O R I G I N A L   A R T I C L E

Type 2 Diabetes Mellitus (Type 2 DM) incidence and associated factors: a cross sectional study in Istanbul, Turkey

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Summary. *Background:* Incidence of Type 2 Diabetes Mellitus (Type 2 DM) is considerably high in Turkey and has been associated with risk factors as obesity, nutrition, socioeconomic status and education. Lifestyle-intervention programs may be of special significance in impaired glucose tolerance and development of DM. *Objective:* This research was planned as a observational cross-sectional study, in order to determine the major factors associated with the incidence of DM. *Methods:* The study was carried out in Beykoz Public Hospital Tepeustu, Istanbul. The patient population comprised of 18970 patients with Type 2 DM. Incidence of diabetes were evaluated according to gender, age, education, income level with descriptive statistical analyses. *Results:* DM incidence was highest in females of age group 61-75 years (31,29%) followed by men within the same age group (16,35%). Also the incidence was highest in the individuals with primary school education (37,97%) followed by individuals with no formal education (32,43%). DM increased as income decreased with highest percentages (36,56%) recorded among patients having personal income less than 1000 TL per month. *Conclusion:* As the study indicates poverty and lack of education are major contributing factors; effective policies aimed at decreasing poverty and increasing education level should be implemented in the lower strata of the society.

Keywords: diabetes mellitus, socioeconomic status, gender, education, age

Introduction

Type 2 Diabetes Mellitus (Type 2 DM) is one of the major chronic disease that has been increasing progressively over the last two decades worldwide as well as in Turkey (1). Presently, 13,7% of the Turkish population is affected by DM (1,3% Type 1 and 12,4 % Type 2), exhibiting a 90% rise in the last 12 years (2).

The association of many chronic diseases and their risk factors with lifestyle, nutrition and health awareness has been well documented (3,4). Evidences from prospective observational studies and clinial trial performed over the past couple of decades emphasize on low glycemic index carbohydrates and vegetarian style dietary pattern for prevention against obesity, type 2 diabetes mellitus and cardiovascular diseases (5). The rise in the incidence of type 2 diabetes is closely linked to the increase in obesity. Approximately 90% of type 2 diabetes is attributable to excess weight especially abdominal obesity which leads to impaired glucose intolerance and metabolic syndrome (6). According to the reports of Turkish Diabetes, Hypertension, Obesity and Endocrinology Diseases Prevalence Studies 2016, TURDEP II (2), incidence of obesity (BMI ≥30) for Turkish adult males and females was found to be 23,9% and 35,0% respectively.

Apart from factors such as obesity, gender, physical inactivity, smoking and low birth weight; socioeconomic status (7,8) and educational level (9) have also been described as risk factors implicated in the development of Type 2 DM Considering the fact that obesity prevalance is also considerably high in Turkey (10,11) lifestyle-intervention programs for increasing awareness may be of special significance in individu-

als with obesity related impaired glucose tolerance and those exhibiting high risk for the development of DM.

This research was planned as an observational cross-sectional study, in order to determine the major factors associated with the incidence of Type 2 DM namely gender, age, education and income level in a population diagnosed with the disease. Obesity has been shown to have a direct relation with Type 2 DM in several studies (6,12). So obesity factor was left out of the parameters considered in this study.

Methods

The study was carried out in Beykoz Public Hospital Tepeustu, one of the two public hospital in the Beykoz county, located on the Anatolian part of Istanbul with a population of about 251.087 (13), having a mixed socio-economic status. All patients visiting the Diabetes Polyclinic of Internal Medicine Department of the Hospital and diagnosed with Type 2 DM as per standardized diagnostic criteria (14) during 2011-2017 years were included in the study (n=18970). Information regarding demographic properties were recorded (Table 1). Level of education (Table 2) and income level (Table 3) were recorded in the hospital database based on respondent's self report. Incidence of Type 2 DM based on gender, age group, level of education and income was evaluated from the database.

Education was categorized into five groups. The first group consisted of individuals who stated having no formal education in school, followed by subjects having 4 years of primary school education, 4 years of secondary school, 4 years of high school education and university graduates.

Based on TEKSIF (Turkish textile, weaving, garment, leather industries labour union) declaration and national wage level classfication (15,16), mimimum monthly wage for an individual to be able to cross the poverty level is approximately 1000 TL. Therefore in this study, personal monthlyincome was classfied into four categories; upto 1000 TL/month (poverty level), 1001-2000 TL/month (lower middle category), 2001-3000 TL/month (upper middle category) and 3001-4000TL/month and above (upper category).

Ethical Issues

The data belonging to the patients have been included in this study with their permission and their identities were kept confidential. This study was approved by the Ethical Committee of Istanbul Aydin University.

Statistical Analyses

SPSS (Statistical Package for the Social Sciences) package program (version 18) was utilized for statistical analyses of the obtained data comprising demographic characteristics (age, gender, education, and income level) of the patient population. Descriptive statistical analyses namely frequencies (n), and percentages (%) were calculated where applicable.

Results

Total number of subjects included in the study was 18970 out of which 7827 (41,26%) were males. Based on age and gender, Type 2 DM incidence was mostly seen in women in the age group of 61-75 years (31,29%) followed by men within the same age group (16,35%). The incidence of Type 2 DM rose noticeably at 46-60 years in both genders and peaked at 61-75 age group. (Table 1, Figure 1).

When evaluated on the basis of education, incidence of Type 2 DM was highest in the individuals with primary school education (37,97%) followed by individuals having no formal education (32,43%). Incidence of Type 2 DM fell drastically among subjects who were high school (5,78%) and university graduates (1,93%). (Table 2)

In Table 3, incidence of diabetes among the patients have been listed against income categories. According to the data the incidence of Type 2 DM increased as income decreased with highest percentages (36,56%) of the disease recorded among patients belongining to the poverty level category followed by lower middle income category (Table 3).

Table 1. Incidence of Type 2 DM According to Demographic Characteristics

| Age Group (years) | Incidence of Type 2 DM (n=18970) | | | |
| | Males | | Females | |
	n	%	n	%
30-45	328	1,73	562	2,96
46-60	1957	10,32	1789	9,43
61-75	3102	16,35	5936	31,29
76 and above	2440	12,86	2856	15,06
TOTAL	**7827**	**41,26**	**11143**	**58,74***

* Incidence of Type 2 DM in females were significantly higher than males significantly higher as compared to males (p<0,05)
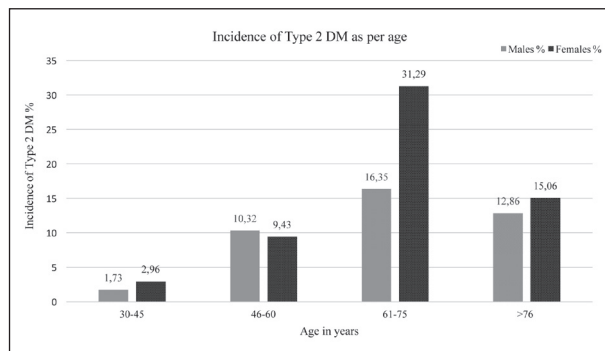
Figure 1. Incidence of Type 2 DM (%) as per age and gender

Table 2. Incidence of Diabetes and Level of Education

| Education | Incidence of Type 2 DM (n=18970) | |
	n	%
No formal Education	6152	32,43
Primary School Graduate	7204	37,97
Secondary School Graduate	4153	21,89
High School Graduate	1095	5,78
University Graduate	366	1,93
TOTAL	**18970**	**100**

Table 3. Incidence of Type 2 DM based on Personal Income Level

| Income Level | Income category | Incidence of Type 2 DM (n=18970) | |
		n	%
0-1000 TL	Poverty level	6936	36,56
1001- 2000 TL	Lower middle	5571	29,37
2001-3000 TL	Upper middle	4520	23,83
3001-4000 TL	Upper	1943	10,24
TOTAL	**TOTAL**	**18970**	**100**

Discussion

The aim of this study was to to determine the major demographic factors associated with the incidence of Type 2 DM in a population and important correlation was identified for factors such as gender, age, economic status and education. (Table 1,2,3, Figure 1).

In 2015, the total number of Turkish population suffering from diabetes mellitus was calculated to be approximately 7 million (9% of total population) of which 85% were diagnosed to have Type 2 DM. Also, difference in diabetes prevelance between males and females or rural and urban life was not found to be significant. (2). However in this study, out of 18970 patients diagnosed with Type 2 DM; incidence of the disease in females was significantly higher than in males (p<0,05). The findings are similar to a study performed in Nigeria investigating gender and age specific incidence and associated risk factors of type 2 diabetes mellitus on 3500 subjects (17). Type 2 DM incidences were higher in females (11,2%) as compared to males (9,6%). Also, the incidence of the disease was highest in the most elderly age group (46-60 years) age group. In a population based study (n=28,788) by Turkish Diabetes, Hypertension, Obesity and Endocrinology Diseases (TURDEP) investigating factors affecting type 2 DM, it was found that education level in men and socio-economic status in women had an effect on impaired glucose tolerance (IGT). Diabetes incidence was also found to be higher in women (p<0,0001) (18).

In this study the elderly groups comprised of individuals above 60 years of age and highest incidence of diabetes occurred in the elderly groups especially between 61-75 years of age (16,35% for males and 31,29% for females) (Figure1). According to TUIK (Turkish Statistical Institute) 2012 figures presented in International Diabetes Leadership Forum, 11% (approximately 8,4 million) of the Turkish population were 65 years of age and above and the Incidence of diabetes in this group was 34,8% (2,4 million) (19) rendering this group to be at a risk and increased predisposition to type 2 diabetes. Moreover, the demographic characteristics of the elderly population in Turkey and the World indicate that majority of older persons are women, poor, lonely and have lower educational levels (20). Older people have been suggested to be vulnerable to malnutrition

for many reasons including physiological and functional changes that occur with age, lack of financial support and inadequate access to food as well as their inability to carry out their day to day activities including preparation of food and intake (21).

In this study, incidence of Type 2 DM decreased with the rise in educational level (Table 2). Of the patients diagnosed with type 2 diabetes, 70% had a education level of primary school or lesser. Literacy and health literacy level has been found to be considerably low in elderly Turkish population in other studies performed (22). Other studies also suggest that age and sex adjusted diabetes incidences are highest in a population with lower socio-economic status or in poorer countries as compared to wealthier countries (23-25). Type 2 DM can be managed well by proper diet, physical activity and lifestyle management, a need for education is essential for health awareness and self management of the disease.

In this study, prevelance of Type 2 DM also fell as the income level increased, with 75% of incidences in patients belonging to the two lowest income level categories having a monthly income of less than 2000 TL. In Turkey (Table 3). Minimum wages in Turkey in 2018 remain approximately at 1600 TL, whereas elderly pension may fall below 1000TL/month due to variable reasons as incomplete payment of premium and so on (15,16). These results are in accordance with several other studies relating diabetes and other chronic diseases with socio-economic status of a population (25-28).

Limitations of the Study

In this study, obesity (or BMI) was not included among the parameters to be considered because there is adequate literature relating BMI/Obesity with Type 2 DM. Apart from that, it would also be of interest to study how the studied parameters (age, income, level of education) correlate among themselves. On the other hand, income and level of education may be expected be strongly correlated to each other. Nevertheless, the study may be repeated on another group including these parameters and others such as ethnic group, marital status, rural or urban life, other chronic diseases as hypertension, cardiovascular diseases and so on.

Conclusion

Effective diabetes care requires a collaboration and active communication between the patient and healthcare professional. This cooperation should include the provision of training to enable the patient to fully understand his illness, effects of the illness on health, providing appropriate and timely information. In addition, diabetes involves a proper balance between medical treatment, nutrition, exercise, blood glucose monitoring and most of all a behavioral change on the aprt of the patient. The consequences of diabetes treatment are to a large extent dependent on whether the patient continues to have a healthy lifestyle and whether he maintains the motivation to adapt to diabetes treatment.

Considering the increasing prevelance of obesity related chronic diseases including diabetes, in Turkey, the following health reforms may be suggested. Health care policies aimed at promoting health awareness, health care reforms introducing health coverage for all, and finally as the study indicates poverty and lack of education are major contributing factors; effective policies aimed at decreasing poverty and increasing education level should be implemented in the lower strata of the society.

Conflict of Interest

None stated by the authors.

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