BLOOD GLUCOSE RESPONSES TO GLUCOSE, SUCROSE, AND HONEY IN PATIENTS WITH TYPE 1 DIABETES MELLITUS

Thesis

Submitted for partial fulfillment
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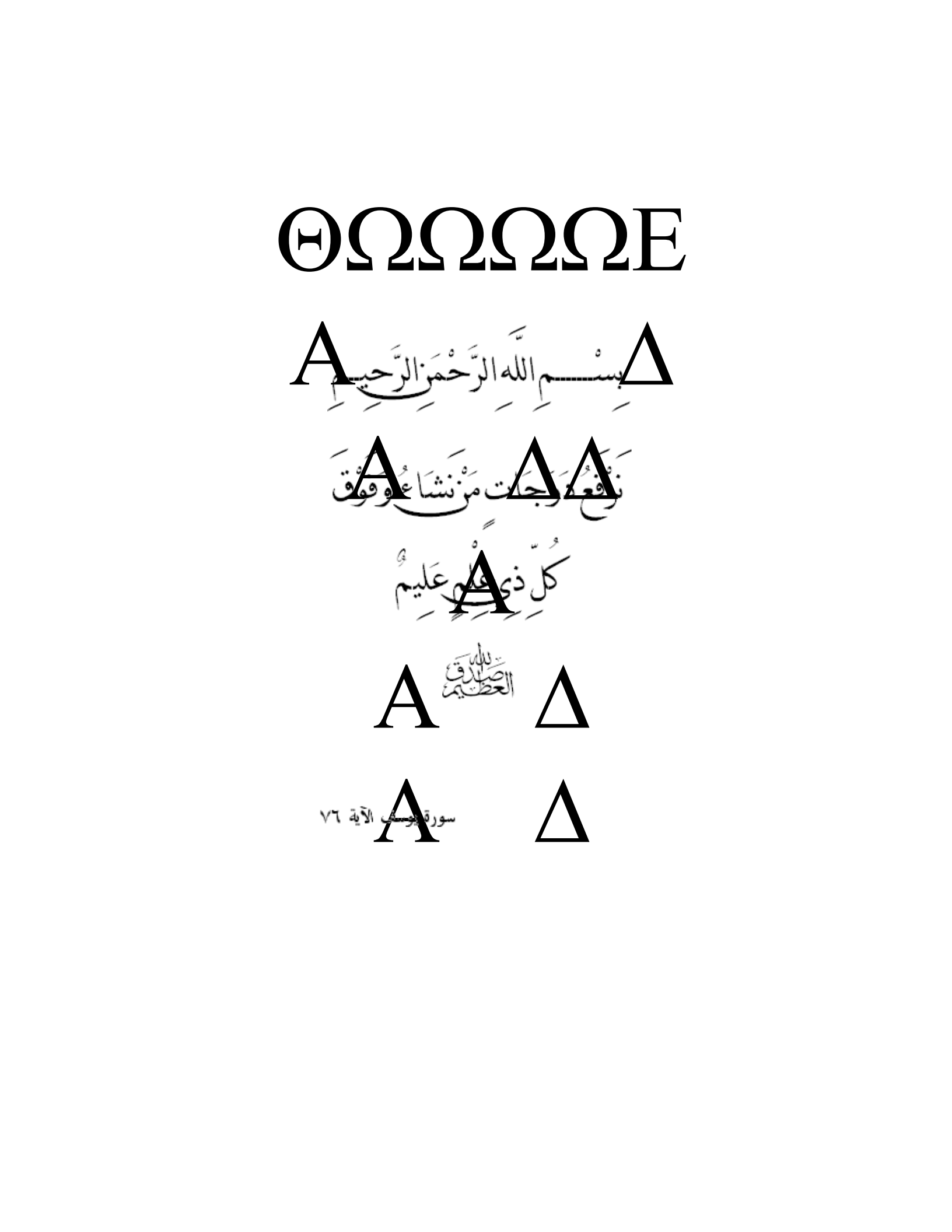
AUC	Area under curve
Aw	Water activity
BMI	Body mass index
BV	Basal value
CHO	Carbohydrates
CRP	C-reactive protein
D.K.A	Diabetic ketoacidosis
DM	Diabetes Mellitus
ECG	Electrocardiogram
FOS	Fructooligosaccharide
GABA	γ-aminobutyric acid
GAD	Glutamic acid decarboxylase
GDM	Gestational diabetes mellitus
GI	Glycemic Index
GL	Glycemic load
GSH	Glutathione

HDL	High density Lipoproteins
HLA	Human leukocyte antigen
HT (%)	Percentage of height to that of the 50% percentile for age
IAA	Insulin auto antibodies
ICAs	islet cell antibodies
IDDM	Insulin Dependent Diabetes Mellitus
IGT	Impaired glucose tolerance
LDL	Low density lipoprotein
NIDDM	Non Insulin Dependent Diabetes Mellitus
NO	Nitric oxide
OGTT	Oral glucose tolerance test
PBF	Palatinose – based balanced formula
PG	Plasma glucose
PGI	Predicted glycemic index
PV	Peak value
RFLP	Restriction fragment length polymorphism
ROS	Reactive oxygen species
SMS	Stiff man syndrome

TG	Triglycerides
WHO	World Health Organization
WT (%)	Percentage of weight to that at the 50% percentile for age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INTRODUCTION

In addition to its reputation as Nature's nutritive sweetener, research also indicates that honey's unique composition makes it useful as an antimicrobial agent and antioxidant ***(Ensminger et al., 1986)***. Honey has been used for treatment of respiratory diseases , urinary diseases, gastrointestinal diseases, skin ulcers, wounds, eczema, psoriasis, and dandruff. Recently, it was found that honey increased blood vitamin C level, β-carotene, uric acid, glutathione reductase, serum iron, copper, zinc, hemoglobin, and packed cell volume in normal subjects. Honey reduces liver enzymes, blood urea, Moreover, honey reduces plasma prostaglandin PGE2, PGF2-alpha, and thromboxane B2 concentrations in normal individuals. Honey increased NO in saliva collected from normal individuals. Intravenous delivery of honey causes improvement of renal and hepatic functions, bone marrow function, and lipid profile. It reduces alanine transaminase, aspartate transaminase, TG, cholesterol, blood urea nitrogen, and blood glucose, and elevates serum protein, serum albumin, hemoglobin, and white blood cell count ***(Al-Waili, 2003).***

In the time of the ancient Olympics, athletes were reported to eat special foods, such as honey and dried figs to enhance their sports performance as these foods would sustain favorable blood sugar concentrations after endurance training ***(Ensminger et al., 1986)***. Honey has been used since ancient times both as a food and as a medicine. It continued to be the sole sweetener available until the "discovery" of refined sugar made from sugar cane or sugar beets. Once these became more widely available, they were in great demand since they provided a relatively inexpensive form of sweetening ***(Wood and Rebecca, 1988)***. Recently, a growing body of research comparing honey as a sweetener to sucrose and dextrose in various disorders exist. One of these disorders of interest is diabetes mellitus ***(Al-Waili, 2004)***. Over the past several years there has been renewed interest in the dietary management of persons with diabetes mellitus. Many of the older concepts are being questioned and dietary recommendations are being revised. A uniform consensus regarding the best diet for insulin-requiring diabetic persons is not available ***(Dorchy, 2003)***. Nevertheless, one can educate patients regarding CHO containing foods which have a large effect on the post meal glucose concentration (cooked potatoes and cereal products such as bread and breakfast cereals) and

those which produce a smaller effect (milk and milk products, fruits, vegetables, table sugar, and honey) ***(Dorchy, 2003)***.

The body breaks down most carbohydrates from the foods we eat and converts them to a type of sugar called glucose. Glucose is the main source of fuel for our cells. After eating, the time it takes for the body to convert carbohydrates and release glucose into the bloodstream varies depending on the type of carbohydrate and the food that contains it. Some carbohydrate-containing foods cause the blood glucose level to rise rapidly; others have a more gradual effect. The glycemic index measures how fast and how much a food raises blood glucose levels. Foods with higher index values raise blood sugar more rapidly than foods with lower glycemic index values do.

Studies comparing the hyperglycernic effect of the carbohydrate of glucose, sucrose and honey in diabetics suggest that honey may prove to be a valuable sugar substitute in diabetics. In patients with type 2 diabetes (primarily a disorder due to defective insulin action or "insulin resistance") natural honey caused a significantly lower rise in blood sugar than either dextrose or sucrose and a significantly larger increase in C-peptide and insulin levels ***(Al-Waili, 2004)***

Samanta et al. (1985) studied the hyperglycaemic effect of the carbohydrate of glucose, sucrose, and honey equivalent to 20 g in twelve normal volunteers, eight patients with insulin-dependent diabetes mellitus (IDDM) and six patients with non-insulin-dependent diabetes mellitus (NIDDM). Honey produced an attenuated postprandial glycaemic response in normal volunteers (vs glucose p less than 0.005; vs sucrose p less than 0.05) and IDDMs (vs glucose p less than 0.005; vs sucrose p less than 0.05). The glycaemic index (GI) showed considerable variability within each subject group. They suggested that honey may prove to be a valuable sugar substitute in diabetics.