8.

Mechanism of hydrochloric acid secretion.

The hydrochloric acid is formed at the membranes of the intracellular canaliculi of the oxyntic cells and then conducted through openings to the exterior.

- 1- Chloride ion is actively transported from the cytoplasm of the oxyntic cell into the lumen of the canaliculus. This creates a negative potential of - 40 to - 70 millivolts in the canaliculus which in turn causes passive diffusion of positively charged potassium ions from the cell cytoplasm also into the canaliculus. Thus, in effect, potassium chloride enters the canaliculus.
- 2- Water is dissociated into hydrogen ions and hydroxyl ions in the cell cytoplasm. The hydroxyl ion is then actively secreted into the canaliculus in