Risk for type 2 diabetes *mellitus* and associated factors

Risco para diabetes *mellitus* tipo 2 e fatores associados

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Abstract

Objetive: Evaluating the risk for type 2 diabetes *mellitus* and its association with clinical and sociodemographic variables.

Methods: Cross-sectional study with 419 users of the Estratégia Saúde da Família (Family Health Program). The survey instrument was a validated questionnaire.

Results: It was found that 25.3% of users were aged ≥45 years; 59.7% were overweight and 84.0% had abdominal obesity; 83.3% had a sedentary lifestyle; 53.7% did not eat fruits/vegetables daily; 12.9% took antihypertensive medication; 5.3% reported previous history of high glucose and 47% family history of diabetes. Among users 24.6% were classified as low risk; 63.5% as moderate risk and 11.7% as high risk.

Conclusion: There was a significant association between the risk of developing type 2 diabetes *mellitus* and the clinical variables: body mass index, waist circumference, diet, use of antihypertensive drugs, history of high glucose and family history , and the sociodemographic variables gender and age.

Resumo

Objetive: Avaliar o risco para diabetes *mellitus* tipo 2 e sua associação com variáveis clínicas e sociodemográficas.

Métodos: Estudo transversal realizado com 419 usuários da Estratégia Saúde da Família. O instrumento de pesquisa foi um questionário validado.

Resultados: Verificou-se que 25,3% dos usuários tinham idades ≥45 anos; 59,7% estavam com excesso de peso e 84,0% com obesidade abdominal; 83,3% eram sedentários; 53,7% não comiam frutas/verduras diariamente; 12,9% tomavam anti-hipertensivos; 5,3% mencionaram história prévia de glicose alta e 47% história familiar de diabetes. Foram classificados como de baixo risco 24,6% dos usuários; 63,5% como de risco moderado e 11,7% de risco alto.

Conclusão: Houve associação significante entre o risco para desenvolver diabetes *mellitus* tipo 2 e as variáveis clínicas: índice de massa corporal, circunferência abdominal, alimentação, uso de anti-hipertensivos, história de glicose alta e história familiar, e as variáveis sociodemográficas gênero e idade.

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Introduction

Type 2 diabetes *mellitus* is one of the greatest public health threats of the 21st century. Changes in human behavior and lifestyle associated with globalization have resulted in a dramatic increase in its prevalence and incidence worldwide.[1,2]

Therefore, type 2 diabetes *mellitus* should be investigated in adults of any age who are overweight and have one or more risk factors. For those without these risk factors, testing should begin at age of 45 and, if results are normal, should be repeated at least every three years.[3]

Risk factors for type 2 diabetes mellitus are: age, gender, ethnicity, family history of type 2 diabetes *mellitus*, obesity, inactivity, gestational diabetes, macrosomia, hypertension, decreased high-density lipoprotein cholesterol, increased triglycerides, cardiovascular diseases, micropolycystic ovary syndrome, high blood glucose on previous testing, impaired glucose tolerance and glycated hemoglobin ≥5.7%.[3]

The present study aimed to evaluate the risk of type 2 diabetes *mellitus* and its association with clinical and sociodemographic variables.

Methods

This is a quantitative cross-sectional study that was carried out in nine basic health units of the *Estratégia Saúde da Família* (Family Health Program) in the Northeast of Brazil.

The inclusion criteria were: individuals of both genders, aged between 20 and 59 years, and waiting for medical appointments in the selected units. The exclusion criteria were: individuals residing in rural areas with a confirmed diagnosis of type 2 diabetes *mellitus,* and those with any chronic condition that might directly interfere in anthropometric measurements.

The sample was calculated from the formula given for cross-sectional studies of infinite population. A significance level of 95% and 50% prevalence of risk factors for type 2 diabetes *mellitus* were considered since these values provide a maximum sample size and sampling error of 5%. It was stipulated a 10% margin of losses summing up 419 people.

The survey instrument was the *Finnish Diabetes Risk Score* (FINDRISK). It is a questionnaire developed in Finland and widely circulated on the Internet that can be accessed and answered by anyone. At the end are issued the resulting score and the risk of developing the disease in 10 years.[4]

In Brazil, this questionnaire has been used in surveys conducted by different areas of health[5,6] because it is a tool of easy calculation and low cost.

It is a questionnaire composed of eight items about age, body mass index, waist circumference, physical activity practice, daily intake of fruits and/or vegetables, use of antihypertensive drugs, history of high blood glucose and family history of diabetes.[4] It was validated by the Department of Public Health of the University of Helsinki (Finland) and showed a sensitivity of 81% and specificity of 76%.[7]

The questionnaire allows a maximum score of 28 points and evaluates the risk of a person developing type 2 diabetes *mellitus* within 10 years. According to the final score of the instrument, the individuals are classified into the following risk levels: low (<7 points); slightly elevated (7-11 points); moderate (12-14 points); high (15-20 points); and very high (higher than 20 points).[4]

Data collection occurred from January to March 2010 in the health units, where sociodemographic variables (gender, age, marital status, employment status, family income, and socioeconomic class) and clinical variables (weight, height and waist circumference) were measured.

The data were double entered and stored in a database built using the Microsoft® Excel software, and processed by the *Statistical Package for Science Social*, version 18.0.

The mean and standard deviation statistical measures were calculated with their respective confidence intervals (95% CI). For the analysis of association between variables the nonparametric tests chi-squared and likelihood ratio were used. It was adopted the significance level p<0.05.

The development of the study followed national and international standards of ethics in research involving humans.

Table 1. Levels of risk for type 2 diabetes *mellitus*

Variables	Levels of risk for type 2 diabetes *mellitus*			
	Low n(%)	Moderate n(%)	High n(%)	p-value
Gender				
Female	84(22.8)	242(65.6)	43(11.7)	0.024
Male	20(40.0)	24(48.0)	6(12.0)	
Aged ≥ 45 years				
Yes	5(4.7)	69(65.1)	32(30.2)	< 0.001
No	99(31.7)	196(62.8)	17(5.4)	
Marital status				
Single/divorced/widowed	51(30.7)	100(60.3)	15(9.0)	0.050
Married/stable union	53(20.9)	166(65.6)	34(13.5)	
Education				
Illiterate/ Incomplete primary education	32(19.4)	115(69.7)	18(10.9)	0.082
Complete primary education/ Incomplete secondary education	16(21.1)	47(61.8)	13(17.1)	
Complete secondary education	45(33.6)	75(56.0)	14(10.4)	
Incomplete higher education/ Complete higher education	11(25.0)	29(65.9)	4(9.1)	
Socioeconomic classification				
Up to B2	9(40.9)	10(45.5)	3(13.6)	0.465
C	36(23.5)	97(63.4)	20(13.1)	
D/E	59(24.2)	159(65.2)	26(10.6)	
Body mass index				
Overweight	88(52.1)	77(45.6)	4(2.4)	< 0.001
Sobrepeso	16(9.3)	127(73.8)	29(16.9)	
Obesity	0(0.0)	62(79.5)	16(20.5)	
Waist circumference				
Normal	50(74.6)	15(22.4)	2(3.0)	< 0.001
Overweight	43(41.3)	57(54.8)	4(3.8)	
Obesity	11(4.4)	194(78.2)	43(17.3)	
Sedentary lifestyle				
Yes	80(22.9)	224(64.2)	45(12.9)	0.056
No	24(34.3)	42(60.0)	4(5.7)	
Daily intake of fruits/vegetables				
Yes	61(31.4)	117(60.3)	16(8.2)	0.005
No	43(19.1)	149(66.2)	33(14.7)	
Taking antihypertensive				
Yes	0(0.0)	7(68.5)	17(31.5)	< 0.001
No	104(28.5)	229(62.7)	32(8.8)	
History of high glucose				
Yes	0(0.0)	4(18,2)	18(81.8)	< 0.001
No	104(26.2)	262(66,0)	31(7.8)	
Family history of type 2 diabetes *mellitus*				
Yes	15(7.6)	135(68.5)	47(23.9)	< 0.001
No	89(40.1)	131(59.0)	2(0.9)	

Results

A total of 419 users of the health service were included, with a majority of the female gender (88.1%); aged between 30 and 44 years (42.5%), 37 years old on average; married or in stable union (60.4%); without a permanent job (57.8%); in-complete primary education (39.4%); average family income of one Brazilian minimum wage per month; and classified as socioeconomic class D/E (58.2%).

In relation to the occurrence of associated with type 2 diabetes *mellitus*, 25.3% of the users were aged ≥45 years; 59.7% had excess weight, with 40.8% classified as overweight and 18.9% as

obese. In relation to waist circumference, 24.8% were classified as increased risk and 59.2% as highly increased risk for cardiovascular disease. The majority (83.3%) did not practice physical activity regularly; 53.7% reported not eating fruits and/or vegetables daily; 12.9% were taking antihypertensive drugs; 5.3% reported a history of high glucose levels in routine exams, during illnesses or during pregnancy and 47% reported family history of type 2 diabetes *mellitus.*

With regard to the distribution of risk levels for type 2 diabetes *mellitus*, 24.6% of users were classified as low risk; 46.3% as slightly elevated risk; 17.2% as moderate risk; 10.2% as high risk and 1.5% as very high risk. Only one user (0.2%) showed no risk. For association of variables, these intervals were categorized as low, moderate and high risk.

The associations between levels of risk for type 2 diabetes *mellitus* and the clinical and sociodemographic variables are showed in table 1.

Discussion

The limits of the results of this study are related to the cross-sectional design that does not allow analyzing and describing the relationship of cause and effect from the associations between risk factors and disease onset.

However, the results confirm the growing trend of increased prevalence of factors associated with type 2 diabetes *mellitus* in different populations. Concerned about this, the nurses of a research group which has been studying the issue of diabetes investigated how these associated factors have behaved in children, adolescents and adults. The nurses observed that among children 21.7% were overweight, 27% had abdominal obesity, 17.9% had high blood pressure and 6.2% glucose alterations.[8] In the adolescent population there was high prevalence of a sedentary lifestyle (65.1%) and family history of type 2 diabetes *mellitus* (51.1%).[9] In adults prevalence was even higher: 47.1% were overweight, 30.7% had abdominal obesity and 70,9% had a sedentary lifestyle.[10]

In this study carried out with adults approximately 98.8% of the sample had some level of risk for type 2 diabetes *mellitus* whether low, moderate or high. Regarding associated factors, the most prevalent were increased waist circumference (84.0%), followed by physical inactivity (83.3%) and excess weight (57.9%).

Similarly, in an international study carried out in primary healthcare which used the same survey instrument to measure the risk for type 2 diabetes *mellitus*, all patients showed some level of risk; 15.1% were classified as low risk, 10.5% as slightly elevated risk, 47.6% as moderate risk, 16.3% as high risk and 10.5% as very high risk. As for the associated factors, the most prevalent were inadequate nutrition (86.1%), followed by excess weight (80.2%), increased waist circumference (74.8%) and sedentary lifestyle (66.3%).[11]

Moreover, 47% of the users in this study reported family history of type 2 diabetes *mellitus*, 12.9% were taking antihypertensive medication and 5.3% reported previous history of high glucose levels. In international research, these same risk factors were presented as follows: 64.6% of the sample reported family history of type 2 diabetes *mellitus*, 12.2% were taking antihypertensive medication and 21.9% reported previous history of high glucose levels.[12]

It is known that the prevalence of individuals at high risk for type 2 diabetes *mellitus* varies considerably depending on the tool used.[13] The prevalence of individuals with high risk for type 2 diabetes *mellitus* varied from 4.5% in Brazil,[5] to 26.8% in Cuba,[11] reaching 28.5% in Norway.[12] It is noteworthy that, despite the higher prevalence of high risk being in a developed country, the subjects of this study were female immigrants from Pakistan.

In the present study the male gender was more prevalent in the high risk category for type 2 diabetes *mellitus*, corroborating national and international findings, according to which men tend to have a higher risk for this disease than women.[5,13]

Recently, in Brazil, a research showed that men had higher prevalence of high risk (6.6%)

compared to women, among which only 0.8% had high risk (p=0.052).[5] Likewise, international researchers found that the prevalence of high risk varied between 1.6 and 24.9% among men, and between 1.1 and 15.7% among women, when comparing seven different score risks for type 2 diabetes *mellitus*.[13] However, a Brazilian survey showed that the prevalence of type 2 diabetes *mellitus* was higher among women (6.0% *versus* 4.4%).[14]

The use of risk scores to identify levels of risk for type 2 diabetes *mellitus* has been increasingly widespread in the literature.[11,13] They are useful for making decisions that have already thresholds, i.e. cutoff above which the risk of the disease increases markedly. Generally, only the identification of associated factors does not provide evidence of these limits.[15]

In assessing relationship of cause and effect of risk factors on the outcome of type 2 diabetes *mellitus*, researchers confirmed higher chances in patients aged ≥45 years (odds ratio - OR=3.00), with low education level (OR=1.76), obesity (OR=4.20), greatly increased waist circumference (OR=5.24), physical inactivity (OR=1,71), no consumption of fruits and/or vegetables (OR=2.21), use of antihypertensive medication (OR=2,30) and previous history of high glucose levels (OR=4.36). Unlike the present study, the variable consumption of fruits and/or vegetables showed no statistically significant association (p=0.21).[16]

In the present study, the increased prevalence of those classified as high risk was directly proportional to the increase in body mass index. International research has shown that overweight and obese individuals had, respectively, 1.35 (p<0.001) and 2.5 (p<0.016) more chances of developing type 2 diabetes *mellitus*, comparing to those with normal weight. Those with excess weight associated with family history of type 2 diabetes *mellitus* were 1.76 more likely to develop the disease (p<0.006).[17]

People at high risk for type 2 diabetes *mellitus* may develop pre-diabetes, a condition wherein the glucose level in the blood is higher than normal but not high enough to diagnose diabetes. For these people, specific interventions, including changes in lifestyle, sometimes accompanied by pharmacological agents have demonstrated efficacy in reducing the incidence of diabetes.[3]

After the identification of individuals at high risk for type 2 diabetes *mellitus*, researchers sought to demonstrate the effects of interventions in these people by changing their lifestyle. After 18 months of follow-up, they confirmed that the lifestyle intervention had a major impact on diabetes prevention, ratifying the aforementioned recommendation.[18]

Considering the complexity involved in the prevention of type 2 diabetes *mellitus*, and the importance of data obtained in that study, the involvement of an integrated multidisciplinary healthcare team is evident. They should promote the active participation of individuals classified as high risk in the aspects of planning and decision-making, for adopting strategies for changes in behavior.

Conclusion

There was a statistically significant association between the risk of developing type 2 diabetes *mellitus* and the clinical variables body mass index, waist circumference, diet, use of antihypertensive drugs, history of high glucose and family history. The sociodemographic variables gender and age were also associated with the development of type 2 diabetes *mellitus*.

Collaborations

Marinho NBP collaborated with the design and project design, analysis and interpretation of data, drafting the article and revising it critically for important intellectual content. Vasconcelos HCA and Alencar AMPG collaborated in writing the article. Almeida PC collaborated with the analysis and interpretation of data. Damasceno MMC collaborated with reviewing it critically for important intellectual content and the final approval of the version to be published.

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