# **Original Research Article**

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# Assessment of the eating habits of diabetic patients and consequential evaluation of targeted intervention in Tripolis, Greece

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## **ABSTRACT**

**Background:** Diabetes mellitus is a global public health problem. The purposes of this study were: development of healthy eating habits, excellent glycemic control, maintenance ideal body weight, smoking cessation, regular physical exercise, prevention of complications.

**Methods:** A sample of 100 diabetic patients (57% males and 43% females, aged 39-89 years old) was monitored in the Hospital of Tripolis. Patients completed a questionnaire about their eating habits. Body weight, height, waist circumference, body mass index (BMI) calculation and glycosylated hemoglobin were measured. Follow lifestyle intervention included dietary guidelines.

**Results:** After the intervention significant differences were observed: increases in physical activity (58.95% from 41.0%, p-value = 0.002), duration of exercise (Q1 = 1.0 from 0.5, p-value = 0.023), consumption of breakfast (94.74% from 86.0%, p-value = 0.013), daily number of meals (median = 5 from 4, p-value = 0.002), average score of frequency in fats / oils / olive consumption (median = 2.8 from 2.5, p-value <0.001) average score of frequency in fruit consumption (median = 4.0 from 2.5, p-value <0.001), and decreases in weight (Q1 = 73.0 from 74.5, p-value = 0.002), BMI (median = 31.7 from 32.4, p-value = 0.002), waist circumference (median = 106 from 108, p-value <0.001), average score of frequency in grain / starchy / legumes consumption (Q1 = 2.6 from 2.8, p-value = 0.050).

**Conclusions:** This study shows that even small interventions can have the desired results. But it needs perseverance and adaptation of programs to the specific characteristics and cultural beliefs of patients.

Keywords: Complications, Diabetes mellitus, Lifestyle intervention, Prevention

# INTRODUCTION

Diabetes mellitus takes "epidemic" dimensions worldwide. The increasing life expectancy, the growing world population and the lifestyle according to Western standards (increasing obesity and sedentary lifestyle), are responsible for the increase in diabetic patients, particularly those with type 2 diabetes. 1-3

It is undeniable that diabetes is a major public health problem worldwide due to the increasing prevalence of increased morbidity and too high own mortality, which have resulted in huge costs to care. The expected increase in diabetes will clearly result in a significant financial burden, not only because of the growing social and medical costs of treatment, but mostly because of the cost of prevention and treatment of diabetic complications. <sup>4-5</sup>

Randomized clinical trials have shown that type 2 diabetes can be prevented or at least postponed by rather modest lifestyle changes. <sup>6-9</sup> In contrast with the rapidly vanishing effect of drug treatment on prevention of

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diabetes, the effects of lifestyle intervention seem to be long lasting. <sup>10-13</sup> The diet is the cornerstone in the treatment of diabetes. Two recent studies, "The Diabetes Prevention Program" (DPP) taken place in the United States and "The Finnish Diabetes Prevention Study" (FDPS) in Europe showed that lifestyle intervention and diet reduced the risk of diabetes by 58%. <sup>6-7</sup> The role of nutrition is very important in the prevention and treatment of diabetes, preventing or at least delaying the appearance of complications.

The objectives of this work were to estimate the percentage of patients who, complied with the recommendations and improved nutrition, increased or reduced their body weight, stopped smoking, increased or decreased their physical activity, increased or reduced blood sugar levels.

#### **METHODS**

This study is a non-intensive lifestyle intervention program. The protocol was approved by the National School of Public Health in Athens, and the Panarkadian General Hospital's Scientific Council. The subjects were informed in detail about the program. The participants entered the study voluntarily, signed an informed consent form prior their participation in the study, and were allowed to discontinue the study at any time point. The study was performed in compliance with the declaration of Helsinki.

The survey was conducted at the Panarkadian General Hospital in Tripolis, Arkadia which covers the health needs of Arkadia's regional unit of Greece prefecture with a population of 8.682.012 and serves the adjacent counties. A sample of 100 patients with diabetes mellitus attending the outpatient diabetic clinic of the Hospital Tripolis were included in the study.

The sample consisted of patients of both sexes, who attended continuing to outpatient diabetic clinic and were treated with diet, drugs or insulin. Excluded from the study subjects, suffering from other diseases, which require a special diet. Data collection was completed within 9 months from September 2011 to May 2012.

The body weight, height, waist circumference, BMI calculation and glycosylated hemoglobin were measured. BMI was calculated as weight in kilograms divided by the square of the height in meters. Blood sample was collected, morning after 8 hours fasting, for the measurement of glycosylated hemoglobin. The glycosylated hemoglobin was measured at the laboratory of Panarkadian General Hospital, using the high performance liquid chromatography (HPLC).

The questionnaire used was consisting by the general and the food part. Its completion was conducted by face-toface session. The general part was used to collect information on socio-demographic characteristics and habits of the patient (age, sex, smoking, exercise, family history, duration of disease, co-morbidity, number of meals, cooking mode etc.). The nutritional part recorded the dietary behaviours and the frequency of consumption in various foods. A 7 grade scale, providing the options for the frequency of consumption, was used ranging from never / a few times a year, 2 months, 1 to 3 times / month, 1 to 2 times / week, 3 to 4 times / week, 5 to 6 times / week, dally. The food frequency questionnaire included information of all the main food groups that are consumed around the world (i.e. questions regarding consumption of dairy products, cereals, fruit, vegetables, meat, fish, legumes, sweets, etc).

The questionnaire form was filled out during the visit at the outpatient diabetic clinic. Each subject in the intervention group received individualized counselling on diet, physical activity, weight control, control of the levels of blood glucose, behaviour modification and medication from trained health visitor. Printed material was provided.

The focus of the visits was on weight, meal frequency, fat intake, quality of fat, use of salt, fiber intake, use of alcohol, exercise and smoking. Specifically, participants were encouraged to lose weight among the overweight through a combination of diet and exercise; to follow the Food Pyramid guidelines (increased whole grains, fiber, vegetables, and fruit; to reduce total and saturated fat, sugar, and refined grains); to avoid adding salt in food and to consume only small amounts of salty foods; to avoid excessive alcohol intake, and those who smoke to stop.

The recommended carbohydrate intake was being constituted by 50-55% of daily total energy, fat intake <30% of total energy and saturated fat <10% of total energy. The recommended protein intake was constituted of about 1gr per kg of ideal body weight and fiber intake over 15 gr per 1000 kcal.

The study subjects were asked to answer if they participate in any kind of physical activity, the kind of the exercise, the number of the days (frequency) and the number of the minutes per day (duration) of their participation in all kinds of physical activities. No formal exercise sessions were provided, except for the general counselling to increase physical activity with a goal of at least 30 min of an activity such as walking 5 days per week.

The evaluation of the intervention was three months after the intervention, with the prior telephone contact with the patients. Changes in weight, waist circumference, physical activity levels, glycosylated hemoglobin and general compliance with the recommendations were assessed.

#### Statistical analysis

The data recorded in the computers and statistical analysis was done with the program Stata version 10. Absolute (number of observations) and relative (percentages) frequencies were used for the qualitative characteristics of this study. The description of the quantitative characteristics based on the calculation of median values and interquartile range - EIF (interquartile range - IQR). The qualitative variables were tested by Stuart-Maxwell test. Non-parametric variables were tested by Wilcoxon Mann-Whitney test. All reported p-values are from two-sided tests and compared with a significant level of 5%.

# **RESULTS**

Table 1 shows the socio-demographic and clinical characteristics of the participants. There were 57 males and 43 females in our study. The largest proportion 36% belonged to the 70 - 79.9 years age group. The 72% of the sample was obese (BMI  $\geq$ 30) and 19% overweight (BMI = 25-29.9).

Among the co-morbidities, 73% of the patients had hyperlipidemia, followed by 69% having hypertensive problems. Regarding glycosylated hemoglobin median was 7.3 with 25% of individuals had HbA1c <6 and 75% of the subjects had HbA1c <8.6 and 25% had HbA1c>8.6. While conducting the investigation two persons (men) died.

#### Clinical outcomes

Favourable changes in clinical characteristics were observed after the intervention (Table 2). Specifically, the participants lost weight [(Q1 = 73.0 from 74.5) (p-value = 0.002)]. Analogous changes were seen in BMI [(median = 31.7 from 32.4) (p-value = 0.002)] and waist

circumference [(median = 106 from 108) (p-value <0.001)].

Table 1: Socio-demographic and clinical characteristics.

Socio-demographic characteristics	Number (%)		
Gender			
Males	57 (57.0)		
Females	43 (43.0)		
Age (years)			
30-39.9	3 (3.0)		
40-49.9	9 (9.0)		
50-59.9	15 (15.0)		
60-69.9	23 (23.0)		
70-79.9	36 (36.0)		
80-89.9	14 (14.0)		
Marital status			
Married	84 (84.0)		
Single	9 (9.0)		
widowed	6 (6.0)		
Divorced	1 (1.0)		
Type of diabetes			
1	7 (7.0)		
2	93 (93.0)		
<b>Duration of diabetes (years)</b>			
<5	28 (28.0)		
5-9.9	25 (25.0)		
10+	47 (47.0)		
Family history of diabetes			
No	46 (46.0)		
Yes	54 (54.0)		
BMI (Kg/m <sup>2</sup> )			
Normal	9 (9.0)		
Overweight	19 (19.0)		
Obese	72 (72.0)		

Data are presented as percentages.

Table 2: Somatometric parameters and glycosylated hemoglobin (HbA1c) before and after the intervention.

	Intervention			
	Before	After		
	Median (IQR)	Median (IQR)	p-value	
Weight (Kg)	83.0 (74.5, 95.0)	83.0 (73.0, 95.0)	0.002*	
BMI (Kg/m <sup>2)</sup>	32.4 (29.2, 36.1)	31.7 (28.6, 36.0)	0.002*	
Waist circumference (cm)	108.0 (101.0, 118.0)	106.0 (99.0, 116.0)	<0.001*	
HbA1c (%)	7.3 (6.0, 8.6)	6.9 (6.3, 8.2)	0.761	

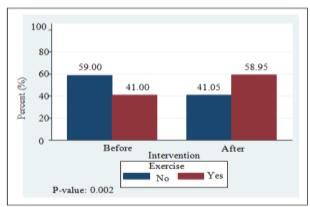
## Dietary intake and physical activity

Statistically significant differences after intervention were observed in the exercise [(58.95% from 41.0%) (p-value = 0.002)] (Figure 1) and duration of exercise [(Q1 = 1.0 from 0.5) (p-value=0.023)] (Figure 2). Significant

increase in the rate of diabetic patients who exercise and the duration of exercise.

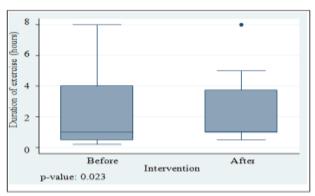
Beneficial changes were seen in the consumption of breakfast [(94.74% from 86.0%) (p-value = 0.013)] (Figure 3) and the daily number of meals [(median = 5

from 4) (p-value = 0.002)] (Figure 4). The percentage of the participants who consume breakfast and the daily number of meals were increased.



Statistically significant difference, increased the percent who exercise.

Figure 1: Exercise before and after the intervention.



Statistically significant deference increased the duration of exercise.

Figure 2: Duration of exercise before and after the intervention.

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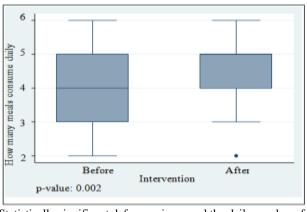
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Statistically significant deference increased the consumption of breakfast.

Figure 3: Consumption of breakfast before and after the intervention.



Statistically significant deference increased the daily number of

Figure 4: Daily number of meals before and after the intervention.

Table 3: Frequency in consumption of food groups before and after intervention.

Intervention				
	Before	After		
	Median (IQR)	Median (IQR)	p-value	
Average score of frequency in milk consumption	2.3 (2.0, 2.8)	2.3 (2.0, 3.0)	0.556	
Average score of frequency in Fruit consumption	2.5 (2.5, 3.0)	4.0 (3.0, 4.0)	<0.001*	
Average score of frequency in vegetables consumption	3.3 (2.8, 4.0)	3.3 (2.8, 3.8)	0.634	
Average score of frequency in meat / fish / egg consumption	2.4 (2.2, 2.6)	2.4 (2.1, 2.7)	0.888	
Average score of frequency in grain / starch / legumes consumption	3.0 (2.8, 3.3)	3.0 (2.6, 3.3)	0.050*	
Average score of frequency in fats / oils / Olive consumption	2.5 (2.3, 2.8)	2.8 (2.6, 3.0)	<0.001*	
Average score of frequency in nuts consumption	1.5 (1.0, 2.0)	1.0 (1.0, 2.0)	0.779	
Average score of frequency in sweets consumption	1.5 (1.2, 1.8)	1.6 (1.2, 1.9)	0.518	
Average score of frequency in liquid food consumption	3.0 (3.0, 3.8)	3.0 (3.0, 4.0)	0.850	
Average score of frequency in alcohol consumption	3.0 (3.0, 3.8)	3.0 (3.0, 4.0)	0.850	

Data are median (interquartile range).\*P-values in Fruit consumption, Grain / Starch / Legumes consumption, and Fats / Oils / Olive consumption are statistically significant.

Significantly greater improvements were observed in the average score of frequency in fruit consumption [(median = 4.0 from 2.5) (p-value <0.001)], the average score of frequency in grain / starchy / legumes consumption [(Q1 = 2.6 from 2.8) (p-value = 0.050)] and the average score of frequency in fat / oils / olive consumption [(median = 2.8 from 2.5) (p-value <0.001)] (Table 3). Specifically, the fruit consumption and the fat / oils / olive consumption were increased. Also, the grain / starchy / legumes consumption was reduced.

After the intervention two people (2.7%) stopped smoking but this difference was not statistically significant.

## **DISCUSSION**

This study focused on the effectiveness of hygienic intervention in patients with diabetes mellitus. After the intervention 52 persons (54.7%) reduced their weight, 21 subjects (22.1%) began to exercise, 38 subjects (40%) reduced the portion sizes that consumed while 4 people (4.2%) increased their portion sizes.

Statistically significant changes after the intervention in the following characteristics were observed: increases in physical activity (58.95% from 41.0%, p-value = 0.002), duration of exercise (Q1 = 1.0 from 0.5, p-value = 0.023), consumption of breakfast (94.74% from 86.0%, p-value = 0.013), daily number of meals (median = 5 from 4, p-value = 0.002), average score of frequency in fats / oils / olive consumption (median = 2.8 from 2.5, p-value <0.001) average score of frequency in fruit consumption (median = 4.0 from 2.5, p-value <0.001), and decreases in weight (Q1 = 73.0 from 74.5, p-value = 0.002), BMI (median = 31.7 from 32.4, p-value = 0.002), waist circumference (median = 106 from 108, p-value <0.001), average score of frequency in grain / starchy / legumes consumption (Q1 = 2.6 from 2.8, p-value = 0.050).

The changes found were in the desired direction and promising. Interventions in the direction of reducing the intake of calories and increasing physical activity improve both glycemic control and other cardiovascular risk factors such as hypertension and lipid parameters while lowering and other effects of obesity. <sup>16-19</sup>

The weight loss (either dietary or surgical) leads to a significant improvement of hyperglycemia, even in type 2 diabetes remission.<sup>20</sup> Weight loss of 5-10% favors the body's processes function beneficial to the improvement of metabolic disorders associated with obesity and insulin resistance. Any weight loss during 1 Kg after age 18 years is estimated to result in lowering glucose at 3.6 mg/dl.<sup>21</sup>

The consumption of fruit, vegetables and legumes has been associated with a reduced risk of insulin resistance and type 2 diabetes mellitus.<sup>22</sup> Dietary fiber and low glycemic load of fruit and vegetables have been linked in

studies to improve both the lipid profile (decreased triglycerides and total cholesterol), and the glycemic control (insulin reduction and fasting glucose), diabetic and non-diabetic subjects.<sup>23</sup> Moreover, according to the results of some epidemiological studies, there is evidence that frequent consumption of fruit and vegetables is associated with a reduced risk of type 2 diabetes, and cardiovascular diseases in a healthy population.<sup>24-26</sup>

One limitation of the study was that the intervention took place at the external public hospital clinics. The space and the conditions were not ideal despite the efforts were made. Time was very limited due to workload. There was no sufficient informative material. There was no consultation with dietitian. Also, there was difficulty in some patients to recover in the second session because they lived in remote areas and for economic reasons. Some patients reported non-implementation of recommendations due to financial problems (failure to provide healthy food).

#### **CONCLUSION**

This study shows that interventions, even small, can have the desired results but it needs perseverance and adaptation of programs to the specific characteristics and cultural beliefs of the patients.

What is needed now is political support to develop national action plans for diabetes prevention. The lifestyle intervention is feasible, safe, effective and can be implemented in primary health care systems.

## **ACKNOWLEDGEMENTS**

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Ethical approval: The protocol was approved by the National School of Public Health in Athens, and the Panarkadian General Hospital's Scientific Council. All participants handed out written informed consent according to the general Recommendations of the Declaration of Helsinkii

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