Original Article

The Nutritional Habits of patients with Type 2 Diabetes Mellitus in Malta: Have they changed since the 1980s?

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Abstract

The main aim of this study was to define the contemporary dietary habits of both patients with Type 2 diabetes mellitus (T2DM) and nondiabetics in Malta and to compare the results with the findings of a similar study performed in 1983 by Katona *et al*. The study was a cross sectional study of representative subsets of the Maltese population. A questionnaire was used to collect the data and record baseline characteristics, information about diet and exercise levels. Results showed that there were no statistically significant differences between the diets of the T2DM and nondiabetic cohorts. Compared to the 1983 data, the Maltese are eating more carbohydrates, less fat and fibre. Diabetics appear not to be changing their lifestyle habits once they are given their diagnosis. The results suggest that continuous education is needed on all aspects of a healthy lifestyle including dietary advice and should include both diabetics and non-diabetics.

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Introduction

Changes in the nutritional habits of the Maltese population have increased the incidence of obesity and of chronic diseases such as T2DM. The prevalence of diabetes in Malta is about 9.9%[1] and 26.6% of the population are obese.[2]

Over the past centuries there was a change in the type of food eaten by the Maltese. Before the nineteenth century, the Maltese had a lower standard of living. Their diet consisted of 'barley bread, cheese, olives, garlic, dried fruit, salt-fish, oil and similar foods.' They ate in abundance whatever was in season and 'they drank moderate amount of wine'.[3]

Eventually, with a general improvement in standard of living the Maltese diet started to include bread, pasta and meat which previously were almost non-existent in the Maltese diet.[3]

The Maltese diet nowadays has more red meat, fried foods, refined sugars, fats and carbohydrates. Recent data from the European Health Interview Survey (EHIS) showed that 74% of the respondents consumed fruit at least once a day and 51% consumed vegetables at least once a day.[4]

In 1981, WHO commissioned a study named National Diabetes Programme in Malta. The aim of this study was to investigate the prevalence of diabetes and diabetic complications. They included a dietary history from which the percentage contributions of different nutrients to the total calorie intake were calculated.[5] From this study it was shown that the Maltese, particularly those working, usually had a one main meal and minor snacks during the day. Diets were rich in fat, low in fibre.[5] Over the following thirty years there were major lifestyle changes including dietary changes,

heavy use of private cars and low amounts of physical activity.[4]

Aims of this study

The aim of this study was to investigate the nutritional habits of both diabetic patients and non-diabetics in Malta and to compare the findings with the findings of Katona *et al* in 1983.

Method

Design of study

This study was a cross sectional study of representative subsets of the Maltese population: a cohort of diabetic patients and a matched cohort for non-diabetic patients.

A questionnaire was used to assess basic participant characteristics such as height, weight, age, level of education, current job and treatment, level of physical activity and dietary history.

Sample

The sample was recruited on a voluntary and random basis. The diabetic cohort was collected from the Diabetes clinic at Mater Dei Hospital. A matched sample of normal participants, were recruited from other hospital clinics and general practice clinics across different locations in Malta. Recruitment of participants started in December 2012 and lasted 6 months.

The inclusion criteria for participants was an age between 20 to 80 years. T2DM is defined as per the WHO diagnostic criteria, of fasting plasma glucose ≥ 7.0mmol/l or 2–hour plasma glucose following an oral glucose tolerance test of ≥ 11.1mmol/l.[6] Both previously diagnosed and newly diagnosed T2DM patients without a history of ketoacidosis were included in the project. Newly diagnosed type 2 diabetics needed to have had previous nutritional advice to be included in the cohort.

Exclusion criteria were patients who had Type 1 diabetes, coeliac disease, hypertension, hyperlipidaemia, pregnancy and any other patient on a special diet.

Both cohorts were matched for age, sex and locality.

Materials and apparatus

A questionnaire was used to assess basic participant characteristics and dietary history. This was taken in the form of a three day food diary. The nutritional data was analysed with Dietplan 6© from www.foresoft.co.uk. Results were then analysed using SPSS©.

Procedure

The questionnaire was filled in by interviewing the participant at the clinic during his or her visit or while they were waiting for their visit. The information was always collected by the same researcher who guided the participants as to portion sizes and weight of foods. These were predetermined from the pilot cohort. The estimate of amounts being ingested was calculated on standardized household measures (millilitres- ml and kilograms- kg).

Ethical issues

Ethical approval was obtained from the University of Malta Research Committee (UREC), and the University of Roehampton. All the data had to be collected within the provisions of the Data Protection Act. Informed consent was obtained from all the patients who accepted to participate in the research project.

Data analysis

The data was compiled on a Microsoft© Excel spreadsheet. Nutritional data was analysed with Dietplan 6© from www.foresoft.co.uk. From the information collected from the questionnaire, inputting the nutritional data in Dietplan 6© provided a report of the daily nutritional intake for each participant. The data collected from these reports were the total daily energy intake in kilo-calories (Kcal); protein, fat and carbohydrate intake in grams (g) including sugar intake. The percentage amounts of daily intake of carbohydrates, protein, fats and alcohol were also calculated. SPSS© was then used for statistical analysis.

Means and 95% confidence intervals were calculated for baseline characteristics and also for the nutritional values of the different samples. For comparison of continuous variables between two groups, i.e. males and females and diabetics and non-diabetics, Mann-Whitney test was used. This test was used because the cohort was skewed and parametric assumptions were not met. A two-sided *p* value at 95% confidence interval was used for this test i.e. *p* value ≤ 0.05 would be significant. Nutritional values reflecting the current dietary habits of the Maltese cohort were compared with similar values from the 1983 study of Katona *et al.*

Results

A total of 166 patients were recruited for the analysis (Table 1). Of these 166, 75 had T2DM and 91 were nondiabetic (Table 2).

***Table 1**: Baseline Characteristics of the cohort- Mean (± 95% confidence intervals)*

	Male and female (*n*=166)	**Males (*n*=83)**	**Females (*n*=83)**	**p value[1]**
Age (years)	56.92 (44.34-69.5)	56.75 (44-69.5)	57.10 (44.61-69.59)	
Weight (kg)	78.58 (61.69-95.47)	87.60 (73.23-101.97)	69.56 (55.32-124.88)	**<0.01**
Height (cm)	164.9 (156.79-173.01)	170.28 (164.39-176.17)	159.51 (153.25-165.77)	**<0.01**
BMI (kg/m^2)	28.82 (23.32-34.32)	30.23 (25.37-35.09)	27.41 (21.71-33.11)	**<0.01**

[1]Mann-Whitney test

***Table 2**: Baseline characteristics according to diabetes status- Mean (± 95% confidence intervals)*

	T2DM (*n*=75)	**Nondiabetics (*n*=91)**	**p value[2]**
Age (years)	59.28 (48.03-70.53)	54.98 (41.65-68.31)	
Weight (kg)	83.93 (67.61-100.25)	74.16 (58.03-90.29)	**<0.01**
Height (cm)	163.88 (156.37-171.39)	165.74 (157.21-174.27)	0.22
BMI (kg/m^2)	31.17 (25.91-36.43)	26.89 (21.96-31.82)	**<0.01**

[2]Mann-Whitney test

There were statistically significant differences in weight, height and BMI between males and females (Table 1) and in weight and BMI in diabetics and nondiabetics (Table 2).

Prevalence of obesity was 43.4% (*n*=36) in males and 25.3% (*n*=21) in females while 49.3% (*n*=37) of the diabetic cohort were obese compared to the 22.0% (*n*=20) of the nondiabetic cohort.

Nutritional data showed there were significant differences between males and females in energy intake, protein, fat, carbohydrate and cholesterol intake (Table 3).

There were no statistically significant differences in the nutritional data for the diabetic and non-diabetic cohorts (Table 4).

The study performed by Katona *et al* 1983, presented the means and standard error of the mean (SEM) for different nutrients and from the data collected in this project, similar data was calculated and hence compared. Of note Katona *et al* 1983 presented data for the whole population of Malta. Table 5 and 6 show the 1983 data and the data from this cohort.

As can be seen from Table 5, the percentage protein intake is similar, percentage fat intake has decreased and percentage carbohydrate intake has increased. These changes were noted both in the male and female cohorts. From Table 6, it can be seen that the mean total daily energy intake is much lower in the current cohort compared to the 1983 cohort. This is reflected in all the mean daily macro-nutrient intake especially fat and cholesterol intake. There was a major decrease in dietary fibre intake for both males and females in the current cohort compared to the 1983 cohort.

***Table 3**: Baseline Nutritional values of the cohort- Mean (95% confidence intervals)*

	Male and female	Males	Females	p value[3]
Energy (kcal/day)	1708.27 (1249.04-2167.50)	1905.85 (1390.15-2421.55)	1510.68 (1481.93-1539.43)	**<0.01**
Protein (g/day)	71.35 (52.41-90.29)	78.51 (58.36-98.66)	64.19 (49.63-78.75)	**<0.01**
Fat (g/day)	63.70 (33.76-93.64)	74.99 (39.48-110.50)	52.40 (35.51-69.29)	**<0.01**
Carbohydrate (g/day)	213.41 (160.96-265.86)	227.50 (172.44-282.56)	199.32 (153.48-245.16)	**0.02**
Sugar (g/day)	87.34 (51.73-122.95)	89.55 (52.58-126.52)	85.15 (50.88-119.42)	0.46
Cholesterol (mg/day)	184.04 (25.65-343.43)	222.55 (19.41-425.69)	145.53 (66.68-224.38)	**<0.01**
Fibre (g/day)	18.19 (11.86-24.52)	18.05 (11.01-25.09)	18.33 (12.75-23.91)	0.44
Poly/Sat fat ratio	0.62 (0.32-0.92)	0.6 (0.29-0.91)	0.63 (0.34-0.92)	0.30

[3]Mann-Whitney test

***Table 4**: Baseline Nutritional values for patients with T2DM and nondiabetics Mean (± 95% confidence intervals)*

	T2DM	Nondiabetics	p value[4]
Energy (kcal/day)	1723.82 (1248.14-2199.50)	1695.45 (1247.98-2142.92)	0.67
Protein (g/day)	71.84 (55.03-88.65)	70.95 (50.34-91.56)	0.33
Fat (g/day)	65.69 (36.82-94.56)	62.06 (31.19-92.93)	0.48
Carbohydrate (g/day)	211.57 (156.92-266.22)	214.93 (164.11-265.75)	0.49
Sugar (g/day)	83.90 (45.35-122.45)	90.17 (57.23-123.11)	0.10
Cholesterol (mg/day)	178.43 (92.26-264.60)	188.66 (-10.95-388.27)	0.43
Fibre (g/day)	19.10 (12.87-25.51)	17.44 (11.17-23.71)	0.09
Poly/Sat fat ratio	0.66 (0.32-1.00)	0.58 (0.31-0.85)	0.12

[4]Mann-Whitney test

***Table 5**: Food intake as percentage of total energy- Mean ± SEM*

	1983 data[5]		Current cohort	
	Males	**Females**	**Males**	**Females**
Protein percentage intake	16.5 ± 2.5	16.5 ± 6.0	16.43 ± 0.34	16.81 ± 0.35
Fat percentage intake	41.5 ± 7.3	45.5 ± 8.0	33.85 ± 0.77	30.34 ± 0.74
Carbohydrate percentage intake	41.9 ± 7.8	38.0 ± 8.5	44.54 ± 0.74	48.40 ± 0.83

[5]Katona *et al*, 1983

***Table 6**: Daily food intakes- Mean ± SEM*

	1983 data[6]		Current cohort	
	Males	**Females**	**Males**	**Females**
Energy (kcal)	3472 ± 1119	2785 ± 757	1905.85 ± 56.60	1510.68 ± 30.92
Protein (g)	139 ± 44	122 ± 28	78.51 ± 2.21	64.19 ± 1.59
Total fat (g)	156 ± 56	145 ± 53	74.99 ± 3.89	52.40 ± 1.85
Carbohydrate (g)	359 ± 136	267 ± 87	227.50 ± 6.04	199.32 ± 5.03
Sugar (g)	126 ± 73	108 ± 62	89.53 ± 4.05	85.15 ± 3.76
Dietary cholesterol (g)	1207 ± 494	1143 ± 656	222 ± 22.29	145.53 ± 8.65
Dietary fibre (g)	31.5 ± 11.8	25.6 ±9.0	18.05 ± 0.77	18.33 ± 0.61

[6]Katona *et al*, 1983

Discussion

The aim of this study was to define the current diet of the Maltese population in particular the dietary habits of people suffering from T2DM and compare it with the 1983 data.

Significant differences between males and females were noted in weight, height and BMI. Males had a significantly higher BMI. T2DM patients weighed more and had a higher BMI than nondiabetics and this was a statistically significant difference with a p value < 0.01. The prevalence of obesity in the diabetic cohort was 49% compared to a 21% in the non-diabetic cohort. This means that T2DM in the Maltese population is strongly related to a higher BMI. Increased weight and obesity are associated with the metabolic syndrome and this in itself predisposes to an increased risk of T2DM.[7]

Therefore lifestyle advice especially on weight loss and physical activity should be the primary focus especially in the newly diagnosed. Lifestyle advice should be given in a structured manner. A number of studies on lifestyle interventions have been published and all emphasize the importance of knowledge.[8-9]

This study showed that patients are not changing their diets after being given the diagnosis of T2DM. There seems to be a general difficulty in changing lifestyle habits when it comes to increasing exercise and eating healthier foods. Since these lifestyle habits are dependent on complex factors like socioeconomic status and attitudes determined by culture they are very difficult to change. It would be easier to instil healthier attitudes among children who will hopefully grow up to be healthier adults. There are multiple studies of interventions in schoolchildren[10-11], however

very little or no data about long term benefits.

Comparison with the 1983 data- did the Maltese diet change over a 20 year period?

From the current cohort, the percentage protein intake was noted to be similar, the percentage fat intake has decreased and percentage carbohydrate intake has increased. The mean total daily energy intake is much lower in the current cohort compared to the 1983 cohort.

Fat intake has decreased markedly. Katona *et al* in 1983 had commented about the extremely high fat intake in the Maltese population at the time. The levels have markedly decreased in males but more exponentially in females. The values for mean daily fat percentage intake are 41.5% for males which decreased to 33.85%, and 45.5% for females which decreased to 30.34%. Dietary cholesterol was also much higher in the 1983 cohort. This probably reflects a change in lifestyle habits and the Maltese are ingesting less saturated animal fats than they used to.

Total carbohydrate intake has increased considerably when compared to the intake in the 1980's. Possibly this has happened because carbohydrates are now replacing the extra fat that the Maltese used to ingest at the time. Paradoxically the amount of simple sugars has decreased when compared to the 1983 data. This means that the carbohydrate intake of the Maltese today is mostly made up of complex carbohydrates as opposed to 20 years ago. Even though the types of food have not been looked into specifically, from simple observation we believe the most popular forms of carbohydrate now eaten in Malta are bread and pasta.

There was a major decrease in dietary fibre intake for both males and females in the current cohort as compared to the 1983 cohort. As previously mentioned this may show that the Maltese are eating less fruit and vegetables. There is a concomitant increase in carbohydrate intake and this suggests that fibre rich foods are being replaced by carbohydrates.

Limiting factors

The sample size was relatively small and this was limited by human resources and time. Data collection was a very long process in itself. There were also logistic problems.

All the participants were recruited through clinics inside the main government hospital and through general practice clinics. The majority were collected from hospital clinics. The whole cohort was a convenience sample and therefore it may not represent a normal distribution.

The figures quoted for the dietary intake levels obtained from the questionnaires may be an underestimate of some of the nutrients in the diet because patients were not exhaustive in their descriptions. This is a recognised problem with dietary histories[12] and the reasons may be very varied. Knowledge of health and diet, perceived body image and perceived reasons of the study are among the possible reasons.[12] Another problem that arose during analysis was that the program used for the analysis, Dietplan 6, was not exhaustive in the list of foodstuffs which are typical of the area. Therefore adjustments were made by replacing some foodstuffs with other similar ones found on the program like for example capers were replaced with green olives.

Conclusion

Previous to this study, very little data had been collected about the nutritional habits of the Maltese population.

From the results one can note that the prevalence of obesity in the T2DM cohort was 49%, on average double that in the normal population which is 21%. Diabetics appear not to be changing their diets once they are given their diagnosis. Compared to the 1983 data, the Maltese seem to be eating more carbohydrates, less fat and fibre.

These results show that education is needed regarding all aspects of a healthy lifestyle including dietary advice. Lifestyle changes need to become a priority to achieve better outcomes and hence quality of life.

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