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Associations among self-reported diabetes, nutritional status, and socio-demographic variables in community-dwelling older adults

Associações entre diabetes autorreferido, estado nutricional e variáveis sociodemográficas em idosos comunitários

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ABSTRACT

Objective

The aim of this study was to describe relationships between self-reported diabetes mellitus and its treatment, according to demographic and socioeconomic data, as well as indicators of nutritional status in community-dwelling older adults.

Methods

This is a population-based and a cross-sectional study derived from the multicentric survey "Frailty in Brazilian Elderly". The random sample consisted of 881 community-dwelling older adults aged 65 years and older from the city of *Campinas*. The self-reported variables were: age, gender, family income (minimum salaries), education (years of education); and absolute data (yes *versus* no) regarding unintentional weight loss and weight gain, diabetes, and its treatment. Anthropometric variables were collected by trained examiners following classic protocols. Body mass index was classified as: underweight <23; normal weight ≥23 and <28; overweight ≥28 and <30; and obesity ≥30. Waist-to-hip *ratio*, indicator of abdominal adiposity, was classified according the metabolic risk, for male and female, respectively: low 0.90-0.95 and 0.80-0.85; moderate 0.96-1.00 and 0.86-0.90; and high >1.00 and >0.90.

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Results

The variables most associated with diabetes were obesity (*OR*=2.19), abdominal adiposity (*OR*=2.97), and unintentional weight loss (*OR*=3.38). The lack of diabetes treatment was associated with advanced age (*p*=0.027), lower educational level (*p*=0.005), and low metabolic risk (*p*=0.004).

Conclusion

Self-reported diabetes was associated with obesity but mostly with abdominal adiposity and unintentional weight loss. Not being treated for diabetes *mellitus* was associated with advanced age, lower levels of education, and lower abdominal adiposity.

Indexing terms: Aged. Diabetes *mellitus.* Nutritional status.

RESUMO

Objetivo

O objetivo deste estudo foi descrever associações entre o diabete melito autorrelatado e seu tratamento, conforme variáveis demográficas, socioeconômicas e indicadores do estado nutricional, em idosos residentes no município de Campinas.

Métodos

Trata-se de estudo de base populacional, transversal, que faz parte do projeto multicêntrico "Fragilidade em Idosos Brasileiros", conduzido com amostra aleatória composta por 881 idosos (de 65 anos ou mais) do município de Campinas. Os itens autorreferidos utilizados foram: *faixa etária, sexo, renda familiar (em salários-mínimos), escolaridade (anos de escolaridade), além de dados dicotômicos (sim* versus *não) referentes a perda e ganho ponderais, diabetes* mellitus *e tratamento da doença. O índice de massa corporal foi classificado como*: *baixo peso <23; eutrofia ≥23 e <28; sobrepeso ≥28 e <30; obesidade ≥30. A relação cintura-quadril, indicadora de adiposidade abdominal, foi classificada conforme o risco metabólico de homens e mulheres, respectivamente: baixo, entre 0.90-0.95 e 0.80-0.85; moderado, entre 0.96-1.00 e 0.86-0.90; alto, >1.00 e >0.90.*

Resultados

Os fatores mais associados ao diabete foram obesidade (OR=2,19), adiposidade abdominal (OR=2,97) e perda ponderal não-intencional (OR=3,38). O não tratamento da doença associou-se a: *idade mais avançada (p=0,027), menor nível de escolaridade (p=0,005) e baixo risco metabólico (p=0,004).*

Conclusão

O diabete autorrelatado associou-se com a obesidade, mas principalmente com a adiposidade abdominal e a perda de peso não intencional. O não tratamento do diabete pelo idoso foi associado com idade avançada, baixo nível educacional e reduzida adiposidade abdominal.

Termos de indexação: *Idoso. Diabetes* mellitus*. Estado nutricional.*

INTRODUCTION

The demographic transition has been accompanied by changes in nutritional and epidemiological population profiles, characterized respectively, by modification of dietary patterns leading to increased prevalences of overweight and obesity and high rates of morbidity and mortality arising from Chronic Non-communicable Diseases (NCD) and its complications, expressed by disabilities and dependency[1].

Among the major NCD, Diabetes *Mellitus* (DM) is defined by the World Health Organization (WHO) as a metabolic disorder characterized by chronic hyperglycemia resulting from changes in the insulin secretion and/or action[2], with consequent chronic complications that overwhelm the health care system and burden the patients' and caregivers' quality of life[3].

The prevalence of diabetes, a public health concern, increases in Brazil and worldwide every year. According to the International Diabetes Federation (IDF), the global prevalence of the disease in 2013 was 8.3%, corresponding approximately to 382 million diabetics, with estimates of 592 million for 2035. Also in this

period, there were 5.1 million diabetes-related deaths and 316 million people with impaired glucose tolerance, a condition which represents an important risk factor for the development of DM[4].

According to a Brazilian Ministry of Health's epidemiological study on risk and protective factors for chronic diseases, the prevalence of self-reported diabetes in this population corresponded in 2011 to 3.4%, 8.9%, 15.2% and 21.6%, in the age groups of 35-44, 45-54, 55-64, and 65 years and over, respectively, indicating higher frequencies in higher ages (55 years and older)[5].

Components such as an ageing population, family history, excessive adiposity, inactivity, and unhealthy diet are associated with high rates of diabetes[6]. In older adults these risk factors combined with physiological changes of aging, such as chronic inflammation, reduced muscle mass, and high percentage of adipose mass, particularly in the abdominal region, potentiate insulin resistance and enhance the risk for disease[6-8].

Obesity, defined as an excess of total body fat, represents one of the major contributors to the development of chronic health conditions, including diabetes[6]. Body Mass Index (BMI) and Waist-to-Hip *Ratio* (WHR) are important anthropometric measures widely used in epidemiological studies as indirect indicators of overall and abdominal obesity, respectively. Although showing good correlation with morbidity and mortality, particularly with DM[9,10], these measures should be performed and analyzed carefully in the elderly, due to the physiological changes of body composition of this specific population[11].

Hence, the purpose of this study was to describe associations between self-reported diabetes and its treatment, according to demographic, socioeconomic, and nutritional status-related variables in community-dwelling older adults.

METHODS

This was a cross-sectional study, conducted with community-dwelling older adults aged 65 years and older, residents of *Campinas*, a city located in the State of *São Paulo*, Brazil, with around 1,144,862 inhabitants[12]. The sample was based on data from the electronic database of *Fragilidade em Idosos Brasileiros* (FIBRA, Frailty in Brazilian Elderly), a multicentric and population-based survey conducted in 2008-2009. This investigation was approved by the Ethics Committee of the Faculty of Medical Sciences of *Universidade Estadual de Campinas* (nº 208/2007).

We performed simple random sampling of census tracts in urban areas of *Campinas*, according to a pre-defined plan, and selected 900 elderly. Survey participants were recruited in their households by a trained and uniformed team comprising gerontology students, community health professionals, and religious pastoral agents, according to the following inclusion criteria: aged 65 years and older; understands instructions; agrees to participate; and is a permanent resident in the household and census tract. The exclusion criteria, the same as suggested by Ferrucci *et al*.[13], used in the Cardiovascular Health Study (CHS), were: having a cognitive deficit suggestive of dementia; being wheelchair-bound or bedridden; suffering from severe stroke sequelae, with localized loss of strength and/or aphasia; having Parkinson's disease in an advanced or unstable stage; having auditory or visual deficits that make communication difficult; being terminally ill. More information about the methodology and the sampling and recruitment processes of FIBRA can be found in the study carried out by Neri *et al*.[14].

After the seniors had signed an Informed Consent Form, the data collection was carried out at local community centers, according to a structured protocol. The demographic and socioeconomic characteristics (gender, age, family income and education level) were based on self-reported items (date of birth, males *vs*. females, and gross family income). The variables

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age (years), family income (in minimum salaries) and educational level were sorted, respectively, into four (65-69, 70-74, 75-79, ≥80), five (0.0 to 1.0, 1.1-3.0, 3.1-5.0, 5.1-10.0, >10.0), and three (never been to school, 1-4 years, ≥5 years) categories.

Diabetes data was obtained from the self-reported question: "Do you have diabetes?" (yes *versus* no). The older adults who answered yes to this item were then asked whether they were being treated for the disease (yes *versus* no).

Anthropometric measurements (weight, height, and waist and hip circumferences) were collected by trained examiners according to classic protocols of the WHO[15]. The weight and height of the participants were obtained, respectively, by a digital balance (G-Tech) and a scale (200 cm) graduated in centimeters and millimeters. BMI was calculated using the equation: BMI (kg/m^2) = weight (kg) ÷ height^2 (m), and classified according to the Pan American Health Organization criteria (underweight <23; normal weight ≥23 and <28; overweight ≥28 and <30; obesity ≥30)[16]. The waist circumference (WC) and Hip Circumference (HC) were measured with a non-elastic tape measure (150 cm), to obtain the WHR, an indicator of abdominal adiposity, which was classified as metabolic risk according to Lohman *et al*.[17] (risk for male and female, respectively: 0.90 to 0.95 and 0.80 to 0.85: low; 0.96 to 1.00 and 0.86 to 0.90: moderate; >1.00 and >0.90: high).

Data regarding weight loss and weight gain were collected from the dichotomous self-reported items: "Did you lose weight unintentionally in the past 12 months?" (yes *versus* no) and "involuntary weight gain" (yes *versus* no).

After the exclusion of 19 participants due to lack of information in self-reported diabetes, the final sample was composed of 881 older adults. Of these, due to missing data, 766 (86.9%), 879 (99.7%), 874 (99.2%), 675 (76.6%), 879 (99.7%) and 878 (99.6%) participants exhibited data concerning family income, education level, weight loss, weight gain, BMI and WHR, respectively.

Descriptive statistics were used to characterize the sample. Categorical (gender, age, family income, education, self-reported DM, treatment for DM, BMI, weight loss, weight gain, and WHR) and continuous (age, family income, years of education, BMI and WHR) data were presented, respectively, by absolute frequencies and percentages; and by mean and standard deviation values. Chi-square analyses and Fisher exact tests were used to compare the categories of self-reported DM and its treatment, with demographic, socioeconomic and nutritional status-related indicators. Binary logistic regression analyses were performed to determine associations between self-reported DM (dependent variable) and the other variables (independent). The multivariate logistic regression analysis was conducted using the stepwise backward method. The significance level of 5% (p<0.05) was adopted in the tests. The Statistical Package for the Social Sciences (SPSS) 17.0 version was used in the analyses.

RESULTS

Of the 881 respondents, 69.5% were females and 66.2% were between 65 and 74 years old. Almost 20.0% of the older adults had never been to school and more than half of the sample had 1 to 4 years of formal education. Mean values of age and education were 72.79 ± 5.81 and 4.69 ± 5.28 years, respectively. Half of the participants had a family income of up to 3 minimum salaries.

The prevalence of self-reported DM was 22.2% (Table 1). Respondents who treated less for DM were older, with no formal education and showed a low metabolic risk according to their WHR (Table 2).

Regarding anthropometric measures, this study found a high frequency of obesity (26.6%) and 63.0% of the sample had some risk for metabolic complications, assessed by WHR (Table 1). Mean values of BMI and WHR were 27.52 ± 4.84 kg/m^2 and 0.90 ± 0.08, respectively. Comparisons between self-reported DM and

Table 1. Characteristics of the participants according to demographic, socioeconomic and nutritional status-related variables. Frailty in Brazilian Elderly. *Campinas* (SP), 2008-2009.

Variables	Categories	Frequencies	
		n	%
Gender	Male	269	30.5
	Female	612	69.5
Age (years)	65-69	301	34.3
	70-74	281	31.9
	75-79	181	20.5
	≥80	118	13.4
Family income (minimum wages)	≤1.0	69	9.0
	1.1-3.0	306	39.9
	3.1-5.0	204	26.6
	5.1-10.0	126	16.4
	>10.0	61	8.0
Education	Never been to school	160	18.2
	1-4 years	478	54.4
	≥5 years	241	27.4
Self-reported diabetes	Yes	196	22.2
	No	685	77.8
Treatment for DM	Yes	173	90.1
	No	19	9.9
BMI	Underweight	136	15.5
	Normal weight	376	42.8
	Overweight	133	15.1
	Obesity	234	26.6
Weight loss	Yes	243	27.8
	No	631	72.2
Weight gain	Yes	182	27.0
	No	493	73.0
WHR (metabolic risk)	Low	325	37.0
	Moderate	237	27.0
	High	316	36.0

Note: BMI: Body Mass Index; WHR: Waist-Hip *Ratio*; DM: Diabetes *Mellitus*.

anthropometric variables demonstrated frequencies of underweight, overweight, and obesity in 12 (6.1%), 35 (17.9%) and 81 (41.3%) diabetic older adults *versus* 124 (18.2%), 98 (14.3%) and 153 (22.4%) without this disease ($p<0.001$). We found low, moderate and high WHR values in 49 (25.0%), 48 (24.5%) and 99 (50.5%) of those who reported DM *versus* 276 (40.5%), 189 (27.7%) and 217 (31.8%) non-diabetics ($p<0.001$). There was also an association between weight loss and self-reported DM (38.7% among diabetics *versus* 24.7% among non-diabetics, $p<0.001$) (Table 2).

Results from the logistic regression analyses (Tables 3 and 4), showed that the factors most associated with self-reported DM were obesity, abdominal adiposity (indicated by high values of WHR) and unintentional weight loss.

DISCUSSION

Diabetes mellitus is a chronic disabling disease associated with urbanization and unhealthy habits that demands a long-term and ongoing management by patients and the health

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Table 2. Distribution of the participants regarding self-reported diabetes and its treatment according to demographic, socioeconomic, and nutritional status-related variables. Frailty in Brazilian Elderly. *Campinas* (SP), 2008-2009.

Variables and Categories	Self-reported diabetes				*p*-value	Treatment for DM				*p*-value
	Yes		No			Yes		No		
	n	%	n	%		n	%	n	%	
Gender										
Male	62	31.6	207	30.2	0.705*	52	30.1	8	42.1	0.282**
Female	134	68.4	478	69.8		121	69.9	11	57.9	
Age (years)										
65-69	70	35.7	231	33.7	0.621*	64	37.0	5	26.3	0.027**
70-74	62	31.6	219	31.9		57	32.9	3	15.8	
75-79	43	21.9	138	20.2		37	21.4	5	26.3	
≥80	21	10.8	97	14.2		15	8.7	6	31.6	
Family income (minimum salaries)										
≤1.0	18	10.5	51	8.6	0.623*	14	9.3	4	25.0	0.121**
1.1-3.0	73	42.7	233	39.2		64	42.4	6	37.5	
3.1-5.0	42	24.6	162	27.2		37	24.5	5	31.2	
>5.0	38	22.2	149	25.0		36	23.8	1	6.3	
Education										
Never been to school	43	22.1	117	17.1	0.246*	31	18.0	10	52.6	0.005**
1-4 years	104	53.3	374	54.7		96	55.8	7	36.9	
≥5 years	48	24.6	193	28.2		45	26.2	2	10.5	
BMI										
Underweight	12	6.1	124	18.2	<0.001*	10	5.8	2	10.5	0.682**
Normal weight	68	34.7	308	45.1		60	34.7	7	36.8	
Overweight	35	17.9	98	14.3		32	18.5	2	10.5	
Obesity	81	41.3	153	22.4		71	41.0	8	42.2	
Weight loss										
Yes	75	38.7	168	24.7	<0.001*	67	38.9	7	38.9	1.000*
No	119	61.3	512	75.3		105	61.1	11	61.1	
Weight gain										
Yes	31	22.3	151	28.2	0.165*	25	20.3	3	23.1	0.730**
No	108	77.7	385	71.8		98	79.7	10	76.9	
WHR										
Low	49	25.0	276	40.5	<0.001*	37	21.4	11	57.9	0.004**
Moderate	48	24.5	189	27.7		44	25.4	3	15.8	
High	99	50.5	217	31.8		92	53.2	5	26.3	

Note: *p-value for Qui-square Test; **p-value for Fischer Exact Test.

BMI: Body Mass Index; WHR: Waist-Hip *Ratio*.

care system. In this study we investigated associations of self-reported diabetes in community-dwelling older adults according to demographic, socioeconomic, and nutritional status-related data.

With reference to the socioeconomic profile of our sample, the educational level of the older adults was similar to the *Saúde Bem-Estar e Envelhecimento* (SABE, Health, Well-being and Aging Survey), a population based-study conducted with 2,143 older adults (mean age of 68 years) from the city of *São Paulo*, in which 21.0% of respondents had never attended school, and 46.4% had less than four years of formal education[18]. Nevertheless, the participants' average income was lower (2.1 minimum salaries)

Table 3. Univariate logistic regression results for self-reported diabetes mellitus (N=586). Frailty in Brazilian Elderly. *Campinas* (SP), 2008-2009.

Variables	Categories	*p*-value	*OR**	95%CI *OR**
Gender	Male (ref.)	-	1.00	-
	Female	0.705	0.93	0.66-1.32
Age (years)	65-69 (ref.)	-	1.00	-
	70-74	0.732	0.93	0.63-1.38
	75-79	0.900	1.03	0.66-1.59
	≥80	0.224	0.71	0.41-1.23
Family income (minimum salaries)	≤1.0	0.323	1.38	0.72-2.63
	1.1-3.0	0.362	1.23	0.78-1.91
	3.1-5.0	0.948	1.01	0.62-1.66
	>5.0 (ref.)	-	1.00	-
Education	*Never been to school*	0.104	1.48	0.92-2.36
	1-4 years	0.568	1.12	0.76-1.64
	≥5 years (ref.)	-	1.00	-
BMI	Underweight	0.013	0.44	0.23-0.84
	Normal weight (ref.)	-	1.00	-
	Overweight	0.043	1.62	1.01-2.58
	Obesity	0.000	2.40	1.64-3.49
Weight loss	Yes	0.000	1.92	1.37-2.69
	No (ref.)	-	1.00	-
Weight gain	Yes	0.166	0.73	0.47-1.14
	No (ref.)	-	1.00	-
WHR	Low (ref.)	-	1.00	-
	Moderate	0.110	1.43	0.92-2.22
	High	0.000	2.57	1.74-3.78

Note: **OR*: Odds *Ratio* for self-reported diabetes; 95%CI *OR*: 95% Confidence Interval for *Odds Ratio*.

BMI: Body Mass Index; WHR: Waist-Hip *Ratio*; Ref.: Reference level.

Table 4. Multivariate logistic regression results for self-reported diabetes mellitus (N=586). Frailty in Brazilian Elderly. *Campinas* (SP), 2008-2009.

Variables	Categories	*p*-value	*OR**	95%CI *OR**
BMI	Underweight	0.399	0.71	0.32-1.56
	Normal weight (ref.)	-	1.00	-
	Overweight	0.070	1.75	0.95-3.21
	Obesity	0.003	2.19	1.29-3,70
WHR (metabolic risk)	Low (ref.)	-	1.00	-
	Moderate	0.099	1.67	0.90-3.08
	High	0.000	2.97	1.68-5.25
Weight loss	No (ref.)	-	1.00	-
	Yes	0.000	3.38	2.12-5.38

Note: **OR*: Odds *Ratio* for self-reported diabetes; 95%CI *OR*: 95% Confidence Interval for *Odds Ratio*.

BMI: Body Mass Index; WHR: Waist-Hip *Ratio;* Ref.: Reference level.

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than the mean value found in the present study (4.5 ± 5.0 minimum salaries)[19].

The prevalence of DM found in this study (22.2%) differs from data regarding Brazilian community-dwelling older adults from SABE (17.5%)[18] and the *Inquérito de Saúde no Estado de São Paulo* (ISA-SP, Health Survey in *São Paulo*) (15.4%)[20]. However, Wennberg *et al*.[21] reported a similar frequency of this self-rated disease (24%) in a representative sample of American seniors (≥65 years).

The high proportion of diabetics in this study may be partially explained by the presence of community health professionals in the recruitment process. Participants often attend the primary health care units because of some chronic disease-related problem and so probably knew some of these recruiters. Therefore, they could have been more willing to accept the invitation to participate in the research. Nevertheless, this DM prevalence may be underestimated, considering the use of a self-report measure and the exclusion criteria, which ruled out the most disabled older adults.

Diabetes was not statistically associated with gender and age, data corroborated by the ISA-SP Study[20]. However, in an investigation conducted with 399 older community-dwellers, Aurichio *et al*.[22] observed higher self-rated DM frequencies in men (22.1% *versus* 15.1% in women). SABE showed a slight predominance of DM in women (18.7% *versus* 16.8% in men) and lower frequencies in seniors older than 75 years in both genders, which could be explained by premature mortality due to the disease's chronic complications[18].

Similarly with the ISA-SP[20], there was no statistically significant difference between self-reported DM and socioeconomic variables (income and education level). Nevertheless, we observed statistical associations between non-treatment for DM with higher ages (80 years and older), illiteracy, i.e., seniors who have never attended school, and lower WHR. Furthermore, a greater proportion of subjects with higher income (>5.0 minimum salaries) was found among the treatment group, compared with those receiving the minimum salary or less.

Barros *et al*.[23], in a sample of 391,868 adults from the Brazilian National Household Sample Survey (PNAD) - 2008, observed an association between disadvantaged social groups (evaluated by years of education and access to private health services) and higher prevalences of chronic diseases, particularly diabetes. In a systematic review, Agardh *et al*.[24] also reported that an adverse economic situation, measured by income, education level, and occupation, was associated with increased risk for type 2 DM occurrence, both in developed and developing countries.

In this study a disadvantageous socioeconomic status, particularly when associated with low education level, and also advanced age, may have prevented the older adults from getting DM treatment. According to the literature, the non-adherence of old people to drug therapy for chronic diseases may be related to factors like low levels of education and information, difficulties in obtaining medications due to their high costs, scarcity of these drugs in primary health care units, insufficient income, multiple comorbidities and polypharmacy, cognitive impairment, and functional disability[25,26].

Regarding the nutritional profile of the sample, we found elevated prevalences of obesity (26.7%) indicated by BMI, and abdominal adiposity (36.0%) represented by high WHR, as well as weight loss and weight gain.

Nascimento *et al*.[27] found frequencies of underweight (BMI <22 kg/m^2) and overweight (BMI >27 kg/m^2), equivalent to 13.6% and 45.0%, respectively (*versus* 15.4% and 41.8% of this study). SABE found higher rates of underweight (24.1%) and lower proportions of obesity (20.8%)[28]. Munaretti *et al*.[29] reported 33.1% of men and 85.5% of women at metabolic risk, considering WHR's cutoff values above 0.95 and 0.8 for men and women, respectively. The discrepancy obtained between literature data and

our results could be explained by methodological criteria used to define cutoff values for BMI and WHR categories.

High prevalences of weight gain and obesity in the general population, particularly among older adults, are associated with the nutrition transition, which is influenced by industrialization and urbanization, and consequently by globalization of unhealthy dietary habits and a sedentary lifestyle[1].

Changes in body composition, physiological features of the aging process, should also be considered. These include loss of muscle mass and redistribution of body fat with increasing intra-abdominal, visceral, and intramuscular adiposity, and decreasing subcutaneous fat. This set of changes results in a decline in the basal metabolic rate, which concomitantly with high or stable caloric consumption, could possibly contribute to involuntary weight gain and high frequencies of overweight[7].

Obesity in turn is a major risk factor for the development of chronic diseases, including diabetes. The present study found a strong association between overweight (p=0.043), obesity (p=0.003) and abdominal adiposity (p=0.000) with the presence of diabetes. These findings corroborate data found in the literature.

In the *Inquérito de Saúde no Estado de São Paulo*[20], self-reported DM was statistically associated with high values of BMI (p<0.01). Although Benedetti *et al*.[30], in a study involving 867 elderly from southern Brazil found no association between self-reported diabetes and high BMI (>25 kg/m^2), they reported statistical association between DM and high WHR values (>0.90 and >0.85 for men and women, respectively) (*OR*=4.32, CI=1.85 - 10.09).

Cheng *et al*.[10], in a sample of 5,107 Chinese (Taiwanese), also reported a significant relationship between self-reported DM and high BMI and WHR (compared with non-diabetics), the latter being an important anthropometric risk predictor for the development of type 2 diabetes mellitus. Other foreign studies also observed associations between high WHR[9] and BMI[9,31] and high risk for DM incidence.

Abdominal adiposity correlates with type 2 DM, whereas it is associated with secretion of substances such as adipokines, free fatty acids, and pro-inflammatory cytokines, such as Tumor Necrosis Factor alpha (TNF-α) and Interleukin 6 (IL-6), which contribute to reduce insulin sensitivity and cause pancreatic beta-cell dysfunctions[8]. This set of risk factors characterizes the metabolic syndrome and also potentiates the development and aggravation of diabetes. Likewise, according to recent studies, features such as central obesity, insulin resistance, and chronic inflammation correlate with worse sarcopenia and development of frailty syndrome in older adults, which leads to greater risks for disabilities, hospitalization, and death[32,33].

The robust association of unintentional weight loss with DM in respondents (*OR*=3.38, CI=2.12-5.38) may be related to the symptomatology of the disease, which involves weight loss, among other factors[2]. Although no association was observed between non-treatment for DM and weight loss, the degree of adherence and treatment effectiveness in those undergoing treatment is unknown. Thus, a possibly inappropriate treatment for DM could have contributed to weight loss in the sample.

In older individuals with chronic diseases, particularly in those with more than one disease, situations such as polypharmacy, dysphagia, xerostomia, lower gustatory and olfactory sensitivity, cognitive impairment, and depressive symptoms may promote inappetence and low food intake. Other aspects such as mobility disorders, disability, and social isolation may preclude access to adequate food[34].

The weight history of an older individual is an important aspect that should be considered. Studies have shown that weight loss[35] and gain[36], as well as weight cycling[35] (described as gain and loss of weight), are associated with mobility

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disability, worsening of health status, and mortality in older men and women. This fluctuations in weight, particularly among old adults with chronic comorbidities, as diabetes, who are more prone to having chronic inflammation and abdominal adiposity, could possibly lead to a progressive loss of lean mass, strength, and functionality[36]. Therefore, monitoring weight changes in these ageing individuals should be a priority of geriatric care[35].

One limiting factor of this study refers to its cross-sectional design, which does not allow establishing a cause-effect relationship, but only drawing a profile of associations, between diabetes mellitus and the other variables. Another limitation of this investigation regards to the use of a self-reported data to indicate the presence of DM, whereas, as mentioned above, this type of measure could have underestimated the real situation of the participants. Nevertheless, despite being a limited method, studies have shown that using self-rated morbidity in population surveys represents a valid, inexpensive and practical method, and may produce adequate prevalence estimates of diseases such as diabetes and hypertension[37,38].

CONCLUSION

This study showed a high prevalence of self-reported diabetes. The disease was associated with obesity (measured by high BMI) but mostly with abdominal adiposity (WHR) and unintentional weight loss, factors that cause a greater impact on functionality, increase risks of morbidity and mortality, and increase the health care system costs considerably.

The non-treatment for DM was associated with advanced age, lower levels of education and low abdominal adiposity (WHR), which reinforce the importance of implementing specific educational interventions focused on the oldest and less educated seniors for an effective diabetes management.

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CONTRIBUTORS

MC MORETTO, MI TADONI, AL NERI, and ME GUARIENTO contributed to project conception and design, and data analysis and interpretation. MC MORETTO and ME GUARIENTO participated in drafting the article and revising it critically for important intellectual content. AL NERI and ME GUARIENTO approved the final version to be published.

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