Original research

Type 2 diabetes and its correlates in a first nationwide study among Cypriot adults

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ARTICLE INFO

ABSTRACT

Obesity rates in Cyprus are very high and epidemiological information on type 2 diabetes mellitus is limited. The correlates of type 2 diabetes among adults remain unknown in the Cypriot population. Thus, the purpose of this study is to provide the first national estimate of the prevalence of type 2 diabetes and investigate its correlates. A randomly stratified nationally sample of 1001 adults aged 18–80 participated in the study. Only 950 subjects completed the study. All subjects were free of any diseases (known diabetes, kidney, liver), medication and supplementation. The overall prevalence of diabetes and pre-diabetes based on WHO criteria was 9.2% and 16.3%, respectively. After adjusting for age, energy intake, smoking and physical activity participants with obesity (BMI) (OR = 2.00, P < 0.001), waist circumference (WC) (OR = 2.08, P < 0.001), hypertension (HT) (OR = 1.99, P < 0.001) and hypercholesterolemia (HC) (OR = 2.07, P < 0.007) were most likely to develop T2DM compared with the normal ones. The odds of having diabetes were also found significant between subjects with high levels of triglycerides (TG) (OR = 1.49, P < 0.007), compared with the normal ones and between subjects with low levels of HDL (OR = 1.44, P < 0.008) compared with the ones with high levels of HDL. The prevalence of type 2 diabetes in Cyprus is relatively medium–high. However, the pre-diabetes rates are very high showing a promising increase toward total rates of type 2 diabetes. Obesity, HT, WC, TG, HC and low HDL are all strong correlates of type 2 diabetes.

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Healthy education programs should be initiated for young and older-aged people and those with described abnormal risk factors.

1. Introduction

Overweight and obesity have reached epidemic proportions globally along with an adaptation of a westernized lifestyle which is characterized by a combination of excess food intake and inactivity [1,2]. In 2008, statistics from all over the world reported that around 1.5 billion of people were overweight (BMI > 25 kg/m^2) while 508 million people were obese [3]. This dramatic rise in the prevalence of obesity has been accompanied by alarming increases in the incidence and prevalence of type 2 diabetes and metabolic syndrome (MS) [4], as well as atherosclerosis, hypertension and stroke [5].

The estimated global prevalence of type 2 diabetes is expected to increase overall 39%, from 4.6% in 2000 to 6.4% in 2030 [6]. Overall, the prevalence of diabetes is higher in men than in women, higher after the age of 40 years, while, on a country basis, India, China, USA, Indonesia and Japan are in the first line [6]. It is worthy to point out that in these countries, the adult diabetic population is estimated to be increased more than double by 2030. A recent review [7] that was published in *Lancet* analyzed the trends of diabetes since 1980 in a pooled analysis study of 751 populations with 4.4 million participants. In this review, the global age-standardized diabetes prevalence increased from 4.3% in 1980 to 9.0% in 2014 in men, and from 5.0% to 7.9% in women. In addition, the age-standardized adult diabetes prevalence in 2014 was lowest in northwestern Europe, and highest in Polynesia and Micronesia, at nearly 25%, followed by Melanesia and the Middle East and north Africa. Moreover, in 2014, American Samoa had the highest national prevalence of diabetes (>30% in both sexes), with age-standardized adult prevalence also higher than 25% in some other islands in Polynesia and Micronesia [7].

Findings from epidemiological studies have repeatedly confirmed the positive relation between obesity and developing type 2 diabetes [8,9]. Other factors related to hyperglycemia are abdominal/visceral adiposity, hyperinsulinemia and insulin resistance [10]. Type 2 diabetes remains a leading cause of cardiovascular disorders, blindness, end-stage renal failure, amputations and hospitalizations. It is also associated with increased risk of cancer, serious psychiatric illness, cognitive decline, chronic liver disease, accelerated arthritis and other disabling or deadly conditions [11].

Cyprus is a Greek island country in the Eastern Mediterranean Sea, off the coast of Syria and Turkey and east of Greece. Data (not full paper) from International Diabetes Federation (IDF) [12] reveal that the prevalence of type 2 diabetes is very high, 10.4% of the total population, while another 6.7% suffer from impaired glucose tolerance (pre-diabetes) [12]. This situation will deteriorate in the future, with an estimate of 15% of adult citizens with diabetes in 2030.

Moreover, about one-third of all people with type 2 diabetes are unaware of their condition and remain untreated. This means that one out of five people with type 2 diabetes are diagnosed too late, resulting in increased complications and costs [13]. Furthermore, Cyprus has one of the highest European incidence rates for obesity: almost one in two Cypriot men is overweight (46%) and one in four is obese (26,5%). One in three Cypriot women is overweight (34%) and one in five is obese (24%) [14]. A more recent study showed that the prevalence of OW and OB in Cyprus was 46.9% and 28.8% for males and 26% and 27% for females, respectively [15].

So far, information of the prevalence of type 2 diabetes is limited and there is no data available concerning diabetes-related complications for the Cypriot population. Thus, the purpose of this study is to report on the prevalence of type 2 diabetes and to identify risk factors associated with, in a population-based study of healthy Cypriot adults.

2. Methodology

The national survey took place during 2005–2009, and included 1001 Cypriot adults aged 18–80 (48.5% males/51.5% females). The figures of the subjects were adopted by the Cyprus Ministry of Health while the statistical error for the sample size was 3%. The sample was representative from all main cities and suburbs in Cyprus (Nicosia, Limassol, Pafos, Larnaka and Famagusta). The selection of the subjects was performed randomly using the 2005 telephone directory, and the total final sample was stratified and in full compliance with the demographics of the Republic of Cyprus. Out of the 1001 adults, after excluding missing data the final sample size was 950 subjects. Detail information of the whole procedure and any possible health risks was given to the subjects prior to any intervention and a consent form was signed by all subjects willing to participate. The study was also approved by the Cyprus National Bioethics Committee.

Body weight and height was calculated using a scale with Stadiometer from Seca 700. BMI was calculated by dividing weight (kg) by height squared (m^2). The categorization of the weight situation of the subjects according to the BMI was taken as follows: BMI 20–25 normal weight, BMI 25–30 overweight, and BMI >30 obese. Waist circumference (WC) was measured to the nearest 0.1 cm using a regular tape. Bioelectrical impedance analysis was used to measure body fat (BF) levels (Tanita TBF-215, England). Blood pressure was obtained in a relaxed supine position; three measurements were performed at intervals of 3 min, and the mean number of the three values was considered as the BP [16]. Blood cholesterol levels were considered "borderline high" if they were ≥200 mg/dL [17].

Information on socioeconomic status and dietary status such as energy intake, carbohydrate and fat intake as well as exercise and smoking information were collected from all par-