LACTOSE ABSORPTION IN PATIENTS WITH CATARACT

Thesis

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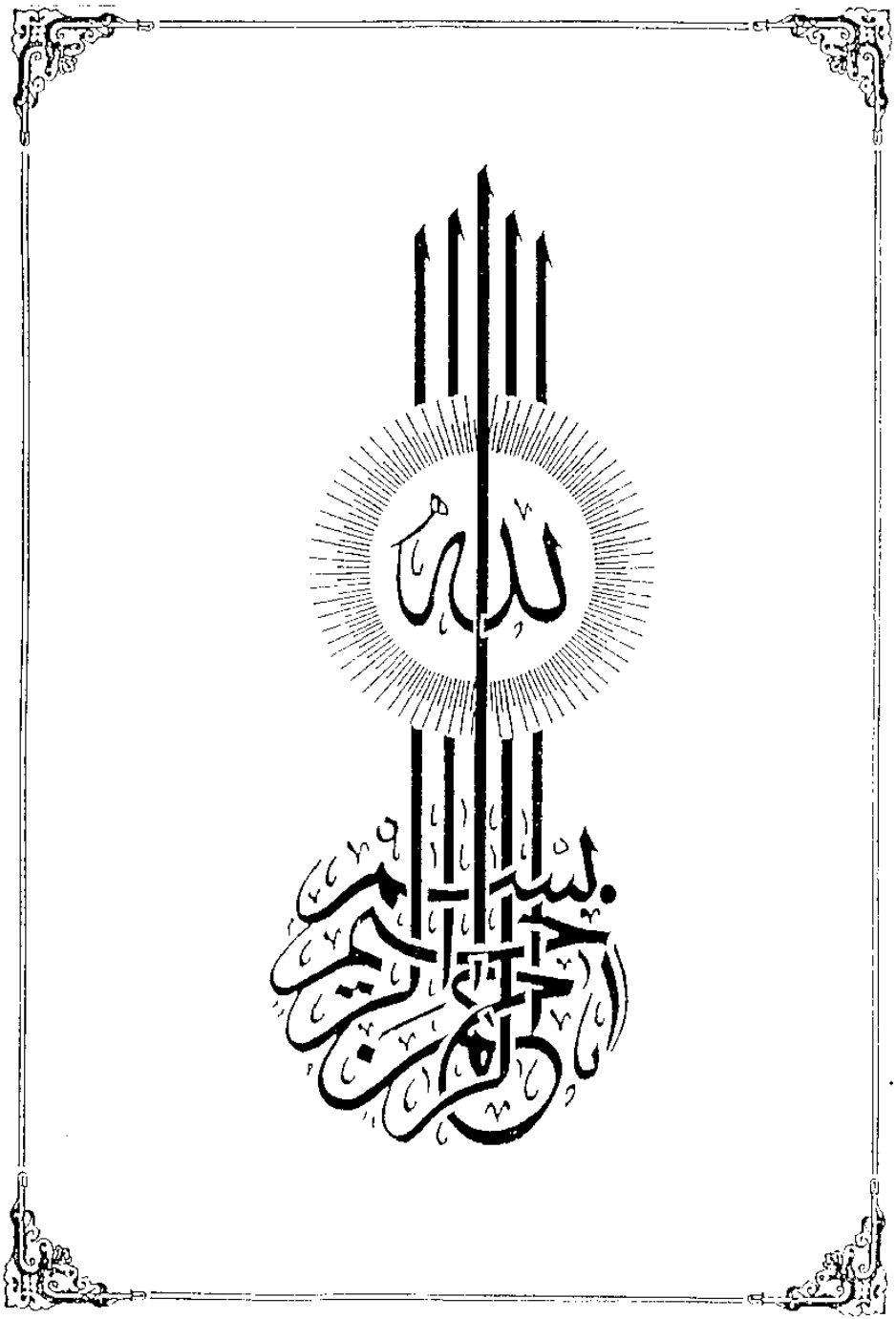

ACKNOWLEDGEMENT

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CONTENTS

AIM OF THE WORK

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Cataract is one of the most important causes of visual disability in the whole world. The most common group of cataracts is that called senile which becomes commonplace at advanced ages. Its pathogenesis is still unclear , but exposure to sunlight or ultraviolet rays , systolic and diastolic hypertension were thought to be contributing factors . Cataract is also known to be found in association with certain metabolic diseases such as diabetes mellitus and galactosemia.

The purpose of this work is to demonstrate the incidence of lactose absorbers in patients with idiopathic senile cataract and also in diabetic patients with cataract and to compare this with a normal control group .

REVIEW OF LITERATURE

CARBOHYDRATE ABSORPTION

Much of the carbohydrate we ingest is in the form of starch, a complex polysaccharide consisting of many hexose units (attached either in 1,4 or 1,6 linkage).

By the action of salivary and pancreatic amylase, starch is hydrolysed to oligosaccharides and then to disaccharides. Disaccharides are split enzymatically into their component sugars by disaccharidases located on or within the microvilli of the intestinal epithelial cells.

There are two types of disaccharidases :-

(1) β - galactosidases (lactase) .

(2) α - glucosidases (sucrase and maltase).

By the action of these enzymes : -

* Lactose will be converted to ------→ glucose+ galactose.
* Sucrose to ------→ glucose + fructose .
* Maltose to ------→ glucose + glucose .

These monosaccharides are then transported through the cell into the portal circulation. Most of the disaccharides are hydrolysed so rapidly by brush border enzymes that the capacity of the transport mechanism is exceeded and some monosaccharides diffuse back into the intestinal lumen. Thus it is the capacity of membrane transport systems rather than

enzymatic hydrolysis which limits the rate of absorption of most of carbohydrates.

But lactose is hydrolysed at a slower rate and thus lactose hydrolysis is the rate limiting step in lactose absorption.

Absorption of glucose and galactose is an active process, which needs energy and it is a carrier mediated process. Glucose and galactose entery into the cell is largely coupled to sodium ions. Both sodium and glucose appear to bind to hexose carrier in the microvillus membrane. Energy comes from the Na-pump and Na^+-K^+- ATPase of the basolateral membrane (Greenberger and Isselbacher, 1983).

CARBOHYDRATE INTOLERANCE

The amylase enzyme is available in great excess because it is secreted from two widely seperated organs, the salivary glands and the pancreas, therefore there is no rate limiting step involving the hydrolysis of starch and glycogen by this enzyme. Hydrolysis of disaccharides is of no use if the damaged mucosa is incapable of transporting the resultant monosaccharides. So carbohydrate malabsorption is either limited to deficiencies of certain brush border oligosaccharidases or to a defect in the active transport of glucose and galactose across the micromembranes of the intestine (Plotkin and Isselbacher ,1964).

Lactose is an important exception as it is hydrolysed relatively slowely , so that lactase activity rather than glucose-galactose transport, is the rate limiting factor in lactose absorption . This relatively lack of reserve of lactase activity may account for the fact that lactose digestion may be impaired in mild intestinal disease even when other oligosaccharides are hydrolysed and absorbed normally (Lifshitz and Klotz ,1965).

LACTASE ENZYME AND METHODS OF ITS ESTIMATION

There are differences in lactase activity within the brush border of a single enterocyte at different phases of its lifespan, in the enterocytes of different segments of the small intestine, and in the intestine of a single individual at different ages from infancy to adult life (Gray ,1975) and (Simoons et al.,1977).

Lactose absorption is further down the gastro-intestinal tract than the duodenum and proximal jejunum where lactase had been previously localized. Cook and Kajubi in 1966, confirmed that lactase is present throughout the small intestine .

In mammals , including most human populations , intestinal lactase activity is very high in the newborn and it declines to low levels after weaning. However , in a few human populations high levels of lactase activity persist throughout adult life (Aurichio et al.,1963)and (Simoons ,1978).

The enzyme is present in high activity in the infant and is slightly active in the intestine of the adult who has difficulty with the digestion of lactose . Also, some biochemical data indicate no

differences between the lactase derived from the intestines of infants and lactose-digestor adults and also the small amount derived from the intestines of lactose non digestor adults (Lobenthal et al.,1974).

It is probable that lactose digestion is the result of mutation or a polymorphism resulting in the production of intestinal lactase in the adult i.e. mutation in a regulatory gene may explain the persistance of the infantile enzymatic state in the adult lactose digestor (Yoshida and Motulsky ,1969).

Ransome-Kuti et al in 1975 have concluded that the ability to digest lactose is transmitted as an autosomal dominent and represents the mutated gene. They studied lactose absorption in some Nigerian families. In these families where both parents were unable to digest lactose, all of the progeny were lactose non digestors. If one parent, usually of Northern European origin, could digest lactose , the progeny are mixed either lactose non digestors or digestors. There was no difference in the results when either the mother or the father was the lactose digestor .

Estimation of the Lactase Enzyme Activity

(1) Lactose-tolerance test has been widely used as a screening test for lactase deficiency and it is important to establish its true value. Several investigators have found a good correlation between the lactase level in specimens of jejunal mucosa and the maximum rise in blood glucose after lactose (Dunphy et al., 1965), (McMichael et al.,1965,1966)and(Welsh ,1966) .

Fifty gm lactose is given orally as 15% water solution in the morning after a fasting period of at least 12 hours. Venous blood is collected before,and 30,60,90,120 minutes after the oral tolerance tests and the blood gluose level is determined in each sample. Lactose malasorption is diagnosed if maximum rise in gluose level after lactose administration is less than 20 mg/dL (Tandon et al.,1981),(Soheir Sheir et al.,1969) and (Salam et al.,1981).

(2) Breath hydrogen concentration after oral lactose administration : Lactose 50 grams is given orally as 15% water solution in the morning after a fasting period of at least 12 hours. Expired air samples are obtained at 30 minutes intervals for 240 minutes, and hydrogen concentration is determined with a gas chromatographic method. Lactose malabsorption

is diagnosed if the maximum increase in hydrogen in the expired air is more than 20 ppm (Rinaldi et al.,1984).

(3) Lactase Activity of Small intestinal mucosa : A small intestinal mucosal biopsy can be taken from the jejunum. It is done by using Crosby capsule (Crosby and Kugler,1957). The biopsy specimen is frozen for estimation of the lactase enzyme.Persistent high lactase activity in adult life is diagnosed if the specific enzyme activity is above 9 U/gm protein or in other wards: low lactase activity is diagnosed when the enzyme activity is less than 9 U/gm proteins (Skovbjerg et al.,1980).