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ORIGINAL

Risk of prediabetes as determined by the Prediabetes Risk Score in Qatar (PRISQ) in the european working population

Riesgo de prediabetes determinada con la escala Prediabetes Risk score in Qatar (PRISQ) en población laboral europea

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Abstract

Introduction: Diabetes is a chronic disease that has a major impact on people's health by increasing the risk of death from cardiovascular and other causes. Pre-diabetes is a state prior to diabetes that is also known to increase health risk. The aim of this study is to apply a tool to detect people at high risk of prediabetes.
Methods: Retrospective, cross-sectional study conducted in 134,065 European workers aged 18-69 years. The PRISQ (Prediabetes Risk Score in Qatar), which uses clinical anthropometric variables, was used to determine the risk of developing prediabetes.
Results: 13.1% of the men and 6.2% of the women in our study had high-risk PRISQ values. The different sociodemographic variables analysed, especially age, but also sex and social class increase the risk of having high PRISQ values.
Conclusion: The PRISQ scale can be useful at all levels of care to detect people at risk of prediabetes.

Keywords: Prediabetes, socio-demographic variables, prediabetes risk score in Qatar, prevention.

Resumen

Introducción: La diabetes es una patología crónica que tiene una gran repercusión en la salud de las personas incrementando el riesgo de muerte de origen cardiovascular y por otras causas. La prediabetes es un estado previo a la diabetes que también se sabe que incrementa el riesgo sobre la salud. El objetivo de este estudio es aplicar una herramienta para detectar personas con alto riesgo de prediabetes.
Metodología: Estudio retrospectivo y transversal realizado en 134.065 trabajadores europeos de 18 a 69 años. Para determinar el riesgo de presentar prediabetes se emplea el PRISQ (Puntuación de riesgo de prediabetes en Qatar) que emplea para su determinación variables antropométricas clínicas.
Resultados: El 13,1% de los hombres y el 6,2% de las mujeres de nuestro estudio presentan valores de PRISQ de alto riesgo. Las diferentes variables sociodemográficas analizadas, especialmente la edad, pero también el sexo y la clase social incrementan el riesgo de presentar valores altos en la escala PRISQ.
Conclusión: La escala PRISQ puede ser de utilidad en todos los niveles asistenciales para detectar personas con riesgo de prediabetes.

Palabras clave: Prediabetes, variables sociodemográficas, puntuación de riesgo de prediabetes en Qatar, prevención.

Introduction

The International Diabetes Federation estimates that, unless prevention programmes are implemented, the global prevalence of diabetes will be 9.9% in 2045, with 629 million people affected worldwide[1].

DM is defined as "a group of metabolic diseases characterised by hyperglycaemia resulting from deficits in insulin secretion, insulin action or both". Chronic hyperglycaemia is associated with a high incidence of micro- and macrovascular complications affecting the kidneys[2], eyes, nerves[3], coronary arteries, cerebral circulation and peripheral arteries[4]. It is clearly established that vascular risk is higher in patients with diabetes mellitus than in individuals without diabetes mellitus, such that diabetic patients have a 2- to 5-fold higher risk of cardiovascular disease than the general population[5]. This increased cardiovascular risk arises as a result of a combination of diabetes-specific alterations and the acceleration of the atherosclerosis process common to all individuals[6,7].

The possible relationship between prediabetes and cardiovascular disease risk has gained prominence in recent years, although the results are not entirely conclusive. A recent meta-analysis conducted in China[8] with 129 studies including more than 10 million people followed for more than 10 years assessed the association between prediabetes and the risk of cardiovascular disease or death from any other cause in people with and without a history of heart disease. The most interesting results were that prediabetes increased the risk of cardiovascular disease by 15% and all-cause mortality by 13% in people with no previous history compared to people with normal blood glucose levels. If there was a previous history of cardiovascular disease, the risk increased by 37% for heart disease and 36% for all-cause mortality.

5-10% of people per year with prediabetes will progress to diabetes, with the same proportion converting back to normoglycaemia. Prevalence of prediabetes is increasing worldwide and experts have projected that more than 470 million people will have prediabetes by 2030[9].

It is important to detect at an early stage those people at high risk of developing pre-diabetes, so the aim of this study is to determine those people at high risk of developing pre-diabetes using one of the few existing instruments, the Prediabetes Risk score in Qatar (PRISQ).

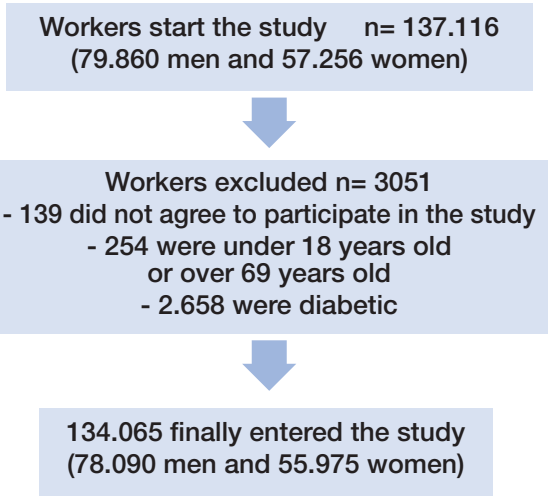
Methods

A retrospective and transversal study is carried out on 134.065 workers from different Spanish geographical areas and belonging to different productive sectors during the period from January 2019 to June 2020. The workers were selected among those who attended the periodic occupational medical examinations. The flow chart is shown in **figure 1**.

Inclusión criteria

- Age between 18 and 69 years old.
- Be an active worker
- Agree to participate in the study.
- Not being diabetic

Figure 1: Flow chart of the participants.



Data collection and management

The anthropometric measurements of height and weight, clinical and analytical, have been made by the health personnel of the different occupational health units participating in the study, after homogenizing the measurement techniques.

To measure the weight (expressed in kilograms) and the height (expressed in cm), a scale/height meter was used: model SECA 700 with capacity for 200 kg and 50 gram divisions, which has an added telescopic height meter SECA 220 with millimetric division and 60-200 cm interval. The BMI is calculated by dividing the weight by the height in meters squared.

The abdominal waist perimeter was measured in cm with a measuring tape: SECA model 20, with 1-200 cm interval and millimetric division. For evaluation, the person is placed in a standing position, feet together and trunk upright, abdomen relaxed and upper extremities hanging on both sides of the body. The measuring tape is placed parallel to the floor at the level of the last floating rib.

CUN BAE[10] (Clínica Universidad de Navarra Body Adiposity Estimator) The formula is:

$-44.988 + (0.503 \times age) + (10.689 \times gender) + (3.172 \times BMI) - (0.026 \times BMI^2) + (0.181 \times BMI \times gender) - (0.02 \times BMI \times age) - (0.005 \times BMI^2 \times gender) + (0.00021 \times BMI^2 \times age)$.

Where male sex equals 0 and female sex equals 1.

The blood pressure was examined in supine position with a calibrated OMRON M3 automatic sphygmomanometer and after 10 minutes of rest. Three determinations were made at one-minute intervals, obtaining the mean value of the three.

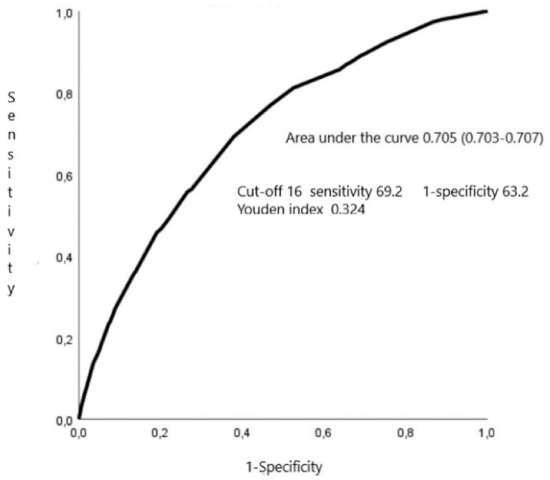
The blood samples were obtained by peripheral venipuncture after 12 hours of fasting and were sent to the reference laboratories where they were processed within a maximum time of 48-72 hours. Glycaemia, total cholesterol and triglycerides were determined by automated enzymatic methods, expressing the values in mg/dl. HDL is calculated by precipitation with dextran-sulphate Cl2Mg, and values are expressed in mg/dl. The LDL is estimated by means of the Friedewald formula (provided that the triglycerides are lower than 400 mg/dl) and is expressed in mg/dl.

Friedewald formula: LDL-c= Total cholesterol–HDL-c–triglycerides/5

The social class is determined from the 2011 National Classification of Occupations (CNO-11), based on the proposal of the group of social determinants of the Spanish Society of Epidemiology[11]. It is classified into 3 categories: Class I. Directors/managers, university professionals, athletes and artists. Class II. Intermediate occupations and self-employed workers without employees. Class III. Unskilled workers.

The risk of developing pre-diabetes is determined with the PRISQ[12] scale, which uses age, sex, waist circumference, BMI and blood pressure to calculate it. The cut-off point for high risk is 16 points for the Qatari population, the same figure as that obtained by us in the Spanish population (see **figure 2**).

Figure 2: Cut-off of PRISQ for spanish population.



Statistical analysis

A descriptive analysis of the categorical variables is carried out, calculating the frequency and distribution of responses for each of them. For quantitative variables, the mean and standard deviation are calculated, and for qualitative variables the percentage is calculated. The bivariate association analysis is carried out by means of the test of chi 2 (with correction of the exact Fisher statistic when conditions require it) and the Student t for independent samples. The statistical method of ROC curves (Receiver operating characteristic) curves were used to determine PRISQ discriminatory capacity of prediabetes). Cutoff values were derived mathematically from the ROC curves. For multivariate analysis, binary logistic regression with Wald's method has been used, with the calculation of Odds ratios and the Hosmer-Lemeshow goodness-of-fit test is performed. The statistical analysis is carried out with the program SPSS 27.0 with the accepted statistical significance level of 0.05.

Ethics statement

Approval for the study was obtained from Balearic Islands Health Area Clinical Research Ethics Committee (institutional review board approval number: IB 4383/20). The study was designed in accordance with the ethical guidelines of the Declaration of Helsinki. All participants sign written informed consent documents before participating in the study.

Results

Table I shows the anthropometric, clinical and analytical characteristics of the study population. In all cases the values are more unfavourable in males with statistically significant differences.

The mean PRISQ values increase with age, and this is true for both men and women. In women, PRISQ values get worse as social class gets worse, this situation is not observed in men. In all cases, age and social class, the values are higher in males. The complete data are presented in **table II**.

The prevalence of high-risk PRISQ values behaves similarly to what we have seen with the mean values, i.e. it increases with age and also as we move down the social class. The global prevalence of high risk of PRISQ is 13.1% in men and 6.2% in women. All data can be found in **table III**.

In the multivariate analysis using binary logistic regression, male sex, age 50 years and older, and belonging to social classes II and III were established as covariates. All three variables increase the risk of presenting a high-risk PRISQ, with age having the greatest influence with an ODDS ratio of 11.62 (95% CI 11.37-12.09). The full data are presented in **figure 3**.

Table I: Characteristics of the population.

	Men n= 78.090	Women n= 55.975	Total n= 134.065	
	Mean (SD)	Mean (SD)	Total (SD)	p-value
Age (years)	40.2 (11.0)	39.5 (10.7)	39.9 (10.9)	<0.0001
Height (cm)	174.7 (6.9)	161.9 (6.5)	169.3 (9.3)	<0.0001
Weight (kg)	81.0 (14.4)	66.2 (13.9)	74.8 (16.0)	<0.0001
BMI (kg/m²)	26.5 (4.4)	25.3 (5.1)	26.0 (4.7)	<0.0001
Waist circumference (cm)	85.9 (10.9)	74.7 (10.5)	81.3 (12.1)	<0.0001
Waist to height ratio	0.49 (0.06)	0.46 (0.06)	0.48 (0.06)	<0.0001
CUN BAE (%)	25.3 (6,5)	35.1 (7.1)	29.4 (8.3)	<0.0001
Systolic blood pressure (mmHg)	127.8 (15.3)	117.2 (15.5)	123.4 (16.2)	<0.0001
Diastolic blood pressure (mmHg)	77.5 (15.3)	72.5 (10.4)	75.4 (11.0)	<0.0001
Total cholesterol (mg/dl)	192.2 (38.6)	190.2 (35.6)	191.4 (37.4)	<0.0001
HDL-c (mg/dl)	50.5 (8.4)	56.8 (8.6)	53.1 (9.1)	<0.0001
LDL-c (mg/dl)	118.0 (36.6)	115.8 (34.6)	117.1 (35.8)	<0.0001
Triglycerides (mg/dl)	121.1 (80.7)	88.2 (46.1)	107.4 (70.3)	<0.0001
Glycaemia (mg/dl)	90.5 (11.9)	88.7 (10.7)	88.9 (11.6)	<0.0001

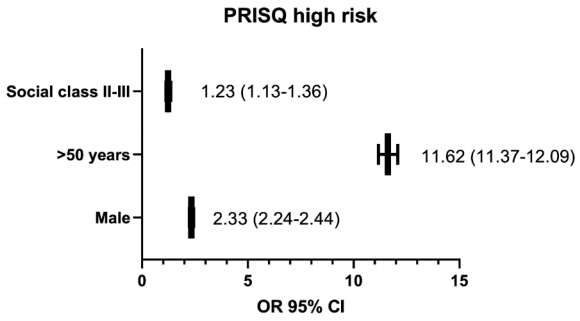
Table II: Mean values of PRISQ according sociodemographic variables by sex.

	Men			Women		
	n	Mean (SD)	p-value	n	Mean (SD)	p-value
18-29 years	15275	5.8 (4.4)	<0.0001	11706	2.5 (4.5)	<0.0001
30-39 years	21791	12.1 (7.9)		16560	8.0 (7.8)	
40-49 years	23602	20.1 (5.3)		16691	16.0 (5.4)	
50-59 years	14736	25.1 (7.4)		9306	20.9 (7.6)	
60-69 years	2686	31.8 (4.9)		1712	27.8 (5.7)	
Social class I	3851	16.8 (9.4)	<0.0001	3995	9.9 (8.6)	<0.0001
Social class II	11702	17.4 (9.4)		13121	11.4 (8.8)	
Social class III	62537	16.2 (9.8)		38859	12.4 (9.8)	

Table II: Prevalence of elevated values of PRISQ according sociodemographic variables by sex.

	Men			Women		
	n	% (95% CI)	p-value	n	% (95% CI)	p-value
18-29 years	15275	0.0	<0.0001	11706	0.0	<0.0001
30-39 years	21791	3.9 (3.8-4.0)		16560	0.9 (0.9-1.0)	
40-49 years	23602	11.3 (11.2-11.4)		16691	4.0 (3.9-4.1)	
50-59 years	14736	32.9 (32.8-33.0)		9306	19.8 (19.6-20.0)	
60-69 years	2686	68.4 (67.9-69.9)		1712	48.8 (48.1-49.5)	
Social class I	3851	12.6 (12.2-13.0)	<0.0001	3995	3.2 (2.8-3.6)	<0.0001
Social class II	11702	13.7 (13.5-13.8)		13121	4.6 (4.4-4.8)	
Social class III	62537	13.0 (12.9-13.1)		38859	7.1 (7.0-7.2)	
Total	78090	13.1 (13.0-13.2)		55975	6.2 (6.1-6.3)	

Figure 3: Binary logistic regression.



Discussion

The data from our study show that applying the PRISQ scale in the Spanish population, the prevalence of high-risk values for pre-diabetes is 13.1% in men and 6.2% in women. Other noteworthy data are that all the socio-demographic variables analysed, especially age, increase the risk of presenting high PRISQ values.

As this is a recently created scale (2021), there are no studies in the medical literature that allow us to compare our results with those obtained by other authors.

In our study age is an important risk factor for the development of pre-diabetes. Previous studies showed that some populations in Mexico and Jamaica[13], as well as non-white minorities in the UK[14] , had an earlier onset of diabetes than white people. In Israel, Arabs were found to have an earlier onset of diabetes than Jewish people[15]. Similarly, Arab men developed diabetes earlier than UK men living in Canada, probably due to an unhealthy lifestyle[16] . In the same vein, we found a study comparing the onset of diabetes in Iraqi immigrants living in Sweden versus Swedes showed that immigrants had a significantly earlier age of diabetes onset (47.6 years versus 53.4 years) and a higher risk of diabetes onset[17].

As strong points, we would highlight the large sample size, more than 134,000 people, and the assessment of the influence of different sociodemographic variables. The most important limitation is that the PRISQ is a scale

based on data from the Qatari population, so we do not know whether it can be extrapolated to the Spanish population, although the cut-off point obtained by us coincides with that obtained by the authors of the scale. Another limitation is that only people of working age (18-69 years) have been included, so the prevalence in other age groups is not known.

Conclusion

PRISQ is a non-invasive tool for detecting pre-diabetes and very easy to interpret. This scale can be easily used in any individual with risk factor measurements, or be implemented in primary care settings and used routinely by healthcare staff.

Interests conflict

The authors declare no conflict of interest.

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