Body composition in children with Type 1 Diabetes and its relationship to glycemic control and cardiovascular risk

Thesis submitted for fulfillment of PhD in childhood studies
(Child Health and Nutrition)
Medical Studies Department

By
Rasha Wafeeq Mohammed Zien Alabdeen
M.Sc. pediatrics, Zagazig University

Under supervision of

Prof. Dr. Randa Kamal Abdel Raouf
Professor of pediatrics
Department of medical studies
Institute of postgraduate childhood studies

Dr. Reham Mohammed El-farahaty
Associate professor of Clinical pathology
Faculty of medicine, Mansoura University

Dr. Nanees Abdel Badie Salem
Lecturer of pediatrics
Faculty of medicine
Mansoura University

Institute of postgraduate childhood studies
Ain Shams University
2016

بسم الله الرحمن الرحيم

قالوا

سبحانك لا علم لنا
إلا ما علمتنا إنك أنت
العليم الحكيم

صدق الله العظيم

سورة البقرة الآية: ٣٢

ACKNOWLEDGMENT

First and foremost thanks to ***ALLAH***

I wish to express my deepest gratitude and appreciation to ***PROF .DR. Randa Kamal Abdel Raouf,*** *Professor of pediatrics, Institute of postgraduate childhood studies, Ain Shams University, for her constant guidance and help ; and her unlimited willingness for advising me. I really have the honor of having her supervision on this work.*

I am very thankful to ***DR.RehamMohammed El-farahaty,*** *Associate professor of Clinical pathology, Faculty of Medicine, Mansoura University for kindly accepting to supervise this work and for the valuable advice throughout the course of this work.*

It is a pleasure to express my deepest regards and gratitude to ***DR. Nanees Abdel Badie Salem,*** *Lecturer of pediatrics, Mansoura University, For her sincere continuous help, true advise, kind supervision and constant purposeful encouragement which provided me all facilities during the conduction of this work.*

I am also greatly appreciating the help of ***DR. Hala Samir Alsaid,*** *lecturer of public health and community medicine, Mansoura University, for her great statistics and his valuable suggestions.*

Lastly, I would like to express my endless gratitude to my dear patients for their kind cooperation and patience wishing them a good quality of life.

Dedication

To all diabetic children in the world with hope

To be of great benefit for them

Abstract

Abstract

Background: Type 1 diabetes mellitus is one of the most common autoimmune diseases. Obesity is a modifiable cardiovascular risk factor. Poor glycemic control increases the risk of complications. Changes in lipids and hsCRP are associated with increased cardiovascular risk.

Aim: Our aim was to evaluate body composition changes during follow up of newly diagnosed type 1 diabetic children and examine the relationship between them and between each of glycemic control and markers of cardiovascular risk, also to evaluate gender differences in body composition, glycemic control and cardiovascular risk markers, finally the study aimed to find predictors of glycemic control in type 1 diabetic children.

Subjects and methods: forty three newly diagnosed T1D patients ≤9 years of age were compared with twenty apparently healthy children of the same age and sex. Anthropometric parameters and BP measurement for patients was assessed basally, at 6 months and after 1 year of diagnosis, body composition was assessed by dual energy x-ray absorptiometry (DXA) at the same stages together with glycosylated Hb (HbA1c). High sensitivity C – reactive protein and complete lipid profile parameters were assessed basally and after one year for patients while in controls anthropometric parameters and body composition were assessed twice in between them 1 year, HbA1c, high sensitivity C – reactive protein and complete lipid profile parameters were assessed once all over the study for them.

Results: The results of the study revealed that patients tended to have lower BMI, lower fat mass than controls at basal stage then significant progressive increase in BMI and fat mass occurred, patients had significant higher basal values of HbA1c and cardiovascular risk markers which decreased after 1 year. There was significant positive correlation between HbA1c and each of BMI, fat mass and hsCRP after 1 year.

Conclusions: Intensive insulin therapy caused weight gain mainly of fat mass, improvement in glycemic control and cardiovascular risk factors after 1 year of diagnosis of T1D. Obese T1D patients tended to have poor glycemic control and they were more liable to dyslipidemia and cardiovascular risk. Males tended to show better improvement in insulin sensitivity (TG/HDL), glycemic control (HbA1c) and cardiovascular risk (hsCRP) than females; that could be explained by their regular physical activity and low fat content. Finally, predictors of glycemic control were fat mass and hsCRP.

Recommendations: Good glycemic control (HbA1c < 7.5) is recommended for all type 1 diabetic children and it is the key for successful diabetes management. High sensitivity CRP assay can be included in annual investigations done for follow up of diabetic children.

Keywords: Type 1 diabetes mellitus-Body composition-Glycemic control-Cardiovascular risk.

Contents

List of Abbreviations

ACEI	Angiotensin converting enzyme inhibitor
ACR	Albumin -creatinine ratio
ADA	American Diabetes Association
AER	Albumin excretion ratio
APECED	Autoimmune polyendocrinopathy -candidiasis-ectodermal dystrophy
APS	Autoimmune polyglandular syndromes
BG	Blood glucose
βOHB	Blood betahydroxybutyrate
BIA	Bioelectrical impedence analysis
BMI	Body Mass Index
CE	Capillary electrophoresis
CGM	Continious glucose monitoring
CHI	Creatinine/ height ratio
CHO	Carbohydrate
CNS	Central Nervous System
Cp	Index for the current period
CSII	Continious subcutaneous insulin infusion
CTT Collaborators	Cholesterol treatment trialists collaborators
CVD	Cardiovascular disease
CZE	Capillary zone electrophoresis
DAFNE	Dose Adjustment For Normal Eating
DBP	Diastolic Blood Pressure
DCCT	Diabetes Control and Comlications Trials
DKA	DiabeticKetoacidosis
DM	Diabetes Mellitus
DME	Diabetic macular oedema
DXA/DEXA	Dual energy x-ray absorptiometry
EASD	European Association For the Study of Diabetes
EDIC	European Diploma in intensive care unit
GADA	Glutamic acid decarboxylase antibodies
GH	Growth hormone
Hb	Heamoglobin
HbA1c	Glycosylated Heamoglobin
HC	Hip circumference
HDL-C	High density lipoprotein cholesterol
HHS	Hyperglycemic hyperosmolar state

HLA	Human leukocyte antigen
HPLC	High Performance Liquid Chromatography
hsCRP	High sensitivity C reactive protein
Ht	Height
HTN	Hypertension
IDF	International Diabetes Federation
IFFC	International Federation Of Clinical Chemistry
IGF-1	Insulin-like growth factor 1
IQR	Interquartile range
ISPAD	International society of pediatric and adolescents diabetes
JDRFCGM Study Group	Juvenile diabetes research foundation continuous glucose monitoring study group.
LADA	Latent autoimmune diabetes of adults
LDL-C	Low density lipoprotein cholesterol
LJM	Limitted joint mobility
MAC	Mid arm circumference
MAMC	mid arm muscle circumference
MS	Metabolic syndrome
MUCH	Mansoura university children hospital
MW	Mann-Whitney test
NHANES	National health and nutrition examination survey
OGTT	Oral glucose tolerance test
PDR	Proliferative diabetic retinopathy
Pp	Index for the previous period
SBP	Systolic Blood Pressure
SD	Standard Deviation
SMBG	Self monitoring of blood glucose
T1D/T1DM	Type 1 diabetes/Type 1 diabetes mellitus
T2DM	Type 2 diabetes mellitus
TC	Total cholesterol
TG	Triglyceride
TNF	Tumour necrosis factor
WC	Waist circumference
WFL	Weight for length
Wt	Weight
2hpp	2 hour post prandial

List of Tables