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Prevalence and associated factors of diabetes in the elderly population in Viçosa, Minas Gerais, Brazil

Prevalência e fatores associados ao diabetes em idosos no município de Viçosa, Minas Gerais

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ABSTRACT: ***Objectives:*** To assess the prevalence and factors associated with diabetes in the elderly population and verify the correlation between the use of medications for diabetes and information about the disease. ***Methods:*** This epidemiological cross-sectional study was conducted in Viçosa, Minas Gerais, Brazil, with 621 elderly people aged 60 years or older selected by simple random sampling. A semi-structured questionnaire was used as a research tool and included questions about socioeconomic conditions, lifestyle, health conditions, and nutritional status. The weight, height, and waist circumference were measured. The dependent variable was the self-reported diabetes. In the association analysis between explanatory variables and self-reported diabetes, the Poisson regression analysis with robust variance was used. In the bivariate analysis, a p value < 0.25 was used to include the variables for the multivariate modeling, and in the final model, the variables with p value < 0.10 association were included. ***Results:*** The prevalence of diabetes was 22.4%. The multivariate hierarchical analysis showed the following factors independently and positively associated with diabetes: gender, self-reported health, history of hypertension/dyslipidemia, polypharmacy, and waist circumference. The elderly schooling was negatively associated with diabetes. ***Conclusion:*** The results showed the need for implementation of educational public policies to promote behavior changes of the population to prevent and control diabetes and its complications.

Keywords: Aged. Diabetes mellitus. Chronic disease. Prevalence. Health of the elderly. Demographic aging.

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RESUMO: ***Objetivo:*** Avaliar a prevalência e os fatores associados ao diabetes em idosos, bem como verificar a concordância entre o uso de medicamentos para diabetes e a informação referida sobre a doença. ***Métodos:*** Estudo epidemiológico transversal realizado na cidade de Viçosa, Minas Gerais, com 621 idosos com 60 anos ou mais, selecionados a partir de amostragem aleatória simples. Utilizou-se como instrumento de pesquisa um questionário semiestruturado que constava de perguntas sobre condições sociodemográficas, estilo de vida, condições de saúde e estado nutricional. Foram aferidos peso e altura, além do perímetro da cintura. A variável dependente do estudo foi o diabetes autorreferido. A análise da associação entre as diversas variáveis explicativas e a presença de diabetes foi feita por meio da regressão de Poisson com variância robusta simples e múltipla. Nas análises bivariadas foi utilizado o valor $p < 0,25$ para inclusão das variáveis na análise de regressão múltipla hierarquizada e, no modelo final, permaneceram as associações cujas variáveis apresentaram associação com o desfecho com valor $p < 0,05$. ***Resultados:*** A prevalência de diabetes foi de 22,4%. A análise múltipla hierarquizada evidenciou como fatores independentemente e positivamente associados ao diabetes: gênero, autopercepção da saúde, história de hipertensão e/ou dislipidemias, polifarmácia e obesidade abdominal. A escolaridade se manteve negativamente associada à presença de diabetes. ***Conclusão:*** Os resultados obtidos são similares aos de outros estudos conduzidos no país, sugerindo que os fatores associados ao diabetes entre idosos são semelhantes em todo o país. Ainda, observou-se moderada concordância entre o uso de medicamentos para diabetes e a informação referida sobre a doença, o que sugere o uso da última como método alternativo de investigação quando não se dispuser de outra forma de avaliação.

Palavras-chave: Idoso. Diabetes mellitus. Doença crônica. Prevalência. Saúde do idoso. Envelhecimento da população

INTRODUCTION

The knowledge of the health–disease process and its determinants in the elderly population has taken on an increasing importance in the context of health research in Brazil. This fact is associated to the populational aging phenomena, which outlines a series of challenges in order to ensure appropriate life conditions to this growing age group[1].

The changes in the Brazilian demographic profile are accompanied by changes in the epidemiological profile. Currently, there is a predominance of chronic noncommunicable diseases (NCDs), especially in older age groups, among which the diabetes stands out, representing an important public health problem with high morbidity, mortality, and significant economic repercussions[2,3].

The *diabetes mellitus* (DM) is characterized as a worldwide epidemic. Currently, the World Health Organization (WHO) estimates that 346 million people reveal diabetes; in 2030, it is estimated that deaths owing to this condition will double in relation to 2005[4]. The current estimate of the total DM carriers, aged between 20 and 79 years, in Brazil, is 11.9 million, corresponding to approximately 6% of the Brazilian population[5]. In the elderly Brazilian population, the prevalence of DM is 16.1%[6].

Different risk factors for DM have been pointed out in the literature, such as family history, ethnicity, and the increasing age. Other factors are related to the growing urbanization and the adoption of unhealthy lifestyles, such as a sedentary lifestyle, inappropriate diet, and obesity; these are found to be the major causes for the incidence and prevalence of DM worldwide[7-9].

Although knowingly increasing worldwide, little is known on the prevalence of this condition in cities other than the Brazilian capital cities. The social, economic, and cultural

differences are clear among the various Brazilian populations, and the effectiveness of DM prevention programs and campaigns are influenced by these different realities[10,11].

One of the reasons for the lack of knowledge on this prevalence is the difficulty for determining it through measuring the blood glucose level and the use of hypoglycemic, which generate costs and operational difficulties[12]. Another alternative is the use of self-reported information that is obtained quickly and at a low cost, enabling their adoption in populational studies. However, owing to some biases — lack of knowledge on the information of interest by the respondent, memory bias, and the desire not to inform the prevalence of the disease or the fact that it is still not diagnosed — there is the need of assessing the reliability of the self-reported diabetes[13,14].

Given the above-mentioned scenario, the objective of this study was to assess the prevalence of the factors associated with self-reported diabetes in elderly population and verify the correlation between DM medication and the information about the disease.

METHODS

DESIGN AND SUBJECTS

This cross-sectional epidemiological study (household survey) was carried out in the municipality of Viçosa, Minas Gerais, during the year 2009.

Six hundred and twenty-one elderly people aged 60 years or older, from both urban and rural areas, were selected and studied from a simple random sampling in a reference population of 7,980 elderly persons.

The elderly people were registered during the National Elderly Vaccination Campaign, in the period from April to May 2008. Later on, the database from the servers of the Federal University of Viçosa, both the active and retired ones, the records of the elderly persons in the Family Health Program (*Programa de Saúde da Família* — PSF), the municipal physiotherapy service, the women's health center, the psychosocial service, care unit, and *HiperDia* and Polyclinic were obtained and confronted with each other. This combination of databases aimed to identify the elderly population who did not take part in the vaccination campaign of 2008 in order to complement the records in the base. After the merger of the databases, the records of the people who were aged 60 years or older totaled to 7,980, which served as a basis for obtaining the sample. The institutionalized elderly people did not take part in this study.

The calculation of the size of the sample was determined considering the reference population of 7,980 elderly people, confidence level of 95%, estimated prevalence of 50% for different outcomes of interest in the study, and 4% of tolerated error. From these parameters, the final minimum sample would be of 558 elderly people, to which an additional 20% was added in order to cover any possible losses, totaling 670 elderly to be studied. Owing to losses by refusal, death, or other reasons (7.3%), 621 elderly were effectively studied.

DATA COLLECTION

For the collection of the data, a semi-structured questionnaire was used, tested in pilot phase. The interviews were held in households and, preferably, prescheduled. Pairs of interviewers, previously trained, would locate the households and visit the elderly people in order to explain the objectives of the research. They would then be invited to take part in it, and a date and time would be scheduled for those who accepted it.

Data collection was carried out by five pairs of interviewers. They were properly trained, previously to the data collection. This step consisted of four days of training, where the pairs administered the questionnaires and underwent the anthropometric measures among themselves with an observed monitoring and evaluating their performance.

The information was obtained using a semi-structured questionnaire with mostly closed and precoded questions. The questionnaire was applied directly to the elderly people, but in case they expressed any difficulties, the next closest respondent (relative or caretaker) would assist them. About 25.7% of the elderly people was assisted in some section of the questionnaire owing to cognitive or communication deficit, with most of this assistance being provided by family members (95%).

VARIABLES OF THE STUDY

The dependent variable of this study was the DM, obtained by the following question: "Has a doctor or another health professional ever said you have diabetes?" The independent variables analyzed were: sociodemographic characteristics (gender, age range, and education); lifestyle characteristics (smoking habits and practice of physical activities); health conditions (self-perceived health, number of doctor appointments in the last year; history of hypertension, dyslipidemia and/or kidney disease, and use of medications within the last 15 days); and nutritional status (excessive weight and abdominal obesity).

The investigation on the practice of physical activities was self-reported (yes or no) and restricted to that performed regularly, for at least 20 minutes, 3 times a weeks, disregarding other dimensions of activities held within the household, work environment, and in going and coming wherever.

Body mass index (BMI was used in order to characterize the elderly people as for their nutritional status and classified according to the cutoff points for elderly people proposed by Lipschitz[15]: low weight < 22 kg/m²; eutrophic between 22 and 27 kg/m²; and overweight > 27 kg/m².

The waist circumference was used in order to detect abdominal obesity, being considered a predictor of cardiovascular risk[16]. The cutoff points used were established by Lean et al.[17] and recommended by the WHO[18], according to the risk for diseases associated with obesity: increased risk for women ≥ 80 cm and for men ≥ 94 cm; and highly increased risk for women ≥ 88 cm and for men ≥102 cm.

The use of medication within the 15 days previously to the interview was identified, and the information regarding the identification of the medication used in this period were collected: time of use of the medication, frequency, and duration of the use of these medications;

and the origin of the prescription/indication. Most medication revealed their uses proven by bullae, packaging and/or prescriptions presented by the participants.

All the medications used and reported were transcribed into their generic names. Later on, a classification of the antidiabetic drugs was carried out, based on the Anatomical Therapeutic Chemical (ATC) classification[19].

DATA ANALYSIS

Initially, a descriptive analysis of the data was performed. The prevalence of DM in the sample and its respective 95% confidence interval (95%CI) was also estimated. The analysis of the association between the various independent variables and the DM was verified by the Pearson χ^2-test and the linear trend χ^2 with a significance level of 5%; the simple Poisson regression with robust variance was used in order to estimate the reasons of gross prevalence.

In the multiple regression model, there were included the variables presenting p-value < 0.25; thus enabling a higher number of variables in the model. The explanatory variables were included using the hierarchical approach on three levels: sociodemographic variables in the distal level; lifestyle variables in the intermediate level; and health conditions and nutritional status variables at the proximal level (Figure 1).

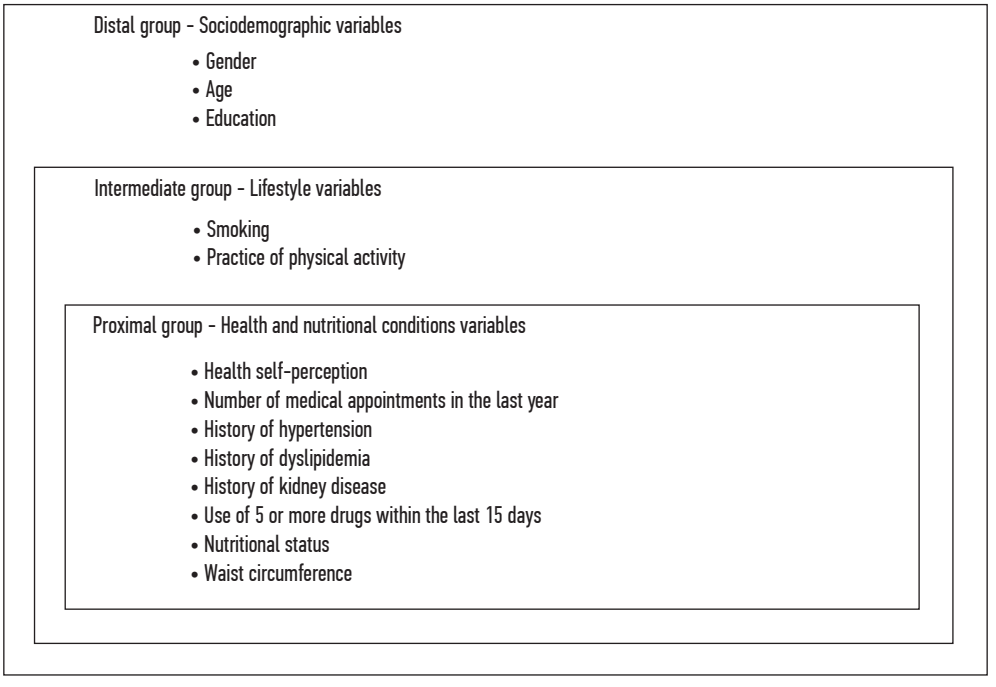

Figure 1. Hierarchical model for determination of diabetes.

According to the hierarchical proposal, once included in the model, the variables were kept until the end, regardless of the p-value in the following stages. In the final model, the associations whose variables presented association to the outcome p-value < 0.05 remained.

In order to assess the concordance between the "use of diabetes medication" and "self-reported diabetes" variables, the Kappa coefficient was used, with the following interpretation: values higher than 0.75 indicate excellent concordance; values lower than 0.40 indicate low concordance; and values between 0.40 and 0.75 represent moderate concordance[20].

The statistical analyzes were performed using the Stata 11 software.

ETHICAL PROCEDURES

The interview was conducted after signing the informed consent by the elderly person or their caretaker, and the protocol of the research was approved by the Ethics Committee on Human Research of the Federal University of Viçosa, process No. 027/2008.

RESULTS

In total, 621 elderly people were studied, most of them (53.3%) being women. The age varied from 60 to 98 years, with median of 69 years, mean of 70.8 years, and a standard deviation (SD) of 8.06 years. About half the number of the elderly people was aged from 60 to 69 years (50.1%). Most of them reported having studied up until the early grades of elementary school (64.0%) (Table 1).

The prevalence of self-reported diabetes was 22.4% (95%CI 18.8 – 26.4). Among the sociodemographic variables, the gender and education level were statistically associated with the DM. A higher prevalence of morbidity among women and among those who had fewer study years was verified. Most elderly people reported not practicing physical activity (70%) and never having smoked (55.7%), not having been observed a significant association between these variables and the self-referred diabetes (Table 1).

It was observed that a significant association prevailed between all the health conditions and nutritional status indicators selected and the presence of self-reported diabetes. The prevalence of a negative health self-assessment and the excessive weight was higher among diabetic people than among nondiabetic people (Table 2).

Among the elderly interviewed, 45.0% of them were overweight at the time of the research. The prevalence of DM among these elderly people was 55% higher in relation to the healthy ones. As for the waist circumference measure, there was a loss of 3.9% of the measures owing to the conditions, which prevented its measuring (bedridden individuals) and/or refusals. It was found that 38.2% of the elderly presented excessively high waist circumference; of these, 31.1% presented diabetes, resulting in a three-time higher prevalence of DM than that among

the elderly people with waist circumference of ≤ 94 cm and ≤ 80 cm for men and women, respectively (Table 2).

Among the 97 elderly people who used antidiabetic medication within 15 days previously to the interview, 94 (96.9%) of them reported a history of DM. Among the 139 elderly persons, who reported a history of DM, 45 (32.4%) did not use lipid-lowering medication. The Kappa coefficient obtained was 0.75 (95%CI 0.68 – 0.82), indicating a moderate to high concordance between the two variables.

Table 1. The prevalence and the reasons for the prevalence of self-reported diabetes, according to the sociodemographic and lifestyle variables for the elderly people, Viçosa, MG, 2009.

Variables	Total		Diabetes		p-value	PR (95%CI)
	n	%	n	%		
Gender						
Male	290	46.7	52	17,9	0.013*	1
Female	331	53.3	87	26,3		1.47 (1.08 – 2.00)
Age range						
60 to 69 years of age	311	50.1	66	21,2	0.317**	1
70 to 79 years of age	216	34.8	48	22,2		1.05 (0.75 – 1.45)
≥ 80 years of age	94	15.1	25	26,6		1.25 (0.84 – 1.86)
Education						
Has never studied	94	15.2	34	36,2	0.000**	1
Up until the early grades of elementary school	397	64.0	86	21.7		0.60 (0.43 – 0.83)
Final grades of elementary school or more	129	20.8	19	14.7		0.40 (0.25 – 0.67)
Pratice of physical activity						
No	435	70.0	95	21.8	0.619*	1
Yes	186	30.0	44	23.7		1.08 (0.79 – 1.48)
Smoking						
Has never smoked	345	55.7	81	23.5	0.731*	1
former smoker	207	33.4	45	21.7		0.93 (0.67 – 1.28)
current smoker	67	10.8	13	19.4		0.83 (0.48 – 1.39)

PR: prevalence ratio; 95%CI: 95% of confidence interval; *Pearson c^2-test; **linear trend c^2-test.

Table 2. The prevalence and the reasons for the prevalence of self-reported diabetes, according to the health condition and nutritional status variables for the elderly people, Viçosa, MG, 2009.

Variables	Total		Diabetes		p-value	PR (95%CI)
	n	%	n	%		
Health self-preception						
Good/very good	272	45.4	40	14.7	0.000**	1
Regular	289	48.2	77	26.6		1.81 (1.28 – 2.55)
Poor/very poor	38	6.3	13	34.2		2.32 (1.37 – 3.94)
Number of medical appointments within the last year						
None	45	7.3	2	4.4	0.000**	1
1 to 5 appointments	449	72.4	93	20.7		4.66 (1.18 – 18.30)
≥ 6 appointments	126	20.3	44	34.9		7.85 (1.98 – 31.13)
History of hypertension						
No	146	23.5	10	6.8	0.000*	1
Yes	475	76.5	129	27.2		3.96 (2.14 – 7.34)
History of dyslipidemia						
No	267	43.0	35	13.1	0.037*	1
Yes	353	57.0	104	29.5		2.24 (1.59 – 3.18)
History of kidney disease						
No	553	89.0	117	13.1	0.037*	1
Yes	68	11.0	22	29.5		1.53 (1.05 – 2.24)
Number of drugs used within the last 15 days						
≤ 4 drugs	397	63.9	48	12.1	0.000*	1
≥ 5 drugs	224	36.1	91	40.6		3.36 (2.47 – 4.57)
BMI						
Eutrophic	228	41.4	42	18.4	0.010*	1
Low weight	75	13.6	12	16.0		0.87 (0.48 – 1.56)
Overweight	248	45.0	71	28.6		1.55 (1.10 – 2.17)
Waist circumference						
Low risk§	147	24.6	15	10.2	0.000*	1
Increased risk	222	37.2	46	20.7		2.03 (1.18 – 3.50)
Highly increased risk	228	38.2	71	31.1		3.05 (1.81 – 5.12)

PR: prevalence ratio; 95%CI: 95% of confidence interval; BMI: body mass index; *Pearson χ^2-test; **linear trend χ^2-test; §corresponds to waist circumference values: < 94 cm for men and < 80 cm for women.

The hierarchical multiple analyses showed the factors independently and positively associated to the DM as the gender, the health self-perception, history of hypertension and/or dyslipidemia, polypharmacy, and abdominal obesity. The education level remained negatively associated with the presence of DM (Table 3).

Table 3. Prevalence and reason of prevalence of the self-reported diabetes, according to the interest of the analysis and hierarchical multiple regression variables, Viçosa, MG, 2009.

Variables	PR (95%CI)	p Value
Gender		
Male	1	0.045
Female	1.36 (1.01 – 1.85)	
Education		
Has never studied	1	
Up until the early grades of elementary school	0.62 (0.45 – 0.86)	0.004
Final grades of elementary school or more	0.43 (0.27 – 0.71)	0.001
Health self-perception		
Good/very good	1	
Regular	1.39 (0.99 – 1.95)	0.059
Poor/very poor	1.73 (1.07 – 2.80)	0.026
History of hypertension		
Yes	1	0.009
No	2.54 (1.26 – 5.11)	
History of dyslipidemia		
Yes	1	0.009
No	1.60 (1.12 – 2.30)	
Number of drugs used within the last 15 days		
≤ 4 drugs	1	0.000
≥ 5 drugs	2.42 (1.71 – 3.42)	
Waist circumference		
Low risk[§]	1	
Increased risk	1.62 (0.98 – 2.69)	0.058
Highly increased risk	2.69 (1.30 – 5.56)	0.007

PR: prevalence ratio; 95%CI: 95% of confidence interval; [§]corresponds to waist circumference values: < 94 cm for men and < 80 cm for women.

DISCUSSION

In this study, the prevalence of self-reported diabetes among the elderly population was estimated at 22.4%, higher than in other studies[11,21-24]. According to the data from the National Research per Household Sample (*Pesquisa Nacional por Amostra de Domicílios* – PNAD), the prevalence of DM in the elderly population in Brazil is 16.1%[6].

In relation to the sociodemographic characteristics, there was a higher prevalence of DM among women, as observed by other studies in Brazil[11,25]. A possible explanation for these results would be the higher proportions of lack of knowledge on the presence of the disease among men and higher frequency of women in health services[26]. The hormonal changes associated with climaterium seem to be responsible for the higher prevalence of DM among women than among men, from the age of 50 years[27].

In this study, higher education levels were inversely associated with the occurrence of DM and in other studies[10,11,28]. The low level of school education may limit the access to health information and hinder the understanding of the guidelines for prevention and/or treatment of DM, resulting in poor adequate control and risk of complications. This fact is especially relevant in Brazil, where illiteracy rates among elderly is still high: 30.7% of the Brazilian elderly exhibit less than one year of school education[6].

As for the age range, there was a significant increase of DM prevalence with growing age. This result corroborates the one observed by other national studies[11,21,22,29].

Most elderly people who were interviewed did not practice any physical activity. It was also observed a slight increase, although significant, in the prevalence of DM among individuals who practiced physical activities, a fact that may have occurred owing to the guidelines for health conditions improvement of these elderly people. Physical exercises result in significant improvement for type 2 DM carriers, such as reducing blood glucose after performing exercises, reduction of blood glucose in fasting, glycated hemoglobin, and improved vascular function[7,30].

The BMI was significantly associated to the DM, which replicates the findings of several studies reporting a statistically significant relation between obesity and incidence or prevalence of DM among the elderly population[22,27,30]. Besides the increased prevalent of general overweight, it was observed a high prevalence of abdominal obesity prevailed among the diabetic elderly. Abdominal obesity is associated with important cardiovascular and metabolic alterations, such as dyslipidemia, glucose intolerance or DM, and hypertension, being considered more relevant in the diagnoses of individuals, with elevated risk to health than the general adiposity[31].

In relation to health condition indicators, it was found that a significant association existed between all the variables and self-reported diabetes. Measuring health is quite difficult, because it encompasses several life aspects of the individual, although the health self-perception has been proving itself as a reliable, robust, and comprehensive subjective method, being useful even in the prediction of risk of mortality. Individuals who perceive their health

as poor or very poor reveal a higher risk of mortality in comparison with those who report presenting excellent health[32].

The higher frequency of medical consultations was associated with the presence of DM and points out to a higher use of consultations by patients with chronic conditions, once that its complexity could demand a higher number of medical appointments[28,33]. It is also considered that the people with health problems and who negatively assess their health condition tend to visit doctors more often for treatment and follow-up[34]. In the study by Boing et al.[35], the prevalence of medical appointments within the last year was 13% higher among people who self-reported DM and 11% higher among those who classified their health negatively.

The reporting of hypertension and dyslipidemia by elderly people was high, and a higher significant prevalence of these diseases among diabetic patients was expected, considering the clinical researches that corroborate the relation between them[22,25]. According to the Brazilian Diabetes Society (*Sociedade Brasileira de Diabetes*)[7], hypertension and the changes in lipids and plasma lipoproteins (typically elevated triglycerides and HDL cholesterol reduction) are configured as risk factors for the development of cardiovascular diseases, which contributed to up to 80% of deaths among diabetic people.

In Brazil, the use of a great number of medication drugs is widely observed among individuals who are aged 60 years or older[36,37]. They are a subject of simultaneous impairment of different organs or systems and, therefore, candidate to multipurpose drugs. In this study, it was observed that a higher prevalence occurred in the consumption of five or more medication drugs among the diabetic people. Here, it is important to reflect about the conditions under which polypharmacy occurs, considering that several studies have related this phenomenon to the inappropriate use of medication among elderly people[38,39], which can be an aggravating factor to the adequate DM control in this population.

Some limitations in the study may be pointed out. The first of them is the cross-sectional design, which does not allow establishing a causal relation between the explanatory variables and the outcome. Another limitation may be the fact that it was used the variable "diabetes" through self-report measuring. However, the use of self-reported information is recommended by the WHO[13], and studies have proven that the information obtained under the presence of chronic diseases have good concordance when compared with medical records or clinical examinations[40-42]. Moreover, in this study, it was observed a moderate to excellent concordance verified through the Kappa test between the use of antidiabetic drugs and the DM report. Although this concordance is not enough in order to validate the use of the dependent variable "self-reported diabetes" as the diagnose method of DM in the sample.

CONCLUSION

On the basis of the results obtained, it is suggested that the factors associated with DM among elderly people of small municipalities are similar to the ones in other national researches, suggesting that the factors associated with DM are similar throughout the country.

In addition to that, the increased concordance observed between the use of DM medication and the reported information on the disease suggests the use of self-reported diabetes as an alternative investigation method when there is no other form of assessment.

Given the results observed, efforts must be made in order to implement and improve the policies and practices for the prevention and control of DM. In this sense, the actions must emphasize the therapeutical adherence, the promotion of healthy eating habits, and the encouraging of physical activity among elderly people.

Despite the high concordance between the self-reported diabetes and the use of hypoglycemic agents, further studies are necessary in order to evaluate the DM from more reliable measures, such as laboratory tests, and which, furthermore, assess other factors that may contribute for the development of DM in the elderly population.

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