(RESEARCH ARTICLE)

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Prevalence of obesity in diabetic patients in the north west of Libya

Khaled Ali Alawaini [1, *] and Mustafa Ali Abugila [2]

[1] PhD student, Biochemistry department, Memorial University, Canada.
[2] Head, Biochemistry and Clinical Biochemistry department, University of Tripoli, Libya.

Abstract

Diabetes mellitus, or simply "diabetes", has been commonly defined as a metabolic disorder that interferes with a body's ability to efficiently turn food into energy. Although the disorder has many different causes, the primary characterization of diabetes is a high level of blood glucose accompanied by disturbed metabolism of fats, proteins and carbohydrates due to defective insulin production or uptake by the body. The main objective of this study is to assess the effect of obesity and lifestyle on diabetes. A total of 500 diabetic patients (215 males and 285 females) of different ages from six primary health care centers in northwestern Libya participated in the study, which was conducted from November 2008 to the end of April 2009. As well, interviews were carried out using a questionnaire to compile information on the patients regarding age, sex, residence, height, and weight. In the study, body mass index was formulated by dividing each participant's weight (in kg) by his or her height (m^2). The results of the investigation indicate that the age at diagnosis ranges between 10-85 years, with a mean age of 54.84 ± 13.73 years. About 36% of the diabetic patients in the study were overweight and 44.4% were obese (males 39.07% and 34.42%; females 33.68% and 51.93%, respectively). Obesity was more prevalent among females than males. Only 96 (19.2%) of the 500 patients were on a diet regimen. It was found that mean BMI was 29.53 kg/m^2 ± 5.07 and mean blood sugar 186.62 ± 69.40 mg/dl.

Keywords: Diabetes; Obesity; BMI; Blood sugar

1. Introduction

Diabetes mellitus is a metabolic disease that can have many causes. It is characterized by chronic hyperglycemia with disturbances of carbohydrate, fat, and protein metabolism resulting from defects in insulin secretion, insulin action, or both [1]. In general, diabetes overwhelmingly tends to occur in relation to obesity, with more than 90% of individuals having type 2 of diabetes [2]. In particular, obesity has been determined to be a significant risk factor for type 2 (T2) diabetes (also known as non-insulin-dependent diabetes mellitus [NIDDM]). This form of the disorder may result in hyperglycemia caused by insulin deficiency or resistance. Type 1 insulin-dependent diabetes mellitus (IDDM) is characterized by hyperglycemia caused by a lack of insulin due to autoimmune disease [3].

Diabetes has an enormous social effect, mostly due to chronic microvascular and macrovascular complications [3]. However, 194 million people worldwide have diabetes, and its prevalence is expected to double by the year 2025 to 6.3% of the global population [4]. In Libya, 88,000 diabetic patients were recorded in 2000, and this number is estimated to reach 245,000 by 2030 [5]. In addition to diabetes, obesity increases the risk of other chronic disorders such as hypertension [6] and cardiovascular disease (CVD) [7]. Obesity in diabetic patients can lead to a disturbance in lipid metabolism, resulting in dyslipidemia, which is associated with a high level of triglyceride (TG) and low levels of high-density lipoprotein (HDL), as well as a high level of low-density lipoprotein (LDL) [8]. A diagnosis of diabetes depends

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* Corresponding author: Khaled Ali Alawaini
PhD student, Biochemistry department, Memorial University, Canada.

on fasting plasma glucose or a 2-hour oral glucose tolerance test (OGTT). Moreover, glycosylated hemoglobin (HbA1C) can provide a full picture of the previous three months ago [9].

1.1. Objectives

To assess the effect of obesity and lifestyle on diabetes.
To evaluate the extent of diabetes control among patients of interest.

2. Study design and research methods

A total of 500 diabetic patients (215 males and 285 females) of different ages from six primary healthcare centers in the northwestern part of Libya (Sabrata, Surman, Alagelat, Zawara, Algamel, and Regdalin) were considered as a sample. The survey was conducted from November 2008 to the end of April 2009. Of the 500 subjects who were approached to participate, 500 (100%) gave their consent. Face-to-face interviews were introduced using a questionnaire that collected information on each patient regarding name, age, sex, residence, height, and weight. A Seca (Germany) scale was used to measure height (in cm), with the subjects measured while standing in an upright posture in bare feet. Body weight was measured (in kg) using a Seca (Germany) weight scale and with subjects in bare feet and wearing light clothes.

Further, and as recommended by the World Health Organization (WHO) and several works in the literature [6], body mass index (BMI) in this study was formulated by dividing the subject's weight in kg by their height in m^2 (i.e., kg/m^2). BMI was categorized as underweight if less than 18.5 kg/m^2, normal weight if 18.5-24.9 kg/m^2, overweight if 25.0-29.9 kg/m^2, and obese if BMI was > 30 kg/m^2. Diabetic patients were also tested for the concentration of fasting blood glucose (FBS) using the Beckman coulter glucose analyzer 2 model. Additionally, venous blood samples were collected in a container with sodium fluoride, after which the plasma was immediately (i.e., within 2-6 hr) separated and measured for glucose concentrations.

2.1 Data analysis

Statistically, the compiled data were computer-analyzed using SPSS version 16 software and Excel 2007.

3. Results

A sample of 500 attending patients was interviewed over the course of six months. The age structure among the sample was divided into six different age groups, with the age at diagnosis ranging between 10-85 years and a mean age of 54.84 ± 13.73 years. The majority of patients were located in the age group > 60, followed by the age group of 50-59. About 36% of diabetic patients were overweight and 44.40% were obese (males 39.07% and 34.42%; females 33.68% and 51.93%, respectively). Out of 222 obese patients, 66% were females and the remaining 44% were males. As illustrated in Table 2, the mean BMI was 29.53 ± 5.07 kg/m^2 and the mean blood sugar (BS) was 186.62 ± 69.40 mg/dl. Only 96 (19. 2%) of the 500 patients were on a diet, as shown in Table 6.

Table 1 Percentage of Patients Based on Address.

City	Total	% Total
Sabratha	65	13.00
Sorman	75	15.00
Alagelat	50	10.00
Regdalin	104	20.80
Alagamel	109	21.80
Zawara	97	19.40
Total	500	100.00

P value > 0.05 Not Significant. In this study, a sample of 500 patients was taken from a different area of north-western Libya, as shown in Table 1.

Table 2 Mean and Standard Deviation of BMI and FBS.

	BMI (kg/m^2)	BS (mg/dl)
Total samples	500	500
Mean	29.53	186.62
Std.	± 5.07	± 69.40

The BMI and blood glucose means were found to be very high (29.53 km/m^2 and 186. 62 mg∕dl, respectively), as shown in Table 2.

Table 3 Mean of Blood Glucose for Different Ages of Diabetic Patients

Age Group	Mean BS in (mg /dl)	Range	STD
10 - 19	185	48 - 360	101.83
20 - 29	181.5	78 - 310	85.52
30 - 39	194.4	72 - 481	95.23
40 - 49	180	44 - 350	63.28
50 - 59	190.4	51 - 469	74.26
> 60	186.6	50 - 399	61.65

The diabetic patients were investigated for blood glucose concentration. It was found that, compared with other groups in the study, the highest level of mean blood glucose was in the age group 30-39 years (194.4 mg∕dl). However, this might indicate a lack of nutritional awareness and bad eating habits of patients within this age group.

Table 4 Classification of Diabetic Patients According to BMI

BMI	Total	Percentage (%)
Normal	92	18.4
Overweight	180	36
Underweight	06	1.2
Obese	222	44.4

The studied patients were distributed according to the WHO classification of BMI. Overall, 19.6% of the patients were either underweight or normal, 36% were overweight, and the remaining 44.4% were obese.

Table 5 Percentage of BMI in Males and Females

BMI	Male	%	Female	%
Underweight & Normal	57	26.51	41	14.39
Overweight	84	39.07	96	33.68
Obese	74	34.42	148	51.93
Total	215	100%	285	100%

P-value <.000001. There was a highly significant difference between the proportion of underweight and normal male and female patients compared to the proportion of overweight and obese male and female patients. Of the 215 male patients, 57 (26.51%) were either normal or underweight, 84 (39.07%) were overweight, and the remaining 74 (34.42%) were obese. Out of 285 females, 41 (14.3%) were either normal or underweight, 96 (33.68%) were overweight, and 148 (51.93%, representing the majority) were obese.

Table 6 Distribution of Patients on a Diet Regimen (Healthy Food).

Total	Diet Regime	% Diet Regimen	No Diet Regimen	% No Diet Regimen
500	96	19.20%	404	80.80%

Among the diabetic patients in this study, only 96 (19.2%) were on some kind of a diet regimen, while the remaining 404 (80.8%) were not.

4. Discussion

 Patients residing in northwestern Libya were enrolled in this study to assess their blood glucose and diet control in relation to age, gender and obesity. A total of 500 diabetic patients, ranging from 10-85 years (with a mean of 54.0 years) participated in the study. It was found that the mean of blood glucose (186.62 ± 69.40 mg/dl) and prevalence rates increased with each successive age group and peaked in the 30-39 years' age group, followed by the 50-59 years' age group. About 36% and 44% of diabetic patients were overweight or obese, respectively, and obesity was found to be higher among women (51.93%) than men 34.42%).

Another study in Libya revealed that 69% have a BMI of more than $25kg/m^2$ [3]. However, in the present study, diabetes was significantly associated with BMI, with a high prevalence rate of obese (44.4%) and overweight (36%) diabetic patients. A survey conducted by Khattab [10], which included 917 patients, showed that 33% of their research participants were overweight, whereas in our study, 36% were overweight. This study showed that 44.4% were obese while in the Khattab study [10] 58% were obese. We also concluded that out of the 215 male patients, 57 (26.51%) were either normal or underweight, 84 (39.07%) were overweight, and the remaining 74 (34.42%) were obese. Of the 285 female patients, 41 (14.39%) were either normal or underweight, 96 (33.68%) were overweight, and the majority 148 (51.93%) were obese. This difference in body weight is statistically significant ($P< .000001$).

The present study also showed that obesity was higher in females than males. Over 51% of the 285 females were obese, whereas only 34.42% of the 215 were obese. Additionally, this study showed that only 19.2% of patients were following nutritional diet regimens, whereas 80.80% were not. In contrast, Abdella [11] revealed that out of 3,299 patients studied in Kuwait, 23.7% were on diet control.

Poor diet control may lead to an increase in blood glucose, with more diabetes complications reflecting an increase in economic costs. The present study found poor diet control in the studied sample, as indicated by the high mean value of blood glucose (186.62 mg/dl) and the high number of patients not using any diet control (80.8%). Over time, poor diet control can lead to significant complications that impact the patient's health.

5. Conclusion

The present study revealed that sedentary lifestyle and obesity are contributing factors to diabetes epidemics. However, more attention should be given to an educational program that emphasizes lifestyle and diet modification. Along with appropriate treatment, exercise and a healthy diet regimen would be of great benefit in glycemic control.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare no conflict of interest.

Statement of informed consent

All individual participants in the study gave their informed consent.

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