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Prevalence of diabetes mellitus *and associated factors in adults: population-based survey*

Prevalência de diabetes mellitus e fatores associados em adultos: inquérito de base populacional

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ABSTRACT

To estimate the prevalence of diabetes mellitus and associated factors in adults. Survey carried out with 1,637 individuals in urban and rural areas of the municipality of Rio Branco, state of Acre. Diabetes was defined by the presence of fasting plasma glucose ≥ 126 mg/dl or the use of oral hypoglycemic agents or insulin. Association measures were estimated by hierarchical logistic regression. The prevalence of diabetes was 6.5% (n = 202). After analysis, the chance of being diabetic was independently and positively associated with age ≥ 60 years (OR: 6.67; 95%CI: 1.83-24.30); family history of diabetes mellitus (OR: 2.88; 95%CI: 1.43-5.81); increased waist circumference (OR: 1.83; 95%CI: 1.01-3.33); dyslipidemia (OR: 2.95; 95%CI: 1.34-6.49); anemia (OR: 3.15; 95%CI: 1.30-7.60); and chronic kidney disease (CKD) (OR: 4.00; 95%CI: 1.70-9.33). A prevalence of 6.5% was detected, with diabetes associated with age, family history, anemia, and CKD. The need for adequate screening of comorbidities in these patients is indicated.

Keywords: Adults. Diabetes mellitus. Epidemiological surveys. Logistic models. Prevalence.

RESUMO

Estimar a prevalência de diabetes *mellitus* e os fatores associados em adultos. Trata-se de um inquérito realizado com 1.637 indivíduos nas zonas urbana e rural do município de Rio Branco, Acre. Diabetes foi definido pela presença de glicemia no plasma em jejum ≥ 126 mg/dl ou utilização de hipoglicemiante oral ou insulina. Medidas de associação foram estimadas por regressão logística hierarquizada. A prevalência de diabetes foi de 6,5% (n = 202). Após análise, a chance de ser diabético esteve independente e positivamente associada a idade ≥ 60 anos (OR: 6,67; IC95%: 1,83-24,30); história familiar de diabetes *mellitus* (OR: 2,88; IC95%: 1,43-5,81); circunferência da cintura aumentada (OR: 1,83; IC95%:1,01-3,33); dislipidemia (OR: 2,95; IC95%: 1,34-6,49); anemia (OR: 3,15; IC95%: 1,30-7,60); e doença renal crônica (DRC) (OR: 4,00; IC95%: 1,70-9,33). Foi detectada uma prevalência de 6,5%, estando o diabetes associado com idade, história familiar, anemia e DRC. Indica-se a necessidade do adequado rastreio de comorbidades nesses pacientes.

Palavras-chave: Adultos. Diabetes *mellitus*. Inquéritos epidemiológicos. Modelos logísticos. Prevalência.

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INTRODUCTION

The increase in the prevalence of diabetes mellitus (DM) in developed countries is mainly due to the growth of the elderly population since, with better access to and treatment of chronic diseases, there is a tendency to increase life expectancy, including DM patients. In developing countries, on the other hand, due to rapid urbanization, the significant increase in obesity, and the low investment in health services in the prevention and treatment of the disease. Estimates indicate that individuals of all age groups will be affected, but the most affected will be those between 20 and 44 years old, whose prevalence is expected to double and, with that, burden the public health system, as in the case of Brazil[1].

Thus, local governments and different health systems are required to make a significant amount of financial investment so that an early diagnosis and adequate treatment can be carried out. The objective is to avoid the emergence of acute and chronic complications that lead a portion of diabetics to prolonged hospitalizations and premature deaths[2]. Data from the National Health Survey estimated a DM prevalence of 9.2% for Brazilian adults, varying by geographic region; it is highest in the Southeast (10.5%), followed by the Central-West (10.3%), Northeast (8.7%), South (8.5%) and North (6.8%)[3].

Articles published in national journals with self-reported DM recognize the risk of underestimating the real prevalence as it is an asymptomatic onset disease and many people are not aware of their real health condition[4]. The prevalence of DM in Brazil ranges from 5.4% to 7.5%, according to self-report[4,5], and from 8.4 to 9.4%, using laboratory criteria[3,6]. The use of laboratory criteria for knowing the real situation of the disease in the country is reliable.

In addition to the factors usually associated with DM, such as aging, family history, low schooling, overweight, and other chronic diseases (arterial hypertension and dyslipidemia)[7-9], others still need further studies, such as chronic kidney disease, anemia, use of health services and physical inactivity. Knowing them favors the promotion of effective screening and early treatment of complications, resulting in a better quality of life, and prevention of early deaths, hospitalizations, and disabilities.

Population surveys provide knowledge of the health status of individuals living in a given region and are of paramount importance for monitoring and surveillance of indicators. It can even serve as a basis for planning and executing DM promotion and treatment actions in communities[10], especially using laboratory criteria.

The present study aimed to estimate the prevalence of diabetes mellitus (DM) and the associated factors in adults in Rio Branco, state of Acre.

METHODOLOGY

This was a cross-sectional analytical observational study with analysis of databases originating from research carried out with the population in the rural and urban zone of Rio Branco, state of Acre, between April and September 2014, and is part of the Study of Chronic Diseases (Edoc) in adults and elderly people from Rio Branco, state of Acre.

The research population consisted of residents of the municipality of Rio Branco aged 18 years or older and included two concomitant household surveys: Edoc-A, on adults (18 to 59 years old); and Edoc-I, on the elderly (60 years or older).

For this survey, data from the 2010 Demographic Census (CD 2010) from the Brazilian Institute of Geography and Statistics (IBGE) were used. Sampling was carried out in two stages: the first (and common to both surveys) was the selection of sectors, and the

second, of households, chosen by systematic sampling with random start and distinct intervals by search. All residents of the selected households were interviewed.

The calculation of the Edoc sample size considered the prevalence of alteration in renal function of 15% for adults and 40% for the elderly, with a confidence level of 95% and an absolute error of 3%. Individuals with impairments that would make it impossible to communicate or understand the questions, as well as pregnant women, were excluded from the samples of both surveys. The Edoc sampling plan is detailed in Amaral et al.[11]. For the present study, a subsample of the base project was used, with adults and elderly people tested for fasting blood glucose and answering the question in the questionnaire about the use of oral antidiabetics or insulin. Access to the matrix database occurred in February 2021.

All procedures for data collection in the original project (Edoc) were performed by trained personnel and supervised by the coordination team. Socioeconomic and demographic information included data on place of birth, age, sex, skin color or ethnicity, schooling, and marital status. In the health module, the questions dealt with self-reported morbidities and information about the current use of medication (dose and frequency), upon presentation of a medical prescription or product packaging.

The anthropometric variables analyzed as independent variables were the body mass index (BMI) – which consists of the ratio of body mass in kg to the height squared in meters – and waist circumference (WC), following the norms recommended by the American College of Sports Medicine, all in duplicate, considering the means of measurements in each variable[12]. An inelastic Cescorf® tape with millimeter resolution was used to measure WC, at the midpoint between the anterior superior iliac crest and the last rib, with participants breathing normally and abdomen relaxed.

For blood collection, all individuals were instructed to fast for 12 hours, and peripheral blood was collected from the antecubital fossa. For the present study, serum glucose was determined by the glucose oxidase method (Labtest Diagnóstica). The serum extracted was stored for biochemical dosage of triglycerides, total cholesterol, and fractions: high-density lipoprotein (HDL), low-density lipoprotein (LDL), and very low-density lipoprotein (VLDL). Total cholesterol was measured using the COD/PAD colorimetric enzymatic method, as well as fractions (HDL, LDL, and VLDL) and GPO/PAP triglycerides (Labtest Diagnóstica). LDL was obtained from VLDL by hydrolysis of different lipolytic enzymes.

The dependent variable of the DM study was defined as fasting plasma glucose ≥ 126 mg/dl and/or use of oral hypoglycemic agents and/or insulin[13]. It was not possible to establish the type of diabetes, however, the exclusion of pregnant women indicates the absence of gestational diabetes among the interviewees.

The independent variables for sociodemographic analysis included were: gender (male, female); age (18-29 years old, 30-39 years old, 40-59 years old, and 60 years old or older); schooling (with little schooling – illiterate or up to four years of complete schooling – and with higher schooling – individuals with five years or more of schooling); and marital status (single, married, separated/divorced and widowed).

The behavioral variables considered were: alcohol consumption in the last week (yes or no); smoking in three categories (non-smoker, smoker, and ex-smoker); physical activity in the last three months (yes or no); and use of health services in the last six months (yes or no). The analysis of self-assessed health was classified into three different categories (very good/good, fair, and poor/very poor), and the family history of DM presented two possible answers (yes or no).

As for variables related to comorbidities, abdominal obesity was measured by waist

circumference (WC) and considered normal when less than 102 cm in men and 88 cm in women according to the criteria of the National Cholesterol Education Program (NCEP/ATP-III). The presence of chronic kidney disease (CKD) was defined according to the formulas of the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) when GFR < 60 mL/min/1.73 m^2 and/or albuminuria > 29 mg/g. Those who, after measuring blood pressure (BP) according to the protocol recommended by the Brazilian Society of Cardiology, had a diastolic blood pressure (DBP) ≥ 90 mmHg, systolic blood pressure (SBP) ≥ 140 mmHg and/or used some type of antihypertensive medication[14], were classified as hypertensive. Dyslipidemic patients were those who use hypolipidemic drugs or with the presence of laboratory values of one or more of the following lipid components: triglycerides ≥ 150 mg/dl; total cholesterol ≥ 200 mg/dl; LDL ≥ 160 mg/dl; and HDL < 40 mg/dl (men) and < 50 mg/dl (women)[15]. The cutoff point for considering anemia was hemoglobin (Hb) < 13 g/dl (men) and < 12 g/dl (women)[16].

As for statistical analysis, the characterization of the study population was performed by descriptive and exploratory data analysis. Quantitative variables were described using measures of central tendency and dispersion, and qualitative variables were evaluated using absolute and relative frequency distributions. To check for differences between demographic, behavioral, and health variables and DM, Pearson's chi-square test was applied.

To assess the factors associated with DM in the present study, a hierarchical logistic regression model was used. The variables that in the bivariate analysis presented a value of p < 0.20 were selected and distributed in three models: 1 (distal level), 2 (intermediate level), and 3 (proximal level). In model 1, the variables gender, age, schooling, and marital status were considered, being considered distal, as they do not act directly in the development of DM. In model 2, the practice of physical activity in the last three months, having used health services in the last six months, having a family history of DM, self-assessed health, and waist circumference were considered with the purpose of expanding the understanding of proximal determinants and their relation to the outcome. In model 3, the comorbidities described in the scientific literature as directly associated with DM were included (hypertension, anemia, dyslipidemia, and chronic kidney disease). Those variables that remained associated with DM were maintained after adjusting for the others at the same level. According to the hierarchical proposal, once included in the model, within each level, the significant variables (p-value < 0.05) remained in it, regardless of changes in the p-value in the following stages (Figure 1).

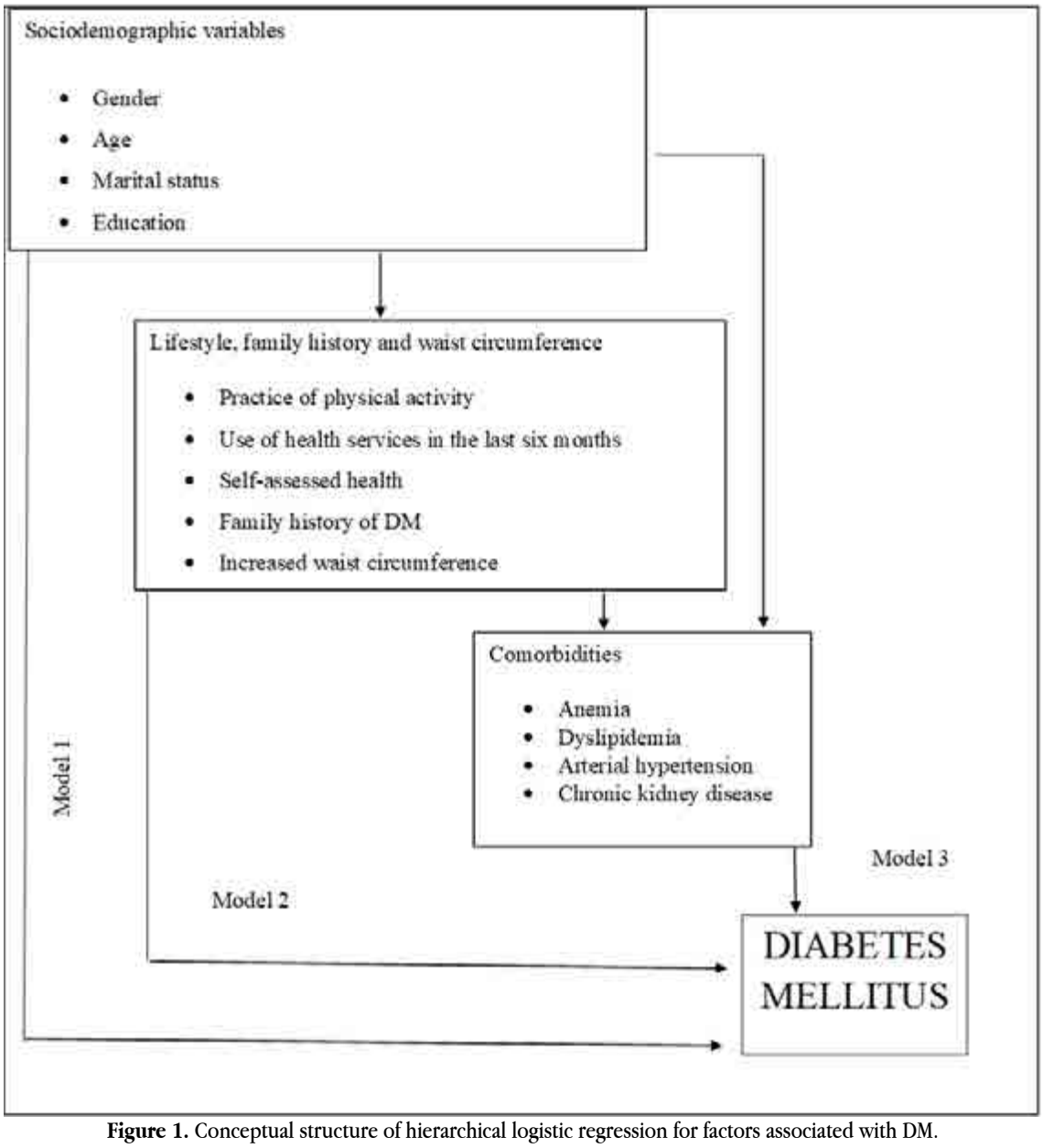

Figure 1. Conceptual structure of hierarchical logistic regression for factors associated with DM.

Crude and adjusted odds ratios were described, as well as the 95% confidence interval of the variables that were independently associated with DM. The analyses were carried out with the Complex samples routine of the Statistical Package for the Social Sciences (SPSS), version 20.0, for Windows, taking into account the effect of the sampling design and the weights of the observations.

The matrix research that gave rise to the present study was approved by the Research Ethics Committee of the Federal University of Acre under CAAE 17543013.0.0000.5010.

RESULTS

The study population consisted of 1,637 individuals, of which 202 were classified as diabetic, having as criteria fasting blood glucose greater than 126 mg/dl and/or use of antidiabetic medication and/or insulin. After considering the effect of sampling design and observation weights, the prevalence of DM was 6.5%, higher in men and increases with aging. The prevalence in the population according to the self-reported DM criterion was 6.4%, and, considering only the laboratory criterion, 5.5% (Table 1).

Table 1. Prevalence of DM according to different diagnostic criteria in Rio Branco, state of Acre, Brazil, 2014.

Variables	Blood glucose and/or medications		Self-reported		Fasting blood glucose ≥ 126 mg/dl	
	%	95% CI	%	95% CI	%	95% CI
Total	6.5	4.6-9.2	6.4	4.8-5.6	5.5	3.6-8.2
Gender						
Feminine	4.8	3.3-7.0	5.3	3.9-7.3	3.7	2.3-5.9
Masculine	8.4	5.2-13.3	7.6	4.8-11.9	7.4	4.3-12.4
Age group						
18-29 years	2.7	0.9-7.5	2.8	1.0-7.6	2.7	0.9-7.5
30-39 years	6.5	2.9-13.9	4.3	2.0-9.2	2.6	2.5-13.7
40-59 years	7.7	5.1-11.6	8.9	5.6-13.8	6.1	3.8-9.8
≥ 60 years	16.6	13.9-19.7	17.3	14.3-20.7	3.7	12.3-15.9

95% CI: 95% confidence interval; % = proportion from the N expanded.

The prevalence of DM was higher in men and increased with aging, reaching 16.6% in the population aged 60 years or older. Among widowers, it was more than twice that of singles. As for individuals who studied for five years or more, the prevalence was 5.9%, while for those who studied four years or less, including illiterates, it reached 12.4%. A lower prevalence was observed among those who reported practicing physical activity in the last three months and also among those who did not attend any type of health service in the six months before the survey. There was no association between DM and alcohol or tobacco consumption (Table 2).

Table 2. Prevalência de DM segundo características sociodemográficas e hábitos de vida em adultos e idosos de Rio Branco, Acre, Brasil, 2014.

Variable	Total		DM						*p*-value
			Yes			No			
	n	N	n	N	%	n	N	%	
Gender									0.050
Feminine	1,035	122,789	124	5,885	4.8	911	116,912	95.2	
Masculine	602	112,520	78	9,463	8.4	524	103,056	91.6	
Age group									< 0.001
18-29 years	201	86,619	04	2,003	2.7	197	84,316	97.3	
30-39 years	148	57,904	09	3,756	6.5	139	54,148	93.5	
40-59 years	302	65,065	22	5,025	7.7	280	60,040	92.3	
≥ 60 years	986	25,728	167	4,264	16.6	819	21,463	83.4	
Marital status									0.017
Single	449	103,713	40	5,298	5.1	409	98,414	94.9	
Married	669	105,294	86	7,712	7.3	583	97,581	92.7	

(Conclusão)

Variable	Total		DM						*p*-value
			Yes			No			
	n	N	n	N	%	n	N	%	
Separated/divorced	171	14,935	24	991	6.6	147	13,944	93.4	
Widowed	339	10,345	50	1,298	12.5	289	9,047	87.5	
Education									0.014
Little schooling (0 to 4 years)	524	27,085	73	3,356	12.4	451	23,728	87.6	
Higher schooling (≥ 5 years)	1,091	204,090	128	11,968	5.9	963	192,121	94.1	
Practice of physical exercise in the last three months									0.159
No	1,323	162,149	167	12,292	7.6	276	68,856	95.7	
Yes	311	71,914	35	3,057	4.3	1156	149,857	92.4	
Smoking									0.954
No-smoker	638	128,988	78	8,269	6.4	560	102,718		
Smoker	292	43,639	24	2,771	6.4	268	40,868		
Ex-smoker	702	61,317	100	4,308	7.0	602	57,008		
Consumo de bebida alcoólica nos últimos 30 dias									0.286
No	1,330	162,135		174	11,807	7.3	1156	150,327	92.7
Yes	267	63,434		18	3,098	4.9	219	60,336	95.1
Alcohol consumption in the last 30 days									0.002
No	548	97,006		47	3,432	3.5	501	93,574	96.5
Yes	1,078	134,053		153	11,363	8.5	925	122,689	91.5

* N exp = N expanded from the weights and the sampling design; % = proportion from the N exp. P-value = Pearson's chi-square test.

The prevalence of DM was approximately three times lower among those who considered their health to be very good or good, compared to those who considered it fair or very poor/poor. On the other hand, it was higher among individuals who reported a family history of DM, those with increased waist circumference, as well as those classified as dyslipidemic, anemic, or hypertensive. In the present study, the highest prevalence was among those with CKD (Table 3).

Table 3. Prevalence of DM according to health conditions in adults and elderly people in Rio Branco, state of Acre, Brazil, 2014.

Variables	DM								*p*-value
	TOTAL		Yes			No			
	n	N	n	N	%	n	N	%	
Self-assessed health									
Very good/good	599	97,567	56	3,060	3.1	543	94,506	96.9	0.008
Fair	788	108,284	107	9,726	9.0	681	98,557	91.0	
Poor/very poor	250	29,465	39	2,562	8.7	211	26,903	91.3	
Family history of DM									0.001
No	973	145,294	58	5,588	3.8	915	139,706	96.2	
Yes	660	88,904	144	9,761	11.0	516	79,143	89.0	
Waist circumference									
Normal	1,088	183,792	102	9,333	5.1	986	174,458	94.9	0.005
Increased	515	47,323	92	4,915	10.4	423	42,408	89.6	
Anemia									
No	1,349	202,940	148	10,336	5.1	1,201	192,603	94.9	0.005
Yes	276	30,874	49	1,391	14.6	227	26,352	85.4	
Dislipidemia									
No	356	64,238	27	1,458	2.3	329	62,780	97.7	0.002
Yes	1,275	170,553	169	13,366	7.8	1,106	157,187	92.2	
Arterial hypertension									
No	706	170,813	35	5,330	3.1	671	165,483	96.9	< 0.001
Yes	909	58,719	166	9,712	16.5	743	49,007	83.5	
Chronic kidney disease									
No	1,340	211,741	117	10,124	4.8	1,223	201,617	95.2	< 0.001
Yes	267	18,468	75	3,989	21.6	192	14,479	78.4	

* N exp = N expanded from the weights and the sampling design; % = proportion from the N exp. P-value = Pearson's chi-square test.

In the analysis by the hierarchical model, in model 1, there was a significant difference only for the age group, comparing those aged 60 years or more with those aged 18 to 29 years (OR_{adj} 6.66; 95% CI 1.83-24.30). The gender variable, although with no statistical significance (OR_{adj} 1.83; CI 95% 0.96-3.50), remained in the analysis for the adjustment of the models due to its importance according to the literature. In model 2, family history of DM was associated with the outcome, with almost three times greater chance of having a diagnosis of DM in individuals who had relatives with this condition. Fat deposition in the abdominal region above normal limits, assessed by waist circumference, was also significantly associated with an 83% increase in the chance of DM occurrence. In model 3, the chance of occurrence of DM was almost three times higher among those with dyslipidemia and among those with anemia. Among participants with CKD, there was a fourfold increase in the chance of the individual being diabetic (Table 4).

Table 4. Bivariate analysis and multivariate models for factors associated with DM according to hierarchical levels of exposure variables studied in adults and elderly people in Rio Branco, state of Acre, Brazil, 2014.

Variables	OR_{crude}	(95% CI)	$OR_{adjusted}$	(95% CI)
Model 1				
Male gender	1.82	1.01-3.32	1.83	0.96-3.50
Age group (reference: 18-29 years)				
30-39 years	2.54	0.83-7.72	2.57	0.80-8.20
40-59 years	3.06	0.95-9.87	3.08	0.85-11.06
≥ 60 years	7.27	2.45-21.61	6.66	1.83-24.30
Schooling: (reference: ≥ 5 years of schooling)	2.27	1.18-4.36	1.20	0.56-2.55
Marital status (reference: single)				
Married	1.47	0.73-2.95	1.04	0.48-2.25
Separated/divorced	1.32	0.61-2.85	0.80	0.35-1.84
Widowed	2.67	1.43-4.98	1.09	0.43-2.80
Model 2				
No physical activity (last 3 months)	1.85	0.78-4.36	1.63	0.56-4.72
Used the health service (last 6 months)	2.52	1.41-4.50	1.96	0.98-3.89
Self-assessed health (reference: very good/good)				
Fair	3.04	1.35-6.86	2.24	0.88-5.72
Very poor/poor	2.94	1.42-6.06	1.55	0.70-3.43
History family of DM	3.08	1.57-6.04	2.88	1.43-5.81
Increased waist circumference	2.16	1.26-3.70	1.83	1.01-3.33
Model 3				
Anemia	3.20	1.34-7.63	3.15	1.30-7.60
Dyslipidemia	3.66	1.65-8.08	2.95	1.34-6.50
Arterial hypertension	6.15	2.98-12.70	2.25	0.94-5.40
Chronic kidney disease	5.48	2.25-13.36	4.00	1.70-9.33

OR: odds ratio; 95% CI: 95% confidence interval. Model 1 (distal): gender, age, schooling, and marital status were considered; Model 2 (intermediate): practice of physical activity in the last three months, having used health services in the last six months, having a family history of DM, self-assessed health, and waist circumference plus the significant variables in the distal model were included; Model 3 (proximal): arterial hypertension, anemia, dyslipidemia, and chronic kidney disease were included, plus the significant variables in the distal and intermediate models.

DISCUSSION

The prevalence of DM in Rio Branco, state of Acre, was 6.5%, using laboratory and medication parameters as a diagnostic criterion for DM. In the analysis using the hierarchical multiple regression method, age equal to or greater than 60 years, family history of DM, increased abdominal circumference, and presence of chronic kidney disease, anemia, and dyslipidemia were associated with DM.

The prevalence of the problem according to the self-reported criterion (6.4%) was similar to the laboratory and medication criteria (6.5%) in the present study, diverging from the values found in other studies, in which the self-reported

prevalence was 7.5%, and in laboratory and medication criteria, 8.4%6. The present study reinforces that, in the case of chronic and highly prevalent diseases, such as DM, surveys with self-reported diagnoses represent a quick and efficient alternative to assess the population profile[4].

Regarding gender, there was a higher prevalence of DM among men (8.4%) than among women (4.8%), differing from other reviewed literature, in which the prevalence of DM is higher in women in Brazil[3-4,6,17,18]; however, this is not a reality in other countries[9,19]. The higher prevalence among females in national studies is associated with greater demand for health services and longer life expectancy[7]. Although the mechanism linking obesity to hyperglycemia is not completely known, it is known that visceral obesity is associated with inflammatory processes and insulin resistance. At least one study carried out in Sweden, pointed to an association between plasma glucose level with visceral fat per kilogram of body mass, being stronger in males[20]. This is a possible explanation for the results of the present study since six out of ten people from Rio Branco are overweight, and this is greater in men (63.2%) than in women (57.8%)[9].

The prevalence of DM in the population aged 60 years and over was 16.6%, a result similar to the expectation published in 2019 by the International Diabetes Federation, which estimated a worldwide prevalence of DM of 19.3% in the population over 65 years[19]. In the present study, this prevalence increased with aging, a result that is in line with that observed in other national studies[4,5]. The high prevalence of diabetes mellitus among the elderly is associated with longer life expectancy and improved access to health services[10].

The association between family history of DM was significant, with the chance of occurrence being almost three times greater in individuals who had relatives with this condition. Type 2 DM accounts for 30-70% genetic conditions, and family history is a significant risk factor. Several genes have already been identified as associated with the onset of the disease, and others are yet to be discovered[21].

Besides genetic conditions, behavioral factors are associated with the onset and complications of DM; among these, the obesity pandemic represents a worrying risk for society and health services. A study that aimed to evaluate the increase in blood glucose in people with high abdominal fat deposition identified negative repercussions, both metabolic and cardiovascular among those with central obesity[22]. Furthermore, the increase in body mass index linearly increases the risk of DM. There are several cellular, adipose tissue biology, and multiorgan insulin resistance mechanisms related to hyperglycemia[24]. It emphasizes the importance of treatments for insulin resistance based on multidisciplinary strategies that take into account its pathophysiological mechanism, the suppression of lipid synthesis in the liver, and the stimulation of fat oxidation in the skeletal muscle, thus being able to prevent or delay the onset of type 2 DM[23].

In addition to obesity, dyslipidemia was also associated with DM. This finding is relevant since the increase in triglyceride and LDL cholesterol levels and the total cholesterol/HDL cholesterol ratio are directly associated with a faster progression of atheromatous plaques in the arteries of diabetic patients compared to non-diabetic individuals[25], increasing the risk of complications and death[26].

In individuals classified as anemic, there was a higher prevalence of the disease. The Brazilian DM guideline recommends both screening and early treatment of anemia to improve the quality of life of diabetics. These patients show a chronic inflammation that decreases the production of red blood cells, as well as there is a reduction in the production of the hormone that stimulates the production of red blood cells (erythropoietin)[1]. The relationship between glycemic control and hemoglobin levels

is associated with macrocellular mechanisms of renal function[27].

Among the chronic diseases evaluated, CKD was the one with the highest odds ratio for the occurrence of DM. Another national study also reported a higher prevalence of CKD in diabetics (17.6%) than in non-diabetics (6.5%)[28]. Probably, more than half of the cases of CKD could be avoided if prioritization were given to screening tests for kidney damage at a timely and early stage, especially in the population at high risk of kidney and cardiovascular disease, as is the case of diabetics[29].

Arterial hypertension was directly associated with the risk of being diabetic in international[19] and national studies[4,30], but in the adjusted model in the present study, it lost statistical significance. Hypertension and DM have risk factors in common, such as a sedentary lifestyle, obesity, and an unbalanced diet. When they occur together, they accelerate the processes that lead to renal and ocular complications and cardiovascular diseases, such as stroke and acute myocardial infarction[5].

A limitation of the present study is the impossibility of drawing causal inferences due to the cross-sectional design. It is worth emphasizing the importance of the exploratory analysis of the set of variables, allowing better knowledge of the DM profile in the studied population and, consequently, better attention to their health. Although the study was conducted with people aged 18 years or older, the type of diabetes was not defined, including types 1 and 2, excluding only gestational diabetes. Another point to be raised is the time elapsed between data collection and presentation of results, which must be carefully evaluated. However, the references used in the discussion, most published in the last five years, allow to infer that the data are still current and capable of indicating the reality of the disease in the study site.

The use of laboratory criteria for diagnosis stands out as a strong point of the present study, thus allowing the identification of individuals who did not know they were diabetic. Population-based research such as the present study should be encouraged across the country, to assess regional differences, and to better understand the factors related to DM.

CONCLUSION

The prevalence of DM was 6.5% and was associated with aging, family history of DM, increased waist circumference, anemia, dyslipidemia, and CKD. DM is a relevant health problem in the population, and this research seeks to contribute to the knowledge of the associated factors in order to support the monitoring of its prevalence, identify the groups most vulnerable to the disease, and thus encourage public policies for the prevention and control of this morbidity. The importance of greater care on the part of health professionals for diabetic patients with obesity, dyslipidemia, anemia, and CKD is emphasized, aiming at a better follow-up to prevent complications and deaths.

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