DOI: http://dx.doi.org/10.12957/demetra.2014.10659

Evaluation of the prevalence of risk factors for development of type 2 diabetes mellitus in patients at the Unesc Clinic

Arelli Bruno[1]
Luciene Rabelo Pereira[1]
Herivelto dos Santos Almeida[2]

[1] Programa de Pesquisa e Pós-graduação, Departamento de Nutrição. Clínica UNESC Saúde, Unidade Honório Fraga. Centro Universitário do Espírito Santo – UNESC. Colatina-ES, Brasil.

[2] Departamento de Engenharia. Centro Universitário do Espírito Santo – UNESC. Colatina-ES, Brasil.

Correspondence
Arelli Bruno
E-mail: arellybruno@hotmail.com

Abstract

Type 2 diabetes mellitus is a public health problem with an increasing number of young people affected. This study aims to determine the prevalence of risk factors for this condition in patients seeking medical or nutritional care at UNESC Clinic in the city of Colatina (ES), Brazil. A random cross-sectional quantitative study was conducted by applying the Finnish Diabetes Risk Score questionnaire, which evaluates the risk factors and classifies them into a risk score for developing diabetes mellitus type 2 within ten years. The sample consisted of 100 patients, 61.0% female and 39.0% male, mean age 38 years and mean body mass index of 26.74 kg/m^2. Among patients, 35.0% were aged ≥ 45 years; 62.0% were overweight; 60.0% had increased value of waist circumference; 89.0% did not practice a minimum of 30 minutes of physical activity per day; 15.0% do not eat vegetables, fruits, vegetables or grains daily; 35.0% ate fried foods, salty snacks or fatty meats every day; 6.0% were smokers; 21.0% reported a history of glycemic change, gestational diabetes or macrosomia; 30.0% used antihypertensive drugs; 25.0% reported having 1st degree relatives with diabetes mellitus, and 31.0% had 2nd degree relatives with the disease. The high prevalence of risk factors, especially modifiable ones, i.e., those which are associated with changes in lifestyle, highlight the importance of the nutritionist's role in promoting food education for prevention of various diseases.

Keywords: Diabetes Mellitus. Public Health. Risk Factors. Prevention. Prevalence.

Introduction

Changes in food and nutrition habits can be seen in the current pattern of consumption, based on replacing the intake of fresh food, with a high content of fiber, vitamins and minerals, with processed foods with high concentrations of saturated fats and simple carbohydrates. In addition, the increase in life expectancy, the increasing number of overweight and obese people and a sedentary lifestyle, have been cited as major risk factors for chronic non-communicable diseases (NCDs), particularly for type 2 diabetes mellitus.[1-3]

According to the Brazilian Diabetes Society (SBD), there are 371 million diabetic patients aged 20 to 79 years worldwide.[4] Brazil ranks fourth among the countries with the highest prevalence of diabetes, accounting for 13.4 million people with diabetes in this age group, which represents approximately 6.5% of the population. According to the National Health Agency (ANS),[5] it is estimated that 50% of the population with diabetes is unaware of having the disease, which is asymptomatic in most cases. Thus, some people remain undiagnosed until they start to show signs of complications.[4,5]

Type 2 diabetes mellitus (DM2) is a chronic disease with metabolic disorder of multiple etiologies, with disturbances in the metabolism of carbohydrates, proteins and lipids caused by peripheral tissue resistance or absence of insulin response associated with a relative deficiency of insulin, which leads to hyperglycemia.[6]

Most commonly, when people show hyperglycemia, they have the two disorders, both in the action and secretion of insulin; however, one of them is predominant. Patients with DM2 do not require treatment with exogenous insulin for survival, as happens to patients with Type 1 diabetes mellitus, but it may be necessary for adequate metabolic control. For this reason, DM2 is also called non-insulin dependent diabetes. Dependence of insulin can occur in very advanced and uncontrolled cases of the disease, when interventions in lifestyle and medication are not sufficient for glycemic control.[7]

Studying risk factors for a disease means studying the likelihood of a particular event. Epidemiologically, the term is used to predict how likely healthy individuals are to develop the disease when exposed to certain factors. It does not necessarily mean that it will occur, but that the presence of these factors makes the individual more vulnerable and prone to the disease. A risk factor "x" can trigger various diseases; conversely, several risk factors may cooperate in the genesis of a common disease.[5,8]

Non-modifiable or irreversible risk factors refer to individual characteristics such as age, ethnicity, family history, previous gestational diabetes and a history of fetal macrosomia. Even though these factors cannot be changed, a person's lifestyle can, thus avoiding the early manifestation of DM 2.[9,10]

Modifiable risk factors can receive more cost-effective preventive interventions. These are the factors susceptible to treatment, such as high blood pressure and abnormal glucose, and changes in lifestyle, such as obesity, smoking, eating habits, sedentary lifestyle, etc. These common and modifiable risk factors underlie the most prevalent chronic diseases.[5,10,11]

Method

A cross-sectional quantitative research, with a random selection procedure, was conducted with patients seeking nutritional or medical care at UNESC Clinic - Honório Fraga Unit.

The UNESC Clinic offers free health care services in the town of Colatina and surrounding towns, provided by doctors and Medicine undergraduates of the Centro Universitário do Espírito Santo (UNESC). Appointments are previously scheduled by phone. The clinic offers health care in the following fields: pediatrics, gynecology, neurology, cardiology, minor surgery, dermatology, vascular surgery, urology, nursing, physiotherapy and nutrition.

The research sample consists of 100 patients who sought these services. They have been selected with respect for ethical principles of non-maleficence, beneficence, justice and autonomy of individuals, and the research has complied with the guidelines and regulatory norms for research activity that involves human subjects. All participants signed a consent form after they had been appropriately informed about the study. The research project was approved by the Ethics and Research Committee on Human Beings of the Centro Universitário do Espírito (approval number 409.343).

The field research was carried out by applying the FINDRISC questionnaire (*Finnish Diabetes Risk Score*), adapted to the culture and habits of Brazilians, while keeping the original calculations, which can be publicly accessed. The original questionnaire was developed in 2001 by the Finnish Diabetes Society and is available from the *International Diabetes Federation* (IDF) website for *download* in multiple languages. The IDF describes the questionnaire as an effective tool that can be used as a basis for the development of national questionnaires, taking into account local factors.[12-14]

Each question of the questionnaire is scored, and the sum of the scores categorizes the patient according to the degree of risk: low risk (less than 7 points) - it is estimated that one out of every hundred people will develop the disease; low to moderate (7 to 11 points) - it is estimated that one out of every twenty five people will develop the disease; moderate (12-14 points), it is estimated that one out of six people will develop the disease; high (15 to 20 points), it is estimated that one out of three people will develop the disease; and very high risk (above 20 points), it is estimated that one out of two people will develop DM 2 within the next ten years. Furthermore, it is a useful questionnaire to identify patients with undiagnosed diabetes and pre-diabetes, with 85% accuracy.[12]

Theanthropometric assessment considered the result of dividing weight in kilograms (kg) by height in meters (m) to measure the body mass index (BMI). Body weight was measured with a mechanical scale for adults (Welmy®) with 150 kg capacity and 100-gram divisions, available at the site of research. The volunteer subjects were wearing light clothes and were barefoot.

Height was measured using the corresponding stadiometer to the scale, with 0.5 cm divisions. The volunteers were barefoot; their weight was evenly distributed between the legs, their arms were extended along the body, in an upright position, with heels together and touching the vertical rod of the stadiometer, positioning their heads in the Frankfurt plane. The BMI classification used by the FINDRISC questionnaire score as the cutoff point was: BMI below 25.0 kg/m^2, BMI between 25 and 30,0 kg/m^2 and BMI above 30 kg/m^2.

Waist circumference was assessed with a (Cardiomed®) inelastic tape with a 0.1 cm scale. Waist circumference was measured at the largest abdominal perimeter between the last rib and the iliac crest, as recommended by the World Health Organization (WHO). Measurements were taken at the time of expiration and held at the nearest millimeter.

The remaining questions of the questionnaire were applied by the researcher with objective responses. As exclusion criteria, pregnant women, people under 18 years of age and volunteers diagnosed with DM2 did not participate in the study. Data collection lasted a month. There is no conflict of interest between researchers and the focus of research.

After data collection, descriptive statistics of the quantitative variables were performed using Microsoft Excel®, and the results were registered during analysis. The Minitab 15® software was used for applying the chi-square test for independence or association which, according to Fonseca and Martins, aims to study the association or dependence between two variables. With the same software, calculations were made for cross-tabulation of the data.[15]

Results

61.0% (n = 61) of the participants were females and 39.0% (n = 39) were males; mean age was 38 ± 14.7 years and mean BMI was 26.74 ± 5.31 kg/m^2. The average score of patients at the UNESC Clinic resulted in 10.52 ± 5.29 points, equivalent to little risk, with a minimum value of 0 points and a maximum of 26 points, mode and median equal to 9.

Considering the score of the FINDRISC questionnaire, 26.0% of participants showed low risk; 35.0%, low to moderate risk; 12.0%, moderate risk; 18.0%, high risk; and 9.0%, very high risk of developing DM 2 within the next ten years.

Considering the risk factors proposed by the questionnaire, the following results were found: 35.0% of patients were aged ≥ 45 years; 62.0% were overweight; 60.0% had increased waist circumference value; 89.0% did not practice a minimum of 30 minutes of daily physical activity; 15.0% did not consume vegetables, fruits, vegetables or grains on a daily basis; 35.0% consumed fried foods, salty snacks or fatty meats every day; 6.0% were smokers; 21.0% had a history of abnormal glucose, gestational diabetes or macrosomia; 30.0% used antihypertensive drugs; 25.0% reported having 1st degree relatives and 31.0%, 2nd degree relatives with DM2. The data can be seen in Table 1.

Table 1. Results of the application of the FINDRISC Questionnaire. Colatina-ES, 2012.

		Low risk		Low to Moderate risk		Moderate risk		High risk		Very high risk	
Risk Factor		n	%	n	%	n	%	n	%	n	%
GENERAL		26	26,0	35	35,0	12	12,0	18	18,0	9	9,0
AGE RANGE	18 a 24 years	12	46,1	4	11,4	2	16,7	2	11,1	-	-
	25 a 32 years	4	15,4	11	31,4	3	25,0	3	16,7	-	-
	35 a 44 years	6	23,1	13	37,1	2	16,7	3	16,7	-	-
	45 a 54 years	4	15,4	5	14,3	2	16,7	5	27,8	3	33,3
	55 a 64 years	-	-	1	2,9	2	16,7	3	16,7	4	44,4
	> 65 years	-	-	1	2,9	1	8,3	2	11,1	2	22,2
	Total	26	100,0	35	100,0	12	100,0	18	100,0	9	100,0
SEX	Female	14	53,9	13	37,1	3	25,0	6	33,3	3	33,3
	Male	12	46,2	22	62,9	9	75,0	12	66,7	6	66,7
	Total	26	100,0	35	100,0	12	100,0	18	100,0	9	100,0
BMI	Low Weight	1	3,9	1	2,9	-	-	-	-	-	-
	Eutrofia	18	69,2	9	25,7	5	41,7	3	16,7	1	11,1
	Overweight	7	26,9	19	54,3	4	33,3	7	38,9	2	22,2
	Obesity	-	-	6	17,2	3	25,0	8	44,5	6	66,6
	Total	26	100,0	35	100,0	12	100,0	18	100,0	9	100,0

WAIST CIRCUMFERENCE	Male	< 94 cm	14	53,9	7	20,0	1	8,3	2	11,1	-	-
		94 a 102 cm	-	-	2	5,7	-	-	1	5,6	1	11,1
		> 102 cm	-	-	3	8,6	1	8,3	3	16,7	2	22,2
	Female	< 80 cm	8	30,8	4	11,4	4	33,3	-	-	-	-
		80 a 88 cm	4	15,4	6	17,1	2	16,7	3	16,7	-	-
		> 88 cm	-	-	13	37,1	4	33,3	9	50,0	6	66,7
	Total		26	100,0	35	100,0	12	100,0	18	100,0	9	100,0
PHYSICAL EXERCISE		More than 4h/week	7	26,9	2	5,7	1	8,3	1	5,6	-	-
		Less than 4h/week	19	73,1	33	94,3	11	91,7	17	94,4	9	100,0
		Total	26	100,0	35	100,0	12	100,0	18	100,0	9	100,0
INTAKE OF VEGETABLES		Daily	24	92,3	26	74,3	10	83,3	16	88,8	9	100,0
		Non-daily	2	7,7	9	25,7	2	16,7	2	11,2	0	0,0
		Total	26	100,0	35	100,0	12	100,0	18	100,0	9	100,0
INTAKE OF FAT		Daily	8	30,7	15	42,8	6	50,0	5	27,8	1	11,1
		Non-daily	18	69,3	20	57,2	6	50,0	13	72,2	8	88,9
		Total	26	100,0	35	100,0	12	100,0	18	100,0	9	100,0

SMOKING	Never smoked	23	88,5	27	77,2	9	75,0	17	83,3	8	88,9
	Stopped smoking	3	11,5	4	11,4	2	16,6	2	11,2	1	11,1
	Smokes 1 - 10 cigarettes/ day	-	-	2	5,7	1	8,4	1	5,5	-	-
	Smokes > 10 cigarettes/ day	-	-	2	5,7	-	-	-	-	-	-
	Total	26	100,0	35	100,0	12	100,0	20	100,0	9	100,0
ABNORMAL GLUCOSE LEVELS	Changed	-	-	4	11,4	2	16,6	7	38,9	8	88,9
	Unchanged	26	100,0	31	88,6	10	83,4	11	61,1	1	11,1
	Total	26	100,0	35	100,0	12	100,0	18	100,0	9	100,0
SH	Presence	-	-	9	25,7	4	33,7	8	44,5	9	100,0
	Absence	26	100,0	26	74,3	8	66,7	10	55,5	-	-
	Total	26	100,0	35	100,0	12	100,0	18	100,0	9	100,0
FAMILY HISTORY OF DM 2	1st DEGREE	Presence	-	-	2	5,7	5	41,7	11	61,1	7	77,8
		Absence	26	100,0	33	94,3	7	58,3	7	38,9	2	22,2
		Total	26	100,0	35	100,0	12	100,0	18	100,0	9	100,0
	2nd DEGREE	Presence	9	34,6	9	25,7	6	50,0	4	22,2	3	33,3
		Absence	17	65,4	26	74,3	6	50,0	14	77,8	6	66,7
		Total	26	100,0	35	100,0	12	100,0	18	100,0	9	100,0

Analysis and discussion of results

The average score of patients at UNESC Clinic resulted in 10.52 ± 5.29 points, which is equivalent to little risk. Similar values were found by Winkler et al.[16] in a study in Hungary, with a mean score of 10.45 ± 5.09 (from 0 to 26 points), with a similar percentage of female (60.1%) and male (40.9%) participants. In turn, Lindström et al. found mean FINDRISC of 13 (ranging between 1 to 24 points) in a Finnish population.[16,17]

Considering the scores of the FINDRISC questionnaire greater than or equal to 12 as more severe risk, and less than 12 as less severe risk, it can be stated that 39.0% (n = 39) of the study population is at higher risk of developing the disease within the next ten years, distributed among moderate, high and very high risk, as seen in Table 1. These findings are similar to those found by Winkler et al.; 41.0% of the people they surveyed had increased risk.[16]

When the severity of risk between females and males was checked, it was observed that only at the low risk level of the amount of men is higher than that of women; in all other risk strata, the proportion of women is approximately twice that of men. The VIGITEL 2011 survey showed a 5.6% frequency of prior diagnosis of diabetes in Brazilian capitals: 6.0% among women and 5.2% among men. Several studies show no significant difference in prevalence of DM between males and females, and associated these differences with increased demand for health services by women, which means they are more frequently diagnosed and monitored.[18,19]

In the low risk stratum, the predominant age group is 18 to 44 years old, with 84.7% of patients in this degree of risk. However, after 45 years of age, the risk strata with greater percentages are high risk (55.6%) and very high risk (100.0%). In other words, between 18-24 years, as the risk of developing DM2 increases, the amount of patients in this stratum decreases; and after 55 years of age, this value increases and so does the degree of risk. Therefore, low risk is considered as the least severe stratum for expression of the pathology, and very high risk, as the greatest possibility.

Data from the 2011 VIGITEL survey showed that the diagnosis of DM2 is more common after age 35 for women and after age 45 for men; more than a fifth of the elderly reported they were diagnosed as diabetic. A multicenter study conducted in 1998 in nine Brazilian cities to determine the prevalence of DM (known as Brazilian Census for Diabetes), showed that the prevalence of DM increases with age, reaching 17.4% in the range between 60 to 69 years. However, between 30 and 59 years, this figure was only 2.7%.[7,18]

Another study conducted in Ribeirão Preto, using the same methodology of the Brazilian Census for Diabetes revealed a prevalence of 12.1% of diabetes and 7.7% of decreased glucose tolerance in the age group 30-69 years.[5]

ABESO (Brazilian Association for the Study of Obesity) uses cut-off points for BMI classification that make an association between BMI and chronic disease or mortality. In effect, in the study population, only 36% (n = 36) are eutrophic, i.e. with a BMI between 18.5 and 24.9 kg/m^2; 39% (n = 39) showed excessive weight accumulation and 23% (n = 23) are classified as obese. It should be noted that the greater the weight-height ratio, the greater the absolute number of patients at the higher risk strata.[20]

As recommended by the WHO, the optimum mean BMI for the adult population lies in the range from 21 to 23 kg/m^2. As BMI increases beyond 24.9 kg/m^2 (the upper limit for eutrophy), people become more susceptible to developing comorbidities correlated with excessive accumulation of weight, including DM 2, because weight is not only a risk factor strongly associated with this disease, but it also enhances other factors.[21]

Although BMI is a good indicator, it is not fully correlated with body fat; one limitation is that it does not necessarily reflect body fat distribution, since obesity located in the intra-abdominal region, i.e., visceral fat, a potential risk factor that is independent of total body fat. Accordingly, it was suggested that BMI should be used for waist circumference measurement, since it reflects visceral fat content and associates it with total adipose tissue. Thus, the following cutoff point was considered for assessing obesity and risk of DM 2: waist circumference between 80 and 88 cm for women, and 94-102 cm for men, as indicative of increased risk of metabolic complications, and greater than or equal to 88 and 102 cm for females and males, respectively, as indicative of substantially higher risk of metabolic complications.[20]

Patients in studies have exemplified these data, allowing an association between increased waist circumference and consequent higher risk for DM 2. A percentage of 61.5% (n = 24) of men had WC below 94 cm, and 26.2% (n = 16) of women had WC below 80 cm. A higher percentage of men (35.9%) had low risk with abdominal circumference below 94 cm; the higher value grouped for females (21.3%) refers to the circumference above 88 cm in the low-risk rating, followed by 14.7% (n = 9) with the same cut-off point for WC with a high risk of becoming diabetic.

Marinho, in a study conducted in the municipality of Itapipoca, Ceará, with patients of the Family Health Program and using the same data collection instrument, found that 41.1% of the subjects were overweight; 18.6% were obese; 16.0% had normal WC (less than 80 cm for women

and less than 94 cm for men) and 84.0% had high WC; 24.8% had increased risk and 59.2% showed substantially increased risk for DM 2. In the present study, 19.0% of the subjects showed high risk and 41.0%, substantially high risk of developing DM 2 because of their WC.[22]

According to Gomes *et al*., overweight as well as accumulation of adipocytes in the mesenteric region, characterize visceral or androgen obesity, which is related to increased mortality compared with peripheral obesity. This difference is due to the fact that visceral adipose tissue is metabolically more active compared to the subcutaneous adipose tissue, leading, for example, to an increased production of glucose and, consequently, DM2 and hyperinsulinemia.[23]

Despite the recommendation of physical exercise for four hours a week, only 11% of patients treated at the UNESC Clinic exercise daily, a percentage lower than the one found in Marinho's research (16.7% of the sample). The largest number of people who do weekly physical activity (n = 7) is in the stratum of low risk for DM 2 development, while there is a greater number of sedentary people as the degree of risk increases. The percentage of physical inactivity is greater than the one determined by Webber *et al*., who stated that between 30 and 60% of the population is sedentary. Thus, people do not practice the amount of physical activity recommended by Brazilian Society of Endocrinology and Metabology, that is, at least 150 minutes of aerobic exercise per week, in order to prevent the development of chronic diseases.[22, 24, 25]

Insufficient physical activity is the fourth leading risk factor for mortality; thus, insufficiently physically active people show a mortality risk of 20% to 30% higher for any cause, compared to those that do at least 30 minutes of moderate physical activity on most days of the week. The practice of 150 minutes of moderate activity per week reduces the risk of diabetes by 27%. Moreover, regular physical activity reduces the risk of stroke, hypertension and depression, and is an important factor in energy expenditure. It is, thus, fundamental to energy balance and weight control.[21]

Considering the high prevalence of a sedentary lifestyle and also the significant risk of chronic diseases that may affect the population, increased physical exercise reflects the quality of health of the community, minimizing spending on treatments.[5]

When asked about their intake of vegetables, fruits, legumes or grains, 85.0% of the subjects reported consuming at least one of the three groups, and the highest percentage (9.0%) of those who reported not consuming these foods is in the little risk stratum. As for the daily intake of fried foods, salty snacks or fatty meats, including chicken skin, 65.0% of them reported not consuming any of these preparations daily, and those who most often eat such foods on a daily basis (n = 15) are in the low risk stratum.

In contrast to findings on food intake in this population, Rtveladze *et al*. showed that the Brazilian diet has always been characterized by low consumption of vegetables and high intake of salt and sugar. In a 16-year period, the consumption of vegetables and fruits decreased by 20%, and in the same period, the consumption of bread and crackers increased by 21%. The latter are the most inexpensive sources of calories in the country, which leads to high rates of obesity.[3]

The Household Budget Survey (HBS) 2008-2009 states that 90% of the population has a daily intake of vegetables and fruit below the levels recommended by the Ministry of Health (400g). The staple diet is a combination of rice and beans together with foods with high calories and few nutrients. Thus, the main inappropriate eating habits of the population refer to the excess of saturated fats (82.0%) and sugar (61.0%) and the lack of fibers (68%) in the diet of Brazilians.[26]

The VIGITEL 2011 survey also showed that regular intake of fruit and vegetables is higher among the age groups 18-24 years and after 65 years. Thus, age groups with the greatest number of people in the job market have a low intake of vegetables. Also in the group aged 18 to 44 years for both sexes, there was a higher intake of meat with excess fat, i.e. red meat or chicken fat with skin, without removal of visible fat from these foods. Consumption of whole milk tends to be lower with increasing age, less often among more educated people and more often among people with an intermediate level of schooling. The intake of artificial juices and soft drinks was reported by 80% of the subjects, at least once a week and 29.8% at least five times a week, and it tends to diminish with increasing age and the level of schooling.[18]

The fact that most Brazilians eat rice and beans daily may have influenced the answer of respondents when asked about their intake of vegetables, fruits, vegetables or grains, since the majority of patients who answered this question reported consuming foods from one of the groups but not from all the three groups, as advised by the food pyramid. It should also be noted that the question asked only whether the participants consumed those foods daily, without focusing on the amount recommended by the WHO as a means of preventing chronic diseases.

As stated by Carolino et al.,[1] food consumption is the main modifiable risk factor, followed by weight control and increased physical exercise. They decrease insulin resistance and, therefore, make people less prone to developing DM2, even those with a family history of this condition.

Only 6.0% reported smoking cigarettes daily and 12% stopped smoking in recent years; the largest amount of people who stopped smoking (n = 4) and those that still smoke (n = 4) are found in the little risk stratum.

In developed countries, there are 42.0% of men smokers and 24.0% of women smokers; in developing countries, fewer women smoke: 7.0%, compared with 48.0% of male smokers. A recent research study in Brazil, conducted by the National Cancer Institute, found that 22.7% of men and 16.0% of women are smokers - this refers to a total of 18.8% of Brazilian smokers.

The results for the prevalence of smokers are lower than those found by VIGITEL 2011 survey, which showed a 10.3% prevalence of smokers, who are most often found among the age group 45-54 years and among men and women with up to eight years of schooling. The survey also revealed that the frequency of former smokers was 22.4% higher among men than among women.[18]

A prospective study involving 7,735 men aged between 40-59 years in 24 British cities, assessed the impact of smoking cessation on the risk of developing DM2 and noted that the benefits only became evident five years after this interruption, because they had greater weight gain at first, so they had a higher risk for diabetes than those who continued smoking. However, their level of risk only equated that of people who have never smoked 20 years after smoking cessation. Although there is no direct causal relationship between smoking and DM2, several studies have shown that smoking increases the concentration of abdominal fat, decreases insulin sensitivity and increases blood glucose concentration. Thus, the risk is attributed to how much and how long someone smoked for.[27,28]

The FRINDRISC questionnaire considered as abnormal glucose impaired glucose tolerance and impaired fasting glucose, further including, for females, the presence of DM during pregnancy and/or children with more than 4.0 kg at birth. Thus, 21.0% of participants reported a history of abnormal glucose, and they were prevalent in high-risk groups (n = 7) and very high risk (n = 9) for the development of the diabetes.

Mariath et al.,[29], in a study carried out in order to assess the nutritional status and identify the main risk factors for NCDs in production line workers and office staff of an industry located in Jaguará do Sul, in the north of the state of Santa Catarina, found average blood glucose of 89.01±16.30 mg /dL, but 4% of the sample had impaired fasting glucose.

Amorim et al.[30] conducted a study aimed at determining the frequency of macrosomia in living newborns in an obstetric service in Campina Grande (PB) and its association with maternal risk factors, attended by 551 women who had given birth recently. They found frequency of 5.4% for macrosomia associated with factors such as overweight and obesity before pregnancy, excessive weight gain, hypertension and clinical or gestational diabetes.

Higher blood glucose levels than normal, but lower than those required for a diagnosis of diabetes, can and should be used to delay or prevent the progression of DM.[7,25]

Systemic hypertension and normotensive patients on antihypertensive medication is present in 30.0% (n = 30) of patients and absent in individuals rated as low risk; on the other hand, it is present in all surveyed people (n = 9) in the very high risk stratum.

According to Francisco et al.,[31] the high blood pressure condition is associated with the highest degree of insulin resistance, hence antihypertensive drugs complicate this process, which consequently makes hypertensive patients three times more likely to develop DM. This association is further worrying because hypertension in diabetic individuals increases the risk of cardiovascular complications such as atherosclerosis and stroke.

According to the diagnostic criteria ≥ 140/90 mmHg for systemic hypertension, its prevalence ranges from 22.3% to 43.9% in the adult Brazilian population, depending on the city under study. Some studies show prevalence rates of 20.0% regardless of sex, but with a clear tendency to rise with age. These indices vary according to the population studied, but they are prevalent in other Latin American countries.[5]

Marinho[22] found that 12.9% of participants used antihypertensive drugs. Vilarinho et al.,[9] in a research study with nursing students to identify risk factors for DM 2, found that 57.5% of those with DM 2 reported cases in their family and 75.0% reported cases of hypertension. However, 45.0% of participants also reported cases of both diabetes and hypertension at once.

In the present study, when asked about the presence of DM 2 in 1st degree relatives, defined as parents, children and siblings, 25.0% (n = 25) of patients reported having relatives with the disease. It is observed that in individuals with high and very high risk, this genetic factor is present in 61.11% and 77.78% of patients, respectively. In turn, 31.0% of patients reported the presence of the disease in 2nd degree relatives, considered to be grandparents, aunts and uncles and first cousins, and in patients with moderate to very high risk, this condition was present in 33.33% of them (n = 13).

Crispin et al., in a study with the population of southern Brazil, found at least 76.6% of diabetic patients who reported the presence of this pathology in at least one first-degree relative; only 9.9% reported having a diabetic father and 35.2%, only the mother with DM 2, while 10% had both parents with the disease. A similar pattern is observed when there is a higher family history of diabetes on maternal relatives (14.9%) than in paternal ones (6.1%), suggesting maternal transmission of DM 2, which has also been observed in the aforementioned studies. [31]

Guerra-Juárez, Gallegos and Cerda-Flores[32] reported that the risks of direct relatives of type 2 diabetic adults developing the disease are higher when they are also overweight or obese. Thus, caution is needed when associating only the genetic factor with increased prevalence and incidence of DM 2; genetically predisposed individuals become more vulnerable to developing the disease when exposed to environmental factors.

In the present study, there was a statistically significant association between variables related to abnormal glucose, use of antihypertensive drugs and DM 2 in 1st degree relatives and the degree of risk for developing this disease over the next ten years. The variables "sex", "daily consumption of vegetables, fruits, vegetables or grains",daily consumption of fried foods, salty snacks and fatty meats" and "DM 2 in 2nd degree relatives" showed no dependence or association with the degree of risk as shown in Table 2. The measurement of other variables (age, BMI, and smoking) was not possible due to the sample size, since it is not advisable to apply the chi-square test of association at frequencies lower than 5.[15]

Table 2. Statistical association between variables and risk of developing DM2. Colatina (ES), 2012.

Variables	Chi-square test of association
Sex	P = 0.432
Daily consumption of vegetables, fruits, legumes or grains	P = 0.194
Daily consumption of fried foods, snacks and fatty meat	P = 0.286
History of abnormal glucose (A.G.)	P = 0.000
A.G. and use of antihypertensives	P = 0.000
DM 2 in 1st degree relatives	P = 0.000
DM 2 in 2nd degree relatives	P = 0.570

A study on diabetes conducted by a group of researchers from the Federal University of Ceará, with staff of the State Hospital of Messejana, showed no statistically significant association between the variables "sex" and "age" and degree of risk for diabetes. However, it confirmed the association between risk of diabetes and hypertension ($p = 0.041$), blood glucose level ($p = 0.000$) and smoking ($p < 0.05$).[33]

Conclusion

Based on the analysis and discussion of results of this study for the magnitude of DM 2, it is concluded that the risk factors for this disease are increasingly prevalent among the population, especially regarding modifiable risk factors - i.e. those that are subject to interventions and treatment, but which make up the basis of chronic diseases.

As evidenced by their name, non-modifiable risk factors are irreversible, but patients' lifestyle can and should be changed in order to avoid the early manifestation of the disease. These interventions are mainly related to weight reduction, maintenance of weight loss, moderate energy restriction, increase in regular physical activity, greater intake of fiber, monounsaturated and polyunsaturated fatty acids, antioxidants and minerals and restriction on consumption of saturated fats, trans fat, cholesterol and sodium. Therefore, nutritional education is one of the main points for the primary prevention of NCDs and, particularly, DM 2, also for patients at high risk of developing the condition; small changes can result in prevention, or at least delay, of the progression and development of the disease.

Considering the risk factors for the development of DM 2 and the importance of changing eating habits in this context, this study reinforces the important role of nutritionists in primary health care, both working alone or in a multidisciplinary team.

References

1. Carolino IDR, Molena-Fernandes CA, Tasca RS, Marcon SS, Cuman RKN. Fatores de risco em pacientes com diabetes mellitus tipo 2. Rev Latino-am Enfermagem [Internet]. 2008; 16 (2). [Acesso em 8 ago. 2013]. Disponível em: http://www.scielo.br/pdf/rlae/v16n2/pt_11.pdf.
2. Carvalho GQ, Alfemas RCG. Índice glicêmico: uma abordagem crítica acerca de sua utilização na prevenção e no tratamento de fatores de fatores de risco cardiovasculares. Rev. Nutr. 2008; 21(5):577-87.
3. Rtveladze K, Marsh T, Webber L, Kilpi F, Levy D, McPherson WK, et al. Health and economic burden of obesity in Brazil. PLoS One 2013; 8(7):1-7.
4. Sociedade Brasileira de Diabetes. São 13.4 milhões de pessoas portadoras de diabetes no Brasil [Internet]. 2013. [Acesso 15 jul. 2013]. Disponível em: http://www.diabetes.org.br/ultimas/sao-13-4-milhoes-de-pessoas-portadoras-de-diabetes-no-brasil
5. Brasil. Ministério da Saúde. Agência Nacional de Saúde Suplementar. Manual técnico para promoção da saúde e prevenção de riscos e doenças na saúde suplementar [Internet]. 4. ed. Rio de Janeiro: ANS; 2011. [acesso em 13 out. 2013]. Disponível em: http://bvsms.saude.gov.br/bvs/publicacoes/manual_tecnico_promocao_saude_4ed.pdf
6. Mello VD, Laaksonen DE. Fibras na dieta: tendências atuais e benefícios à saúde na síndrome metabólica e no diabetes melito tipo 2. Arq. Bras. Endocrinol. Metabol. 2009; 53(5):509-18.
7. Sociedade Brasileira de Diabetes. Diretrizes Sociedade Brasileira de Diabetes, 2009 [Internet]. Disponível em: http://www.prograd.uff.br/farmacoclinica/sites/default/files/diretrizes09_final_0.pdf
8. Almeida VCF. Ocupação e fatores de risco para Diabetes Mellitus tipo 2: contribuição ao estudo do processo saúde-doença de trabalhadores de enfermagem [Tese] [Internet]. Fortaleza: Centro de Ciências da Saúde, Universidade Estadual do Ceará; 2007. [Acesso em 21 jun. 2013]. Disponível em: http://www.repositorio.ufc.br/ri/bitstream/riufc/2153/1/2007_tese_vcfalmeida.pdf
9. Vilarinho RMF, Lisboa MTL, Thiré PK, França PV. Prevalência de fatores de risco de natureza modificável para a ocorrência de diabetes mellitus tipo 2. Esc. Anna Nery Rev. Enferm. 2008; 12(3):452-56.
10. Alves A, Marques IR. Fatores relacionados ao risco de doença arterial coronariana entre estudantes de enfermagem. Rev. Bras. Enferm. 2009; 62(6):883-88.
11. Malta DC, Cezário AC, Moura L, Morais Neto OL, Silva Júnior JB. A construção da vigilância e prevenção das doenças crônicas não transmissíveis no contexto do Sistema Único de Saúde. Epidemiologia e Serviços de Saúde 2006; 15(3):47-65.

12. São Paulo. Prefeitura. Telessaúde. Núcleo São Paulo. Diabetes. Questionário: risco de ter diabetes [Internet]. Disponível em: http://www.prefeitura.sp.gov.br/cidade/secretarias/upload/saude/arquivos/programas/Questionario_Risco_de_ter_Diabetes_Telessaude.pdf

13. International Diabetes Federation. Diabetes Questionnaire [internet]. Brussels: IDF; 2013 [Acesso 19 mar. 2013]. Disponível em: http://www.idf.org/diabetes-prevention/questionnaire

14. International Diabetes Federation. About diabetes [Internet]. Brussels: IDF; 2013. [acesso 03 mar. 2013]. Disponível em: http://www.idf.org/about-diabetes.

15. Fonseca JS, Martins GA. Curso de estatística. 6. ed. São Paulo: Atlas; 2010.

16. Winkler G, Hidvégi T, Vándorfi G, Balogh S, Jermendy G. Prevalence of undiagnosed abnormal glucose tolerance in adult patients cared for by general practitioners in Hungary. Results of a risk-stratified screening based on FINDRISC questionnaire. Med. Sci. Monit. 2013; 19:67-72.

17. Lindström J, Peltonen M, Eriksson JG, Aunola S, Hämäläinen H, Ilanne-Parikka P, et al. Determinants for the effectiveness of lifestyle intervention in the finnish diabetes prevention study. Diabetes Care 2008; 31(5):857-62.

18. Brasil. Ministério da Saúde. Vigitel Brasil 2011: Vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico. Brasília: Ministério da Saúde; 2012. 131 p.

19. Fereirra CLR, Fereirra MG. Características epidemiológicas de pacientes diabéticos da rede pública de saúde: análise a partir do sistema HiperDia. Arq. Bras. Endocrinol. Metabol. 2009; 53(1):80-86.

20. Associação Brasileira para o Estudo da Obesidade e da Síndrome Metabólica. Diretrizes brasileiras de obesidade 2009/2010 [Internet]. 3 ed. Itapevi, SP: AC Farmacêutica; 2009. [acesso em 22 set. 2013]. Disponível em: http://www.abeso.org.br/pdf/diretrizes_brasileiras_obesidade_2009_2010_1.pdf

21. World Health Organization. Diabetes [Internet]. [Acesso em 24 jun. 2013]. Disponível em: http://www.who.int/mediacentre/factsheets/fs312/en/

22. Marinho NBP. Avaliação do risco para diabetes mellitus tipo 2 entre adultos de Itapipoca, CE [Dissertação]. Fortaleza: Universidade Federal do Ceará. Programa de Pós-Graduação em enfermagem; 2010.

23. Gomes F, Telo DF, Souza HP, Nicolau JC, Halpern A, Serrano Júnior CV, et al. Obesidade e doença arterial coronariana: papel da inflamação vascular. Arq. Bras. Cardiol. 2010; 94(2):273-279.

24. Webber L, Kilpi F, Marsh T, Rtveladze K, Brown M, McPherson k. High rates of obesity and non-communicable diseases predicted across Latin America. Plos One 2012; 7(8):e39589.

25. Sociedade Brasileira de Endocrinologia e Metabologia. Projeto diretrizes. Diabetes Mellitus tipo 2: prevenção. São Paulo: AMB; 2011.

26. Instituto Brasileiro de Geografia e Estatística. POF 2008 - 2009: mais de 90% da população comem poucas frutas, legumes e verduras [Internet] [Acesso em 05 out. 2013]. Disponível em: http://saladeimprensa.ibge.gov.br/noticias?idnoticia=1937&t=pof-20082009-mais-90-populacao-comem-poucas-frutas-legumes-verduras&view=noticia

27. Wannamethee SG, Shaper AG, Perry IJ. Smoking as a modifiable risk factor for type 2 diabetes in middle-aged men. Diabetes Care 2001; 24(9):1590-95.

28. Lyra R, Oliveira M, Lins D, Cavalcanti N. Prevenção do Diabetes Mellitus tipo 2. Arq. Bras. Endocrinol. Metab. 2006; 50(2):239-249.

29. Mariath AB, Grillo LP, Silva RO, Schimitz P, Campos IC, Medina JRP, et al. Obesidade e fatores de risco para o desenvolvimento de doenças crônicas não transmissíveis entre usuários de unidade de alimentação e nutrição. Cad. Saúde Pública 2007; 23(4):897-905.

30. Amorim MMR, Leite DFB, Gadelha TGN, Muniz AGV, Melo ASO, Rocha AM. de et al. Fatores de risco para macrossomia em recém-nascidos de uma maternidade-escola no Nordeste do Brasil. Rev. Bras. Ginecol. Obstet. 2009; 31(5):241-8.

31. Francisco PMS, Belon AP, Barros MBA, Carandina L, Alves MCGP, Goldbaum M, et al. Diabetes auto-referido em idosos: prevalência e fatores associados e práticas de controle. Cad. Saúde Pública 2010; 26(1):175-84.

32. Guerra-Juárez R, Gallegos EC, Cerda-Flores RM. Mudança em os padrões de vida em descendentes de progenitores com diabetes mellitus tipo 2 do nordeste do México. Rev. Latino-Am Enfermagem 2007; 15 (5):909-913.

33. Coelho MM, Silva LF, Lino RV, Almeida PC, Ribeiro ME, Caracas M, et al. Diabetes mellitus tipo 2: riesgo en funcionários de un hospital público (datos oficiales). Enfermería Integral 2005; (70):29-35.

Received: April 26, 2014
Reviewed: June 2, 2014
Approved: Aug 4, 2014