Assessment of the Lifestyle Intervention in Prevention of Type 2 Diabetes Mellitus

Thesis submitted for partial fulfillment of M.D degree in Endocrinology and Metabolism

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Introduction

Type 2 diabetes mellitus(T2DM) is the predominant form of diabetes worldwide, accounting for 90% of cases ,it has become one of the world's most important public health problems and it is now well established that the 21st century will be characterized by a global epidemic of it ***(Buse., et al 2008)***.

An epidemic of T2DM is under way in both developed and developing countries, Egypt was among the top 10 countries in number of people with diabetes in age group between 20-70 years (4.4 Million) in 2007 and it is estimated to be 7.6 million by the year 2025 ***(International Diabetes Federation 2006).***

Epidemiological studies have demonstrated that T2DM results from an interaction between a genetic predisposition and lifestyle factors, including obesity and sedentary behavior. Changes in demographic and lifestyle characteristics in the population have led to a progressive increase in the prevalence of both diabetes and impaired glucose tolerance (IGT), a precursor to T2DM ***(Herman ., et al 2005)*** **&(Knowler ., *et al 2002).***

Fortunately, several large clinical trials now provide evidence that T2DM can be delayed or prevented by changes in these lifestyle factors Collectively, these studies demonstrate that lifestyle interventions involving structured diet and physical activity programs that result in modest, sustained weight loss in overweight adults with IGT can significantly reduce the development of diabetes ***(Gillies ., et al 2007)***.

The Finnish Diabetes Prevention Study and the Diabetes Prevention Programs provided conclusive evidence that type 2 diabetes could be prevented or delayed with modest lifestyle changes 5% - 7% loss of body weight and 150 min/week of physical activity. Both used intensive intervention strategies and continued support and follow-up to achieve study goals. A review of the evidence led the American Diabetes Association to conclude that lifestyle interventions should be the first choice for prevention or delay of diabetes and that drug therapy should not be a substitute for lifestyle interventions as healthy and appropriate food choices and physical activity ***(Marion 2007).***

Aim of the work

- To evaluate the role of systematic dietary education, counseling and physical training in a group of high risk of T2DM diabetes in the prevention of T2DM.
- To evaluate risk forum of the Finnish study in prevention of T2DM in Egyptian population.

Study Type and Design

It is intervention study which will be carried out on **(500) individual with different risk score for T2DM selected from endocrinology out patient clinic at Ain-Shams University and the National Nutrition Institute (NNI)** out patient clinic.

The intervention will include a combination of individual counseling and group sessions on diet/lifestyle in the 3 months the intervention period lasts.

Evaluation: The main end point of the intervention will be the fasting and 2-h plasma glucose value after an oral glucose tolerance test (OGTT). This will be measured at baseline and after 3 months of intervention. Secondary end-points will be Serum lipid profile (e.g. triglycerides, HDL-cholesterol, LDL) ; body weight; waist and hip circumference; self-reported level of intensity, duration and frequency of physical activity; self-reported level of "Stages of change" in regard to motivation and behavioral change; self- reported subjective health complaints; self-reported coping strategies; Dietary information will be collected 24 hours dietary recalls. The intake of energy and nutrients will be calculated from the recalls, as well as the intake of food groups. The diet will also be evaluated by a culturally adapted food frequency questionnaire (with portion sizes). In addition, the use of cooking oils will be registered by questions about the type and quantity of oil used per time unit in the household.

Additionally, information on knowledge and perceptions on diet and health before and after the intervention will be registered.

Physical activity will be registered as regard the duration and frequency of physical activity, duration of lying down, duration of sleeping.

The completion of the questionnaires will take the form of an interview.

Inclusion Criteria:

- Male and female patients age 40 to 60 years of age.
- Ability to provide written informed consent.
- Mentally stable and able to comply with the procedures of the study protocol.
- Able to fill out questionnaires.
- Has metabolic syndrome as defined by three or more of the five risk factors

    - elevated blood pressure (BP) above 130 mm Hg systolic and/or 85 mm Hg diastolic or drug therapy for elevated blood pressure
    - elevated waist circumference (WC)above 35" (female) or above 40" (male)
    - reduced high-density lipoprotein (HDL) of below 40 mg/dl (male) or below 50 mg/dl (female) or drug therapy for reduced HDL
    - elevated triglycerides (TG) of 150 mg/dl or above or drug therapy for elevated TG

Exclusion Criteria:

- Has been diagnosed with diabetes
- Significant exercise-restricting disease
- ECG evidence of ischemic heart disease at rest.
- Poorly controlled hypertension
- Psychiatric disease or dementia
- Already on unusually restrictive diet
- Use of tobacco
- Pregnant women.
- Subjects with major illness such as cancer, hepatic or cardiac diseases.

Methods:

1. Patients undergo routine history and physical examination.
2. Anthropometric assessment (height, weight, BMI, waist circumference, hip circumference).
3. OGTT using 75 gm glucose.
4. Diabetes risk score according to the Finnish study.
5. Behavioral: Lifestyle intervention and provider feedback

Patients receive lifestyle education and counseling after each visit. Life style modification goals are set and progress monitored. Frequency is dependent on frequency of visits which can range from one week to one month.

Feedback on provider performance as assessed by provider documentation of diagnosis and treatment recommendations compared to patient outcomes is given three months

Consent Form

All patients will be explained in details about the study and investigation that will be done and sign the informed consent for the study.

Ethical Considerations

Detailed consent form keeps the patients informed with the ethical regulation of conducting the study on human patient participant (see consent form).

Statistical Analysis:

SPSS statistical software package (Version 13.2, 2003, Echosoft Corp., USA) will be used for data analysis.

- The mean ± SD will be used for data description as regards non-categorized or quantitative data.
- Number and percent (%) for categorized or numerical data.
- To present the mean variation of levels with time, a model of linear regression of random effects will be constructed using the following equation: $y = \beta 0 + \beta 1 \times \log(\text{time}) + \beta 2 \times$, in which each parameter represents a random effect in each patient. These models are characterized to present residuals that are normally distributed.
- Chi-Square test will be used for correlation between each 2 independent parameters as regards %.
- A level of ($P<0.05$) was accepted as statistically significant, and a level of ($P<0.001$) was accepted as statistically highly significant.

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Back ground

The efficacy of lifestyle intervention in reducing the incidence of type T2DM has been established by the Diabetes Prevention Program and other studies. Our primary objective was to test the feasibility of integrating less intensive lifestyle intervention therapy into patient visits to improve weight loss and decrease the intensity of metabolic syndrome and pre-diabetes risk factors. **METHODS:** 500 middle-aged, overweight subjects; mean age, 47 years; mean body-mass index 38 were screened from 9/2009 till 2011for the presence of prediabetes. We surveyed their characteristics of life style: eating and exercise habits, body mass index, waist line, resting blood pressure, OGTT plasma glucose, total cholesterol, triglyceride, HDL after a 12-hour fasting. After ruling out secondary obesity a tailored individual life-style which focused on dietary interventions (low calorie diet) and increased physical activity. An oral glucose-tolerance test was performed at the end for those at risk of diabetes. The mean duration of follow-up was one year. **RESULTS —**The intervention group showed significantly greater improvement in each intervention goal, with significant mean differences weight change (−8.58 kg, (P<0.000)).Also, there is improvement in other markers for risk of progression to diabetes {BMI (P<0.000) and waist circumference (P<0.000)}. The magnitude of weight loss was strongly associated with improvements in glycemia, with significant differences in fasting glucose (P<0.000), and post load blood glucose profiles 1-h (P<0.015) and 2-h (P<0.042), were seen. **CONCLUSIONS —** Intensive lifestyle intervention (diet, physical activity) produced beneficial changes in, clinical and biochemical parameters in those who are at risk of T2DM. This type of intervention is a feasible option to prevent type 2 diabetes and should be implemented in the primary health care system.

Key words:

Type 2 diabetes, life style intervention, diet, prediabetes , blood glucose ,anthropometric measures

Results

The first subject was assigned to a group in August 2009 and the last in September 2011.The mean duration of follow-up was one year. The base-line characteristics of the group

TABLE 1 Base-Line Characteristics of the Subjects.

Variable	Mean ± SD
Age (years)	47.28±6.80
Weight(kg)	96.35±15.21
BMI (kg/m^2)	38.22±5.67
Waist circumference (cm)	112.75±11.06
hip circumference (cm)	121.36±10.67
Fasting blood glucose (mg/dl)	99.30±24.88
1-h plasma glucose OGTT (mg/dl)	150.06±48.11
2-h plasma glucose OGTT (mg/dl)	126.66±75.1
Serum total cholesterol(mg/dl)	175.4±44.41
Serum LDL cholesterol(mg/dl)	108.39±40.53
Serum HDL cholesterol(mg/dl)	44.32±12.71
Serum Triglyceride(mg/dl)	114.27±52.64
Systolic blood pressure (mmHg)	125.61±15.84
Diastolic blood pressure (mmHg)	81.245±11.11
Blood pressure lowering medication %	24.3%
First degree relative with diabetes%	44.9 %

TABLE (2) Changes in Selected Clinical and Metabolic Variables from Base-Line to the End of Year 1 in the Subjects in the Intervention Group

Variable	Base-Line data Mean ± SD	End of study Mean ± SD	P value
Weight(kg)	97.98 ± 13.59	89.40±13.23	0.000
Waist(cm)	113.37±8.49	102.21±7.55	0.000
OGTT Fasting(mg/dl)	117.58±32.01	96 ±16.42	0.000
OGTT 60 minute(mg/dl)	172.13±40.71	154.12±38.77	0.015
OGTT 120 minute(mg/dl)	169.12±179.34	119.45±27.55	0.042

Content

Content

List of Abbreviations

DALY	disability-adjusted life year
QALY	quality-adjusted life year
TFA	Trans fatty acids
MUFA	Monounsaturated fatty acids
SFA	Saturated fatty acids
n-6 FA	Omega 6 fatty acid
n-3 FA	Omega 3 fatty acid
GSIS	glucose-stimulated insulin secretion
K_{ATP} channel	ATP-sensitive K^+ channel
FFAs	free fatty acids
DF	dietary fiber
CHO	Carbohydrates
RCT	Randomized controlled trial
IFG	Impaired fasting glucose
HVOs	hydrogenated vegetable oils
FBG	Fasting blood glucose
T2DM	Type 2 diabetes mellitus
NO	Nitric oxide
BMI	Body mass index
RR	relative risk
GLUT4	glucose transport 4
IGT	Impaired glucose tolerance
b.i.d.	Twice per day
t.i.d.	Thrice per day
OGTT	Oral glucose tolerance test
MetS	Metabolic syndrome
ADA	The American Diabetes Association
EMR	Eastern Mediterranean Region
FFQ	food frequency questionnaire
WHO	World Health Organization
SSBs	Sugar sweetened beverages
HFCS	High-fructose corn syrup
HCHF	High carbohydrate high fiber
GIP	Glucose dependent insulinotropic polypeptide
SCFA	Short-chain fatty acids
GPCR	G protein-coupled receptors
NF-κβ	Nuclear factor kappa light-chain-enhancer of activated B cells
LPS	lipopolysaccharides
FA	fatty acid
E	Energy
CLA	Conjugated linoleic acid
TLR	Toll-Like Receptors
PPARγ	peroxisome proliferator-activated receptor-gamma
CE	Cinnamon extract
PG	Plasma glucose

List of Figures