

Prevalence of diabetes mellitus and Impaired glucose tolerance in a rural Palestinian population

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معدل انتشار السكرى وعدم تحمل الغلوكوز في مجتمع ريفي فلسطيني
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خلاصة: تم استقصاء معدل انتشار السكرى وعدم تحمل الغلوكوز في دراسة مقطعية مجتمعية السرئكتز، في مجتمع ريفي فلسطيني يشمل 500 من الإناث والذكور الذين تتراوح أعمارهم بين 30 و65 سنة. وتبين أن معدل انتشار السكرى كان 9.6% بين الإناث و10.0% بين الذكور. وكان معدل انتشار عدم تحمل الغلوكوز 8.6%: حيث كان 10.3% بين الإناث، وكان 6.2% بين الذكور. أما المعدل الإجمالي لعدم تحمل الغلوكوز (السكرى + عدم تحمل الغلوكوز) فكان 18.4%. إن هذه الدراسة تقدم أول بيانات قاعدية حول السكرى وعدم تحمل الغلوكوز في فلسطين. وتبين النتائج ارتفاع معدل انتشار عدم تحمل الغلوكوز. وتلك معلومات ذات أهمية أساسية في تطبيق التخطيط الوطني وتوفير الخدمات.

ABSTRACT The prevalence of diabetes mellitus and impaired glucose tolerance was investigated in a cross-sectional population-based study in a rural Palestinian population of 500 females and males aged 30–65 years. The prevalence of diabetes was 9.6% and 10.0% in females and males respectively. The prevalence of impaired glucose tolerance was 8.6%; 10.3% in females, 6.2% in males. The prevalence of total glucose intolerance (diabetes mellitus + impaired glucose tolerance) was 18.4%. Our study provides the first baseline data on diabetes mellitus and impaired glucose tolerance in Palestine. The results indicate a high prevalence of glucose intolerance, information that is essential for the implementation of national planning and service provision.

Prévalence du diabète sucré et de l'abaissement de la tolérance au glucose dans une population palestinienne rurale

RESUME La prévalence du diabète sucré et de l'abaissement de la tolérance au glucose a fait l'objet d'une étude transversale dans une population définie: il s'agissait de 500 hommes et femmes palestiniens âgés de 30 à 65 ans vivant en milieu rural. La prévalence du diabète était de 9,6% et de 10,0% chez les femmes et les hommes respectivement. La prévalence de l'abaissement de la tolérance au glucose était de 8,6% (10,3% chez les femmes et 6,2% chez les hommes). La prévalence de l'intolérance au glucose totale (diabète sucré + abaissement de la tolérance au glucose) était de 18,4%. Notre étude fournit les premières données de base sur le diabète sucré et l'abaissement de la tolérance au glucose en Palestine. Les résultats indiquent une forte prévalence de l'abaissement de la tolérance au glucose, une information qui est essentielle pour la mise en œuvre de la planification nationale et la prestation des services.

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Introduction

Over the past 2 decades, the lifestyles of people in countries of the Eastern Mediterranean Region (EMR) have been changing because of rapid urbanization and socio-economic development [1]. Such changes have led to an increase in noncommunicable diseases such as cardiovascular disease, hypertension and diabetes mellitus (DM). Epidemiological studies on the prevalence of DM in the region come mainly from Saudi Arabia, Tunisia, Oman, Iraq and Egypt [1]. In the Omani national survey of glucose intolerance conducted in 1991 according to World Health Organization (WHO) recommendations, the prevalence of DM in the population aged 20 years and over was estimated to be 9.7% and 9.8% in males and females respectively [2]. The prevalence of DM has been estimated at 9.3% in the total Egyptian population aged 20 years and over [3], while in rural Egypt it has been reported to be 4.9% for that age group [3]. A recent study of urban and rural populations in Saudi Arabia indicated an alarming prevalence of DM in those aged 15 years and older of 12.0% for males and 14.0% for females in the urban population and 7.0% for males and 7.7% for females in the rural population [4]. In an urban study in Isfahan, Islamic Republic of Iran, the overall age standardized prevalence of diabetes has been estimated at 7.8% for adults aged 40 years or older [5].

Epidemiological data on DM and impaired glucose tolerance (IGT) in Palestine are lacking. Baseline data are important to allow proper health planning, policy-making and service provision. We aimed to estimate the prevalence of DM and IGT in a rural Palestinian population among 30–65-year-olds.

Subjects and methods

The study was carried out in Kobar, a semi-rural village located north-east of the city of Ramallah in the centre of the West Bank and connected to Ramallah by an asphalt road, about 15 km long. With an entirely Muslim population, the village may be considered prototypical of several villages of the central West Bank in Palestine, in terms of size, demographic characteristics, employment, living conditions and cultural characteristics.

To obtain data for the study, a household survey was carried out, followed by individual assessment of eligible subjects. A trained team of local fieldworkers visited each house in the village. For each household, a structured interview (questionnaire), administered to the female head of the household, sought information on the number of inhabitants in the household, their age, sex, social status, employment, education level and relationship to the head of the household. The survey was completed over a 1-month period in June 1996.

The household survey showed that 2360 individuals lived in 368 households in the village. Socioeconomic status was assessed using the key informant method [6]. For individual assessment, male and female residents of the village aged 30–65 years were invited to participate. Excluded from the survey were individuals with residence of less than 6 months in the village prior to the start of the individual assessment, and individuals mentally and physically incapable of participation in survey procedures. Based on these criteria, 585 out of 588 individuals were deemed eligible to participate.

Eligible men and women were issued a written invitation delivered by local fieldworkers. The invitations contained detailed instructions to consume an unrestricted diet 3 days before testing and to

fast 12 hours prior to the test appointment. Participants were also requested to bring any medication they were using at the time to the test centre, in order to identify people with previously diagnosed diabetes who were taking oral or injectable hypoglycaemic drugs at the time of the survey [7]. On the scheduled day of the test, participants were registered at the village council hall, which was used as the testing centre. Fasting was verified by questions from the registration team member. Participants who were not fasting were rescheduled to another day.

A measurement of finger-prick fasting capillary blood glucose (FCBG) was obtained from all participants using a glucometer (ExacTech Blood Glucose Monitoring System, Medisense, United States of America). A glucose load of 75 g anhydrous glucose in 250 ml water was then given for measurement of blood glucose 2 hours later. During this period, a trained physician and nurse measured each participant's blood pressure and conducted a structured interview to identify selected medical symptoms, including DM symptoms. Trained fieldworkers also took anthropometric measurements, including the height, weight, and waist and hip circumference of each participant. This was followed by a structured interview about health-related background information. Exactly 2 hours after the glucose load, venous blood was collected into 3 tubes: plain for blood chemistry, EDTA-coated for complete blood count (CBC) and sodium fluoride-coated for blood glucose determination. Processed blood samples were transported on ice to a private laboratory for analysis. For clinical chemistry, a fully automated clinical chemistry analyser (Kone Supra Specific) was used. A fully automated 18-parameter haematology analyser (Sysmex K4500) was used for haematology analysis.

DM and IGT were defined according to WHO criteria [8].

Excluded from the glucose load were individuals previously diagnosed with diabetes who were using hypoglycaemic medications. However, their fasting capillary blood glucose was measured, and blood was drawn for haematology and chemistry analysis (excluding the oral glucose tolerance test) immediately following the FCBG measurement. The participant then followed all the other steps of the individual assessment as the other participants.

All steps in the survey were subject to quality control procedures. All team members and fieldworkers were trained in a standardized manner. Scales and glucometers were calibrated daily. The laboratory at which the specimens were examined used both external and internal quality control programmes. In addition, daily duplicate aliquots of a random specimen (usually every 15th specimen) were stored at -20°C and sent on dry ice to the Department of Clinical Chemistry at Rikshospitalet, Oslo, Norway for quality control.

The coefficient of correlation r between duplicate samples of glucose concentration measurements was 0.996 ($P < 0.01$). The mean difference in the glucose concentration between the reference laboratory and the laboratory where the specimens were analysed indicated a slightly higher average for the reference laboratory. However, this had no effect on the prevalence of IGT and DM when applied to the results.

Statistical analysis

Data analysis was performed using SPSS. Crude and age-specific prevalence rates were calculated. Direct standardization of the overall prevalence rate (30–64 years) was performed using the WHO world population age structure [9]. The age

standardized prevalence rate (30–64 years) was also calculated using the age structure of the Palestinian population [10], and 95% confidence intervals (CI) were calculated for total, age-specific and sex-specific prevalence rates [11].

Results

Of 585 eligible individuals, 500 participated in the study, including 209 males with a median age of 41 years and 291 females with a median age of 40 years. This represented a total response rate of 85% (95% for females and 75% for males). A very high response rate was achieved among females aged 30–39 years and among males aged 40–49 years. Of the total 500 participants, 44% reported 7 years or more of education, 9% of males reported agriculture as their main employment, 48% reported construction work and related jobs, and 81% of women were housewives.

The overall prevalence of DM (30–65 years), including both previously diagnosed and study diagnosed was 9.8% (95% CI: 7.3–12.3%) (Table 1). The prevalence in males was 10.0% (95% CI: 5.9–14.1) compared with 9.6% (95% CI: 6.3–12.9) in females. Age-standardized prevalence of DM using the 30–64 years age for the Palestinian population was 9.3%. Standardization according to the WHO standard world population [11] gave a prevalence of 11.3%. The overall prevalence of IGT was 8.6% (95% CI: 6.1–11.1) (Table 1). The prevalence of IGT was higher in females (10.3%) (95% CI: 6.8–13.8) than in males (6.2%) (95% CI: 3.1–9.3). The overall prevalence of DM plus IGT was 18.4% (95% CI: 15.1–21.7).

As expected, and as shown by Table 1, the prevalence rates of DM and total glucose intolerance (DM plus IGT) increased with age. The prevalence of DM increased

consistently with age in males, peaking at 21.7% in the 60–65 years age group. The pattern was similar, although slightly less consistent, in females, where there was a slight drop in the prevalence of DM from the 40–49 years age group to the 50–59 years age group. The highest prevalence of DM in females (31.6%) occurred in the oldest age group (60–65 years). In males, the prevalence of IGT increased from the younger to the older age groups, although not consistently. For females, the prevalence of IGT increased consistently and then dropped for the age group 60–65 years. In all age groups, the prevalence of IGT in females was higher than in males (Table 1).

Contrary to expectations, there were more previously diagnosed diabetic patients than study diagnosed (Table 2).

Discussion

The overall crude DM prevalence of 9.8% is high, especially since the study was performed in a rural area where the prevalence of DM would be expected to be lower than in urban areas. In rural Egypt [3], the prevalence was 4.9% (including both study diagnosed and previously diagnosed). In urban Egypt, in areas of lower socioeconomic status, the prevalence of DM among those aged 20 years and over was 13.5%, compared to 20% in urban areas of higher socioeconomic status [3]. The present high prevalence of DM may be partially due to the effect of rapid urbanization and change of lifestyle, but this is impossible to assess because of the nature of the study and the absence of baseline data for comparison. Another explanation which should be explored is the link between DM and fetal undernutrition and suboptimal development *in utero* [12,13], especially since the participants were born between the 1930s and

1960s—times of conflict and migration for the Palestinians.

When comparing the present prevalence estimate with other countries in the EMR with comparable population charac-

teristics, such as race, nutrition and exercise rates, and experiencing similar transition in lifestyle, the results are similar or slightly lower. For example, in a Saudi Arabian rural population aged 15 years and

Table 1 Prevalence of diabetes mellitus (DM) and impaired glucose tolerance (IGT) by age group and sex for the village of Kobar, Palestine

Age group (years)	Sex	n	DM % (95% CI)*	IGT % (95% CI)*
30-39	M	89	3.4 (0.7-9.5)	2.3 (0.3-7.9)
	F	131	1.5 (0-3.7)	3.1 (0.2-6.0)
	Both	220	2.3 (0.3-4.3)	2.7 (0.5-4.9)
40-49	M	62	11.3 (4.7-21.9)	9.7 (3.6-19.9)
	F	67	11.9 (5.3-22.2)	13.4 (6.3-24.0)
	Both	129	11.6 (6.1-17.1)	11.6 (6.1-17.1)
50-59	M	35	17.1 (6.6-33.7)	8.6 (1.8-23.0)
	F	55	10.9 (4.1-22.3)	23.6 (13.2-37.0)
	Both	90	13.3 (7.1-22.1)	18.0 (10.5-27.3)
60-65	M	23	21.7 (7.5-43.7)	8.7 (1.1-28.0)
	F	38	31.6 (17.5-48.7)	10.5 (2.9-24.8)
	Both	61	27.9 (17.2-40.1)	9.8 (3.7-20.2)
30-65	M	209	10.0 (5.9-14.1)	6.2 (3.1-9.3)
	F	291	9.6 (6.3-12.9)	10.3 (6.8-13.8)
	Both	500	9.8 (7.3-12.3)	8.6 (6.1-11.1)

*For n < 100 exact 95% CI s were obtained from Exact confidence limits for P, published in Geigy scientific tables [16]. For n > 100, 95% CIs were calculated.

CI = confidence interval.

M = male.

F = female.

Table 2 Prevalence of diabetes mellitus (DM), impaired glucose tolerance (IGT) and glucose intolerance (DM plus IGT) by sex for the village of Kobar, Palestine

Sex	n	% DM previously diagnosed (95% CI)	% DM study diagnosed* (95% CI)	% IGT (95% CI)	% DM plus IGT (95% CI)
Male	209	7.2 (3.7-10.7)	2.9 (0.5-5.3)	6.2 (2.9-9.5)	16.3 (11.2-21.4)
Female	291	6.9 (4.0-9.8)	2.7 (0.7-4.7)	10.3 (6.8-13.8)	19.9 (15.0-24.4)
Both	500	7.0 (4.8-9.2)	2.8 (1.4-4.2)	8.6 (6.1-11.1)	18.4 (15.1-21.7)

*Study diagnosed = newly diagnosed.

CI = confidence interval.

older, the prevalence was 7.0% for males and 7.7% for females, rates considered among the highest in the world [4]. A recent study in a rural town in Pakistan of adults aged 25 years and older reported a DM prevalence of 16.2% in males and 11.7% in females [14].

In our study, there was a drop in the prevalence of IGT and a sharp rise in the prevalence of DM among females at age 60–65 years. It is likely that in this advanced age group, the cases of IGT have progressed to diabetes.

Of those with DM, more than two-thirds had already been diagnosed prior to the study. In rural areas, where health services are often less accessible or less adequate than in urban areas, opposite results were expected. It is probable that the proximity of this village to the town of Ramallah and the relative ease of transportation have improved access to health services.

The high prevalence of DM and IGT in a rural population in Palestine is alarming, especially in light of the relatively young age of the population. The age distribution is comparable to other countries in the EMR where children < 15 years comprise about 43% of the total population [15]. As the population

progresses into older age with expected increases in life expectancy, the prevalence of DM will increase, as will the burden on health services. The life expectancy at birth in the EMR has increased from 56 years in 1985 to 62 years in 1990 [15].

Prevalence data point to the importance of assisting communities and individuals, through provision of information needed to initiate prevention programmes, including community-oriented preventive education, to adjust certain risk factors in their lifestyles, such as diet and exercise. Our study provides the first baseline data on DM and IGT in Palestine and indicates a high prevalence of glucose intolerance in the rural population. This information is important for proper national planning and service provision.

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