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Full Length Research Paper

Trends in the prevalence of type 2 diabetes mellitus among Arabs in Israel: A community health survey

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In recent years, type 2 diabetes mellitus (T2DM) had become a worrying pandemic disease. Its prevalence was increasing in almost all societies worldwide, particularly in Arab populations. The aim of the current study is to determine the prevalence and trend of T2DM, during two successive periods of time, among Arab population in Israel, in relation to various sociodemographic variables. Data were collected from cross-sectional surveys during two periods (2005 and 2015). Databases were created and statistical analysis was carried out. Our results indicated that the incidence rate of T2DM was increasing significantly from 11.3% to 17.7% (p<0.05) during the periods surveyed, with a progressive increase with age in both genders. The high incidence rate among females in the first period was reversed to males during the second period. We conclude that recent changes in socioeconomic status and lifestyle in our community could be responsible for the increased occurrence of T2DM. Therefore, it is recommended to implement an intervention program for a systemic decrease in this alarming trend.

Keywords: Type 2 diabetes mellitus, Arab in Israel, Prevalence, Lifestyle

INTRODUCTION

Diabetes mellitus (DM) has increased dramatically worldwide during the last decades and it affects more than 382 million people around the world, of whom 90% are diagnosed with type-2 DM (T2DM) (Atlas, 2013). It is rapidly increasing in developing as well as developed countries, moreover, it is even found to be increasing to a higher extent in the Arab world (Boutayeb, 2012; Meo et al., 2017). The Middle Eastern and North African region has the highest comparative prevalence of 11% (Meo et al., 2017) and the second highest rate of increase in diabetes globally, with the number of people affected is expected to increase by 96.2% in 2035 (Atlas, 2013). Among the top 10 countries with the highest prevalence of diabetes (in adults aged 20 to 79 years), six of them are Arab countries *viz*, Kuwait (21.1%), Lebanon (20.2%), Qatar (20.2%), Saudi Arabia (20.0), Bahrain (19.9%) and UAE (19.2%) (Atlas, 2011). This chronic disease not only affects the health of patients themselves, but it also imposes significant direct and indirect costs on them, their relatives, and the whole society (Seuring et al., 2015).

Factors such as obesity, fast urbanization and lack of exercise are key determinants of the rapid increase in the rate of T2DM among the Arab world (Badran and Laher, 2012). Furthermore, the vast changes in the lifestyle of

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the people in the Gulf Cooperation Council (GCC) countries, often described as "westernization", due to the swift in the socio-economic condition, are leading to rapid changes in their way of life. This includes rapid growth in urbanization and a change in the traditional diet habits, thus, embracing fast food with deskbound lifestyle, that are the main causes of obesity and diabetes mellitus (Musaiger, 1992; Meo et al., 2006; Atlas, 2016).

The Arab population in Israel, which today counts about 1.8 million and belongs to various religions: Muslims (83.9%), Christians (8.3%) and Druze (7.8%), is an ethnic group with some unique cultural, religious and social characteristics that differ from those of the general population in Israel (Central Bureau of Statistics-Israel, 2016). This community is characterized by a high rate of consanguineous marriages and they live in localities, which were founded by small numbers of individuals (Sharkia et al., 2016). Furthermore, in recent years the Arab population of Israel has experienced a rapid change towards a westernized lifestyle (Treister-Goltzman and Peleg, 2015). The life expectancy of Arabs in Israel was lower than that for Jews, the main causes of death that might contribute to this gap between the two communities could be due to chronic diseases; especially ischemic heart disease and diabetes (Na'amnih et al., 2010). A study which was conducted on 1100 Arab and Jewish urban patients older than the age of 20 from the central area of Israel, showed that the prevalence of diabetes was 21% in Arabs while it was 12% in Jews. However, it was observed that Arabs developed diabetes 11 years earlier than Jews; 25% of the Arab population was diagnosed with diabetes by the age of 57 compared to the age of 68 in the Jewish population (Kalter-Leibovici et al., 2012). Recently, a self-reported survey confirmed the differences between Jews and Arabs in Israel in terms of diabetes prevalence accounting for 5.7% and 10.7%, respectively (Zucker et al., 2016). There are number of studies that investigated the prevalence of T2DM in the Arab community of Israel, but these studies concentrated on a specific regions or/and for a specific period of time. To the best of our knowledge, no previous study had been conducted on a sample that presented this community at various periods of time. The aim of our current comprehensive study is to determine the prevalence and the trends of diabetes type 2 among Arab community in Israel in relation to demographic factors.

METHODS

Study population and sample.

This research is based on data from two socio-economic and health cross-sectional surveys among the Arab population in Israel, conducted by the Galilee Society (GS) during two periods: the first period in 2005, and the second period in 2015. Each of the two samples was stratified multi-stage random sample which was designed in three stages: selection of enumeration areas in one stratification level, selection of thirty responsive households in the chosen enumeration area and selection of two persons; a male and a female, aging 18 years and above. This selection was chosen from each household in the second stage, using the spreadsheet (Kish) for random selection. The study population was divided into homogeneous strata taking into account the gender and the age group variables.

The samples size was estimated to be 3,173 households in the first period and 2,250 households in the second period.The target population consisted of all Arab households in Israel and focused, in the current study, on individuals aged 30 years and above from both the periods.

Survey questionnaire and data collection.

The survey accessed information about health status and sociodemographic parameters. Data regarding the sociodemographic variables included: gender, age, religion, educational level, labor force (employment, unemployment or outside the labor force that include the homemakers, the disabled and retired people) and location. Each locality was stratified by ‘place of residence’ according to: urban (>10,000 population), semi-urban (between 5,000 and 10,000 population) and rural (<5000 population). Information on diabetes was obtained from the subjects through interviews by the questions: have you ever been diagnosed by a physician as a diabetic? Participants, who answered yes, were asked about the type of diabetes and how old was he/she at the time of diagnosis? The sample excluded subjects that were affected with type 1 diabetes.

Questionnaires were completed through face to face interviews. The fieldwork team was recruited from a group of field experienced surveyors. A training course was conducted for these surveyors by the supervisors and the project administrators.

Data analysis.

The database was prepared in Access software. The data was subjected to random spot-checking and verification, and then it was imported into SPSS program for data management and statistical analysis. Frequency tallies were performed on all categorical variables, prevalence rates determined, and ^{2} tests were carried out as appropriate. A p-value <0.05 was considered significant.

All the participants recruited for the study gave their informed written consent after being given an explanation of purposes, conducted in accordance with the declaration of Helsinki.

Table 1. Prevalence (%) of T2DM in the studied sample during the two successive periods surveyed in relation to gender and age group.

Period Surveyed	2005			2015		
Age Group (years)	Men (%)	Women (%)	Total (%)	Men (%)	Women (%)	Total (%)
30-39	1.4	2.0	1.7	3.7	0.2	2.0
40-49	6.9	6.8	6.8	12.2	9.8	10.9
50-59	16.2	21.1	18.5	24.0	17.7	20.7
≥ 60	30.2	34.6	32.2	42.1	42.5	42.3
Total	10.7	12.0	11.3	19.4	16.1	17.7

Table 2. Prevalence (%) of T2DM in the studied sample during the two successive periods surveyed in relation to gender and demographic factors (30+ years).

Period Surveyed	2005			2015		
Demographic factors	Men (%)	Women (%)	Total (%)	Men (%)	Women (%)	Total (%)
Religion:						
Muslims	10.3	11.6	11	20.2	16.4	18.3
Christians	13.2	12.5	13	14.4	13.8	14.2
Druze	11.1	13.9	12.5	19.8	16.5	18.5
Locality Classification:						
Urban	11.9	14.3	13.1	18.4	16.2	17.3
Semi-Urban	10.5	11.2	10.1	21.7	16.1	18.8
Rural	9.1	9	9	19.2	15.9	17.6
Education:						
Not educated	19.7	22.8	21.7	38.5	35.7	36.7
Elementary and Preparatory	12.2	10.4	11.3	23.4	15.5	19.8
Secondary	4.2	2.6	3.5	10	6.3	8.2
Academic	7.4	3.4	5.7	9.6	4	6.7
Labor Force participation:						
Employed	5	2.9	4.5	9.9	4.2	8.1
Unemployed	4.4	3.7	4.3	9	12.5	11.1
Outside LF	20.8	14.3	16.3	39	21	26.7

RESULTS

Table 1 presents the prevalence of T2DM among the study population during the two successive periods surveyed (from 2005 and 2015), in relation to gender and age groups. The general incidence rate of diabetes in the Arab population in Israel was found to be increasing significantly from 11.3% to 17.7% (p<0.05) during the periods surveyed, reflecting an overall increase of about 6.4 per 1000 persons annually. It was found that the rate of incidence of T2DM was increasing progressively with age in both genders, this data is valid for the two successive periods surveyed. The data showed that the most affected age group is the ≥60 years, having a progressive increase in the occurrence of this disease. It was further noticed that in the first successive period surveyed, the rate of this disease is higher among females compared to males. While, in the second period surveyed, this rate was reversed i.e. higher among males than females, except in the ≥60 years age group, in which the rate was similar in both genders.

Table 2 shows the prevalence of T2DM in the studied sample during the two successive periods surveyed in relation to gender and sociodemographic factors. The prevalence of T2DM was remarkably increased among Muslims and Druze during the two studied periods, while, there was a slight increase in this trend among Christians. It is noticeable, that there is no significant differences in the incidence rate of diabetes between these religious groups in each of the two studied periods. It was further observed that in the first period surveyed, the rate of this disease is higher among females compared to males among Muslims and Druze, while, the rate is approximately comparable between the two genders among Christians. In the second period surveyed, this rate was reversed i.e. significantly higher

among males than females in all religious groups. The incidence rate of diabetes in both genders was found to be increasing significantly between the two successive time periods surveyed, especially among Muslims and Druze males in which the rate was doubled (~100% increase), while, this trend was absent among Christians reflecting a minimal increase (~7% increase).

The incidence rate of diabetes was found to decrease significantly (p<0.05) with an increase in educational attainment in the two studied periods. This trend was observed in both genders. Interestingly, between the two studied periods (2005 and 2015), the incidence rate of the disease was substantially increased among the lowest educated group from 21.7% (19.7% in men and 22.8% in women) to 36.7% (38.5% in men and 35.7% in women), i.e. this rate of increase represents about 150 per 1000 persons. On the other hand, this rate was slightly increased in the highest educated group from 5.7% (7.4% in men and 3.4% in women) to 6.7% (9.6% in men and 4% in women), i.e. 10 per 1000 persons.

There was a remarkable increase in the prevalence of T2DM in all types of localities (urban, semi-urban and rural) during the two studied periods. It is noticeable, that there is no significant differences in the incidence rate of diabetes between these localities in each of the two studied periods separately. Moreover, there are no noticeable differences between males and females belonging to these localities in the first period studied, while, in the second period noticeable differences could be detected between both genders; men more affected than women in all localities.

According to labor force, in both genders the prevalence of the disease increased in all labor force categories (employed, unemployed and outside labor force) during the two studied periods. It is noteworthy that any of the two genders belonging to the 'outside labor force' category, prominently had the highest incidence rate in each of the two studied periods, on the other hand, subjects in the 'employed' and 'unemployed' categories, had the least rates with no significant differences between them.

DISCUSSION

Type 2 Diabetes Mellitus has a global dramatic rising during the last decades and it became one of the most common health problems worldwide. Our study is a unique research in several ways, as it explores a basic and vital problem in a comprehensive manner. It is based on data obtained from cross-sectional surveys that presented the Arab population in Israel, as well as it investigated the change in the rate of T2DM over a recent decade (2005 and 2015).

The findings from our results showed that the prevalence of T2DM among Arabs in Israel was as high (11.3% at 2005 and 17.7% at 2015) as in other Arab populations; with a mean prevalence of 16.17% as calculated by Meo et al. (2017). In contrast to the values obtained from the Arab world, the Jewish population in Israel had a prevalence rate of 5.7% (Zucker et al., 2016), resembling the data obtained globally, 6.4% (Shaw et al., 2010). Hence, the present study shows a sharp increase of T2DM among Arabs in Israel. This finding was found to be in concordance with a previous study, based on a review of the official health statistics, found that the incidence rate of T2DM in the Israeli Arab population increased by 9.1 per 1000 persons annually, while it decreased among Jews (Idilbi et al., 2012). On the other hand, this trend of increasing incidence was also observed among other Arab populations (Meo et al., 2017). Furthermore, this trend was described worldwide in various communities (World Bank Data: Arab World, 2015), as well as the global prevalence of diabetes among people aged 20-79 years was estimated by Shaw et al., (2010) and found to be 6.4% in 2010, which this prevalence expected to increase 7.7% by 2030.

The worldwide increase in the rate of T2DM was eventually associated with the rapidly changing life style featured by high intake of caloric foods, physical inactive lifestyle and the prevailing comprehensive urbanization (World Bank Data: Arab World, 2015). This fact was easily manifested in the GCC Arab countries compared with the other Arab countries. Thus, the higher the GDP and energy consumption in the Arab population, that are a logical outcome of the high economic growth, results in high prevalence of T2DM (Meo et al., 2017; Musaiger, 1992). We assume that these factors may play a vital role in increasing the prevalence of T2DM among Arab society in Israel. Recently, this is well documented in the Arab population of Israel as it experienced a rapid change towards a westernized lifestyle (Idilbi et al., 2012; Sharkia et al., 2008).

The results obtained in our work were in concordance with previously documented results indicating an increase in the rate of incidence of T2DM with progress in age in both genders. The specific sharp increase in the prevalence of T2DM was reflected in the age of 50 years and above as shown in males as well as females. Remarkably, Kalter-Leibovici et al., (2012), found that Arabs in Israel were affected with T2DM at a younger age than Jews, and 25% of the Arab population was diagnosed with T2DM by age 57 as compared to age 68 in the Jewish population. Additionally, this pattern was also noticed in various Arab societies i.e. in Bahrain (Al-Zurba, 2001), Kuwait (Channanath et al., 2013) and UAE (Malik et al., 2005).

In our study during the first period surveyed i.e. 2005, the rate of T2DM was found to be higher among females compared to males in most age groups. This finding was found to be in concordance with another study conducted by Abdul-Ghani et al., (2005) at the same period revealing that the prevalence of T2DM in Arab patients who were younger than the age of 65 was significantly

higher among women than men. Moreover, it highlighted that the diabetic women were younger than men at diagnosis (48 yr. *vs* 59 yr.). Surprisingly, our study during the second period, 2015, showed a reversed shift i.e. the incidence was higher among males compared to females in most age groups, except in the last age group (>60 yr.) reflecting similarity rate between both genders. This trend was noticed among Muslims and Druze, while, it was less evident among Christians (Table-2). Generally, T2DM was considered to show no major overall sex bias, but different cohort studies in various societies showed that the occurrence of T2DM was more common among women than men (Gale and Gillespie, 2001; Spiegelman and Marks, 1946; Westlund, 1966; Pincus et al., 1934). A similar pattern was observed in few Arab countries (Bener et al., 2009; Al-Mahroos and McKeigue, 1998).

Although, intermittent studies indicated an interchangeable ratio between both genders; a study conducted during two periods of time in one Norwegian county revealed that diabetes was significantly more common in women at the first period (1984-1986), but a decade later (1995-1997) the prevalence in men had risen up equaling to that in women which didn't change (Midthjell et al., 1999). Furthermore, in a cross-sectional analysis study, assessing the gender difference in T2DM conducted on 201 cases, it was observed that the ratio between both genders was 55.2% males to 44.8% females (Aregbesola et al., 2017).

On the other hand, as far as the Arab societies are concerned, it was observed that the prevalence of T2DM was more common among males than females. This ratio was found to be potentially supported by different studies from Algeria; 20.4%: 10.7% (Zaoui et al., 2007), Saudi Arabia; 34.1%: 27.6% (Alqurashi et al., 2011), Libya; 16.3%: 13.0% (Kadiki and Roaeid, 2001), Tunisia; 16.1%: 14.1% (Romdhane et al., 2014) males vs. females respectively. An explanation to the changing sex ratio in late-onset of diabetes in males might be attributed to their more sedentary life styles (Gale and Gillespie, 2001). In our society the increasing trend towards modernization in life style in the past few decades might be associated with the reversed sex ratio in males-inflected with T2DM.

Regarding the sociodemographic factors, our findings demonstrated that the critical increasing rates of T2DM were dominating in males from Muslim and Druze, in the non-educated and in the 'outside labor force' categories.It was found that the educational level is inversely proportional to the prevalence of T2DM, as the higher the educational level, the lower is the occurrence of the disease, which is valid for both genders. Additionally, the lowest education level reflected the highest increase in the rate of diabetes, while the highest education level revealed the lowest rate of increase during the two studied periods. These findings were in accordance the a previously obtained results (Zucker et al., 2016). From these results it could be ascertained that education spreads awareness and knowledge to community members about the risk factors and drawbacks of a non-healthy and inactive lifestyle that may lead to the evolvement of diabetes. Furthermore, education widens and enlightens peoples' perspectives about life and building a healthy family.

No significant differences in the prevalence of T2DM could be observed between the various religions (Muslims, Druze and Christians), neither between genders nor during each of the two periods studied. On the other hand, the increased prevalence of diabetes among Muslim and Druze as compared to Christians may be due to their higher level of academic education.

Many studies among Arab societies demonstrated a high rate of T2DM affecting the inhabitants of different localities i.e. urban and rural areas (Musaiger and Abdulaziz, 1986; Al-Lawati et al., 2002; Romdhane et al., 2014). It could be stated that the differences in the lifestyle of both the localities in some Arab countries is high as the rural inhabitants there still use the non-sedentary way of life, while those in the urban areas use sedentary, live in luxury and have a high lavish style of life. Furthermore, the risk factors that may contribute to the increased incidence of diabetes in a particular country include; obesity, physical inactivity, changes in eating habits and alteration in social conditions (Meo et al., 2017). In contrast with many other studies among Arab societies, our results showed similar occurrence of diabetes in various types of localities. They indicated the presence of a minimal difference in the occurrence of diabetes between the two localities (urban and rural) in the first period studied, while, there was almost no noticeable difference in the second period of study. This may be explained by the nonexistence of much difference between the lifestyles of the inhabitants of both urban and rural areas in our society in the past two decades. This may be due to the exposure of the rural dwellers to modernization; telecommunications, convenient transportation and technology that is almost equally available to urban areas. The availability of these facilities, that encourage an inactive way of life, to rural inhabitant made them similarly subjected to the various risk factors of diabetes.

Regarding the labor force, it has been found that the highest increase in the prevalence of T2DM was observed in the unemployed category. Furthermore, the outside labor force category; that include the disabled people, homemakers and pensionaries, had the highest incidence rate in the two studied periods. This could be explained by the inactive way of lifestyle in these two categories. A recent study showed that the majority of the diabetic people from the studied cases were those who did not work (Hemavathi et al., 2017).

In conclusion, we assume that the fundamental social changes occurred in the Arab population including socioeconomic status and lifestyle during the last two

decades, could have been the culprit that contributed to the increase of the T2DM. Furthermore, the advancement of food technology and the introduction of industrially manufactured sugars and sweeteners into lots of food products, could be a potential health hazard that might be leading to the large increase in diabetes cases (Gulati and Misra, 2014). This finally could be due to human greed for obtaining high financial profit. Hence, it is of utmost importance to realize and understand the detailed risk factors that lead to the increase in the prevalence of T2DM in order to initiate and build up an effective educative and intervention programs for a systemic decrease in this worrying trend. Therefore, it is very much desirable to enhance health prevention programs that spread knowledge about the deleterious effects of a non-healthy lifestyle.

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