

Risk Factors for Type II Diabetes Mellitus: an Integrative Review

REVIEW

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Abstract

Objective: To identify the evidence available in the literature about the risk factors for type II Diabetes Mellitus.

Method: There was an integrative review of the literature in the following databases: PubMed, LILACS, SciELO and Scopus, using the descriptors *type II diabetes mellitus* and *factors of risk* in Portuguese and English. The research returned 504 articles from 2006 to 2016. After inclusion and exclusion criteria, one obtained 14 studies, which compose the study sample.

Results: Of the studies included in the review, 21.4% were in 2011 and 2015. Regarding the method, 57.0%, were cross-sectional studies. The prevalent Qualis was the category A. In all studies, there were factors of risk for T2DM.

Conclusion: By analyzing the studies, it was possible to identify a wide range of factors of risk found in the literature, showing what can favor the development of the disease and the possible means to build preventive and promotional strategies for groups prone to develop that problem.

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Keywords

Diabetes; Type II Diabetes Mellitus; Factors of Risk.

Introduction

Over the years, due to the accelerated globalization, urbanization and population growth, there have been several changes in the lifestyle of people in society. Stress, consumerism, alcohol, smoking, sedentary lifestyle, excessive calorie diet and lack of physical activity in their lives are some of the possible factors that can trigger diseases, including diabetes mellitus (DM).

The Brazilian Society of Diabetes describes the DM as a syndrome of multiple etiology of metabolic disorders caused by the lack and/or deficiency of insulin, which causes a chronic condition that requires the person affected by DM continuous change in both the lifestyle as adapting the disease [1].

According to the International Diabetes Federation, in 2015, there were in the world 415 million adults affected by the problem, and, in 2040, there shall be 642 million people with diabetes. In addition, there are projections that one in two adults have undiagnosed diabetes, representing high risk of developing complications with higher costs, since the disease has an economic burden of US\$ 673 billion in investments in health, corresponding to 12% of the total invested in health in the world. The DM also carries high mortality rates, with estimates that every six seconds a person dies from diabetes [2].

In accordance with the 2015-2016 Brazilian Guidelines for Diabetes, in 2014, 11.9 million people, aged from 20 to 79 years, were affected by DM, and estimates suggest that by 2035, this number may rise to 19.2 million [1].

Based on the ADA and the World Health Organization, the Ministry of Health classifies Diabetes Mellitus in types: I. Destruction of beta cells that produce insulin due to an error in the immune system and II. There is a defect in the secretion of insulin associated with a resistance to the substance, predominating in 90% of cases of diabetes. The gestational diabetes, not fully understood, can occur due to hyperglycemia, firstly diagnosed during

pregnancy, and may disappear, or not, after delivery. There are other types characterized by genetic defects associated by disease or drugs [1].

The development of type II Diabetes Mellitus (T2DM) relates to the predominance of genetic factors associated with inappropriate lifestyle standard [3], with a prevalence of 90% to 95% of cases [1].

Obesity, physical inactivity, hypertension, hyperlipidemia, gestational diabetes history, increasing age, differences in ethnic groups and hereditary factors are factors of risk that can contribute to the development of type II diabetes mellitus [4].

Therefore, knowing the factors of risk that predispose to the development of T2DM is important to health professionals. That knowledge enables professionals who work in Basic Health Units identifying the user predisposed to develop T2DM, and reducing the possibility of the disease onset.

In Brazil, the healthcare professional from primary care is more likely to identify risk factors for DM, once their activities are performed in the first level of health assistance, promoting a longitudinal care [5].

Primary Healthcare is characterized by a set of individual and collective health actions comprehending health promotion and prevention of diseases, diagnosis and treatment that provides holistic and longitudinal care, by means of qualified multiprofessional teams acting in basic healthcare facilities [5].

The Basic Health Units (BHU) consist of a multidisciplinary team, composed by: doctor, nurse, dentist, Community Health Agents and other professionals. They use methodologies and tools for organizing the work process, such as receptiveness, spontaneous demand, and consultation of risk groups for chronic diseases, comprehensive care and home visits in order to meet the health needs of the population [6]. The nurse, as a member of that team, uses, as the main strategy, the nursing consultation, being important for health education [7].

Given the need to advance in the knowledge about factors of risk for type II diabetes mellitus, the following leading question emerged: What are the factors of risk that may contribute to the development of type II diabetes mellitus published in national and international studies? Thus, the objective of this study was to identify the evidence available in the literature on the factors of risk for type II diabetes mellitus.

The justification of interests in this integrative review is the progressive increase in T2DM cases in the world, and the social impact of that disease, compromising the quality of life. The consequence of that disease results in increased demand in health services, causing high rates of visits, hospital admissions, periodic exams and availability of medication for frequent and continuous use. Considering that, prevention, treatment and control of diabetes are difficult, because they require constant care, often neglected by the health team, family or even by the own person affected by T2DM.

Material and Method

This is an integrative review, a type of study that examines the scientific literature with the intention to integrate and promote knowledge about a particular subject [8].

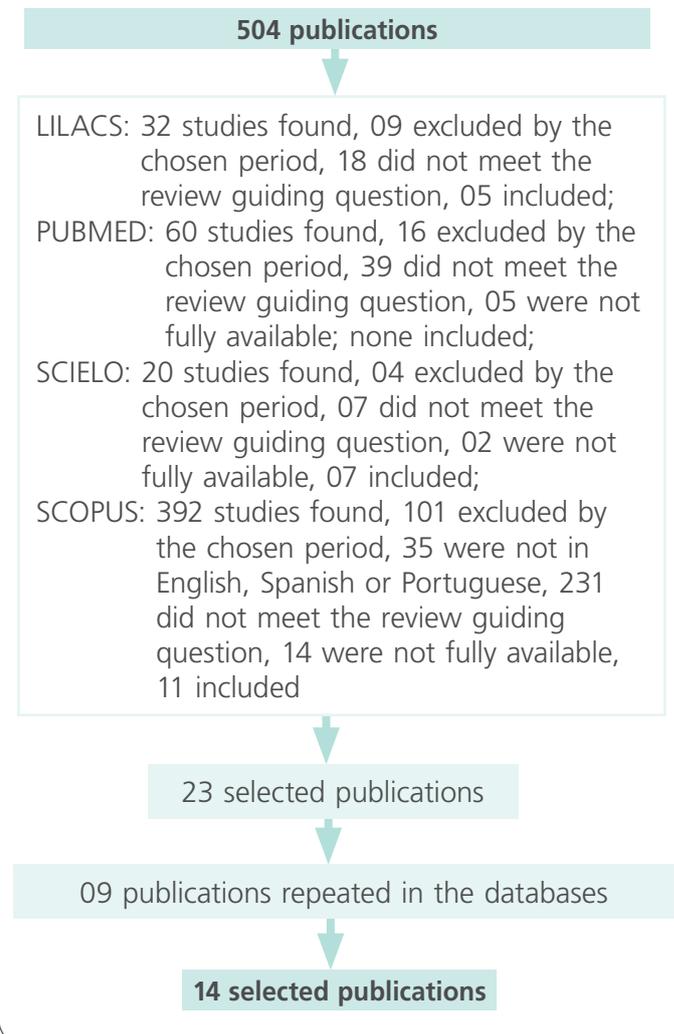
Its development occurred from May to July 2016 in the following databases: Scientific Electronic Library Online (SciELO), Latin American and Caribbean Health Sciences (LILACS), US National Library of Medicine National Institutes of Health Medical Online (PUB-MED) and Scopus. The search of the journals at the mentioned databases was performed using the terminology in health found in Descriptors in Health Sciences (DeCS).

Thus, DeCS identified the terms "Diabetes Mellitus Tipo 2" or "Type 2 Diabetes Mellitus" and "Fator de risco" or "Risk factor". Those descriptors, combined with the Boolean operator "and", were used, conditioning their presentation in the title of

the work in order to refine the studies that addressed only the selected theme. After searching in the databases there was conducted the reading of the titles and abstracts to identify whether they contemplated the objective of the review. Given the relevance of the study, the next step was to verify if the text was fully available. There was exclusion of studies that had text and abstract with relevant theme, but were not complete. Thus, it was possible to identify 504 publications.

In order to select the sample, the studies had to meet the following inclusion criteria: publications in the form of article or review with full text, having as theme the factor of risk for type II Diabetes Mellitus,

Figure 1: Summary of the data extraction process. João Pessoa, Paraíba, Brazil, 2006-2016.



published in the period from 2006 to 2016, available in Portuguese, Spanish and English. There was exclusion of dissertations, theses and books. Thus, the exclusion of 295 studies do not contemplate the guiding question of review; 09, for being repeated in selected bases; 21 that were not fully available; 130 did not belong to the selected time limit; 35 for not being in Portuguese, English or Spanish. Thus, the study sample consisted of 14 items, as shown in **Figure 1**.

Therefore, the final sample consisted of 14 articles for the review analysis. Among them, six were in English, two, in Spanish, and six, in Portuguese. It is noteworthy that the commitment to the ethical aspects constitutes the citation of the analyzed authors.

In order to extract the main data, there was preparation of an instrument that had information on Journal/Year/Authors, Journal title, Objectives, Study/Qualis Design, Factor of risk and Conclusion. The results and analyzes are presented below.

Results

The study sample consisted of 14 publications that contemplated the factors of risk for type II diabetes mellitus within the prescribed period. Among them, 2015 and 2010 had three (21.4%) publications each, representing the highest percentage of the review, 2008, 2013 and 2014, two (14.2%), and 2011 and 2016, one (7.3%). In 2006, 2007, 2009 and 2012,

there were no publications that met the criteria inclusion in this study.

Regarding the type of study, cross-sectional studies prevailed, with eight (57%) publications. Regarding Qualis, most of them belonged to category A, with seven [50%]; six (42.8%) studies of the review had no Qualis and one (7.2%) belonged to Qualis B. Regarding the target population of each review article, **Table 1** shows the results.

Table 2 shows the results of the synthesis of the articles selected for the integrative review.

Table 1. Distribution of the population found in the scientific production, by articles and databases. João Pessoa, Paraíba, Brazil, 2006-2016.

Population of the Study	Quantity of Articles	Databases
Children	02	LILACS, SCIELO, Scopus
Adolescents	01	SCIELO, Scopus
University students	02	LILACS, SCIELO, Scopus
Nursing workers	02	LILACS, SCIELO, Scopus
Outpatients	01	Scopus
Users of the FHS*	01	SCIELO, Scopus
Employees of a metal products factory	01	Scopus
Adults	04	LILACS, SCIELO, Scopus

Source: LILACS, SCIELO, SCOPUS, 2006-2016.
*: Family Health Strategy

Table 2. Synthesis of the articles selected for the integrative review. João Pessoa, Brazil, Paraíba, 2006-2016.

Journal/Year/ Authors	Title of the journal	Objectives	Study design/ Qualis	Risk factors for DM2	Conclusion
Cuban Journal of Endocrinology/ 2016/Yadicelis Llorente Columbié, Pedro Enrique Miguel-Soca, Daimaris Rivas Vázquez, Yanexy Borrego Chi [36].	Risk factors associated with the coming of Diabetes mellitus type 2 in adults	To determine the risk factors associated with the coming of Diabetes mellitus type 2 in adults.	Case control/ Without qualis	Family history of Diabetes/Obesity/ Hypertension	The knowledge about the risk factors in patients at high risk is the first step in the design and implementation of preventive measures.

Journal/Year/ Authors	Title of the journal	Objectives	Study design/ Qualis	Risk factors for DM2	Conclusion
Asia-Pacific Journal of Public Health/2015/ChungT. Nguyen, Ngoc Minh Pham, Andy H. Lee, and Colin W. Binns [35].	Prevalence and risk factors for Diabetes Mellitus type 2 in Vietnam: a systematic review	To examine the prevalence of DM2 and to identify the risk factors among adults in Vietnam	Systematic review/ Without qualis	Advanced age, urban residence, high levels of body and abdominal fat, sedentary lifestyle, genetic factors and hypertension.	A fast increase in the prevalence of DM2 in Vietnam suggests that the extra effort is needed to prevent and control this disease
The Nursing Clinics of América/2015/Michele Montgomery, Paige Johnson, Patrick Ewell [12].	The Presence of Risk Factors for Type 2 Diabetes mellitus in Underserved Preschool Children	To determine the presence of selected risk factors for the development of the DM2 (high-risk racial/ethnic group, obesity, high blood pressure, the occasional high blood glucose, total cholesterol, and the presence of Acanthosis nigricans) in preschool children from low-income families in Tuscaloosa, Alabama, with or without a family history of diabetes	Cross-sectional/ A1	Family history of diabetes mellitus, high body mass index, and high blood pressure.	This study allowed the identification of the importance of early screening for diabetes in low-income children and preschool age.
Diabetes Research and Clinical Practice/2015/Din Ding, Shanley Chong, Bin Jalaludin, Elizabeth Comino, Adrian E. Bauman [33].	Risk factors of incident type 2 Diabetes mellitus over a 3-year follow-up: Results from a large Australian sample	To describe the incidence of DM2 among middle-aged and older adults.	Cross-sectional /A2	Gender, advanced age, hypertension, dyslipidemia, family history of DM2, overweight and obesity	The risk factors for DM2 incident can facilitate the identification of populations at risk and thus, develop preventive strategies to fight the epidemic of diabetes
Acta Biochemical Clinics Latin-american/2014/Mónica Natalia Lovera, María Susana Castillo Rascón, Cristina Malarczuk, Carlos Castro Olivera, Graciela Alicia Bonneau, Blanca Haydee Ceballos, et al. [23].	Incidence of type 2 Diabetes mellitus and associated risk factors in a cohort study with health workers	To measure the incidence and associated risk factors in a cohort study with hospital workers in the city of Posadas, Misiones, since 2001 until 2012	Cohort/ Without qualis	Age, metabolic syndrome, obesity	These findings serve as a support for public health authorities to implement a program of prevention of DM2 in this sector

Journal/Year/ Authors	Title of the journal	Objectives	Study design/ Qualis	Risk factors for DM2	Conclusion
Latin-American Nursing Journal /2014/Adman Câmara Soares Lima, Márcio Flávio Moura Araújo, Roberto Wagner Júnior Freire de Freitas, Maria Lúcia Zanetti, Paulo César de Almeida, Marta Maria Coelho Damasceno [18].	Risk factors for Diabetes mellitus type 2 in university students: Association with sociodemographic variables	To identify the modifiable risk factors for diabetes mellitus type 2 in university students and associate these factors with the sociodemographic variables	Cross-sectional / A1	Sedentarism followed by overweight, central obesity, fasting plasma glucose and high blood pressure	Different risk factors were present in the population investigated, especially the sedentary and overweight.
Journal of Diabetes Investigation/2013/ Masaru Sakurai, Koshi Nakamura, Katsuyuki Miura,Toshinari Takamura, Katsushi Yoshita, Satoshi Sasaki, et al. [32].	Family history of diabetes, lifestyle factors, and the 7-year incident risk for type 2 Diabetes mellitus in middle-aged Japanese men and women	To investigate the association between family history of diabetes and the risk of incidence of DM2	Cohort / Without qualis	Family history of DM	Family history of diabetes was associated with the risk of diabetes, and these associations were independent from other risk factors.
Acta Paulista of Nursing/2013/ Niciane Bandeira Pessoa Marinho, Hérica Cristina Alves de Vasconcelos, Ana Maria Parente Garcia Alencar, Paulo César de Almeida, Marta Maria Coelho Damasceno [4]	Risk for DM2 and associated factors	To assess the risk for type 2 Diabetes mellitus and its association with clinical and socio-demographic variables.	Cross-sectional/ A2	Sedentary lifestyle, BMI, waist circumference increased, gender, age and family history of diabetes.	There was a significant association between the risk to develop Diabetes mellitus type 2 and the clinical variables of the study
Latin-American Nursing Journal /2011/Vitória de Cássia Félix de Almeida, Maria Lúcia Zanetti, Paulo César de Almeida,Marta Maria Coelho Damasceno [24].	Occupation and risk factors for type 2 diabetes: Study with nursing workers	To analyze the interrelationship between occupation and prevalence of risk factors for type 2 diabetes	Cross-sectional / A1	Abdominal obesity, waist/ hip, sedentary lifestyle	Nursing workers presented a higher risk to develop diabetes mellitus than other health professionals
Latin-American Nursing Journal /2010/Suyanne Freire de Macêdo, Márcio Flávio Moura de Araújo, Niciane Pessoa Bandeira Marinho, Adman Câmara Soares Lima, Roberto Wagner Freire de Freitas, Marta Maria Coelho Damasceno [13].	Risk factors for diabetes mellitus type 2 in children	To identify the risk factors for type 2 diabetes mellitus in a population of public school children in Fortaleza, CE, Brazil	Cross-sectional / A1	Body mass index, blood pressure, capillary blood glucose and waist circumference.	Nursing can act in schools through health education, encouraging the adoption of healthy lifestyle habits and in identifying children at risk for type 2 diabetes mellitus

Journal/Year/ Authors	Title of the journal	Objectives	Study design/ Qualis	Risk factors for DM2	Conclusion
USP Nursing School Journal/2010/Hérica Cristina Alves de Vasconcelos, Márcio Flávio Moura de Araújo, Marta Maria Coelho Damasceno, Paulo César de Almeida, Roberto Wagner Júnior Freire de Freitas [16]	Risk factors for type 2 diabetes mellitus among teenagers	To identify risk factors for DM2 in a population of adolescents in private schools from Fortaleza	Cross-sectional / A1	High blood pressure, excess weight, high blood glucose capillary, sedentary lifestyle, family background DM	Most of the risk factors for DM 2 identified in this study are modifiable, so amenable to preventive interventions in the school context
Afr J Prm Health Care FamMed/2010/ Masemiano P. Chege [22].	Risk factors for type 2 diabetes mellitus among patients attending a rural Kenyan hospital	To describe the risk factors for type 2 diabetes mellitus among patients seen in clinics in a rural hospital in Kenya	Case-control/ Without qualis	Advanced age, history of kinship in the family of DM, abdominal obesity, hunger and malnutrition in childhood.	The risk factors for diabetes mellitus type 2 described in this rural population include the advancement of age, diabetes in a relation of the first degree and central obesity.
Anna Nery School/2008/ Rosa Maria Fernandes Vilarinho, Márcia Tereza Luz Lisboa, Priscila Katzer Thiré, Priscila Vieira França [19]	Prevalence of nature modifiable risk factors for the occurrence of type 2 diabetes mellitus	To investigate the risk factors for type II diabetes mellitus in nursing college students	Cross-sectional/ B1	Family history of DM, hypertension, sedentarism, overweight, obesity.	The data collected point to the need for investments in health promotion and preventive measures within the training unit.
European Journal of Internal Medicine/2008/ Thomas Almdal, Henrik Scharling, Jan Skov Jensen, Henrik Vestergaar [34].	Higher prevalence of risk factors for type 2 diabetes mellitus and subsequent higher incidence in men	To investigate the risk factors and the incidence of type 2 DM in the European population.	Cohort/ Without qualis	High triglyceride, high BMI, hypertension, gender	Indicates that men have a higher risk of developing type 2 DM than women.

Source: LILACS, SCIELO, SCOPUS, 2006-2016.

Discussion

The Ministry of Health uses, in the screening of asymptomatic adults for type II diabetes mellitus, the following factors of risk: age >45 years, overweight (Body Mass Index BMI >25), central obesity (waist circumference >102cm for men and >88 cm for women measured at the height of the iliac crests), family history [mother or father] of diabetes, high blood pressure (>140/90mmHg), HDL <35 mg/dL and/or triglycerides >150 mg/dL, macrosomy or gestational diabetes history, previous diagnosis of polycystic

ovary syndrome and cardiovascular, cerebrovascular or peripheral vascular disease [9]. In T2DM, the most common factors of risk in adults are overweight and family history of DM [10]. The International Diabetes Federation advert that the factors of risk responsible for the development of type II diabetes mellitus are overweight, family history of diabetes, unhealthy diet, increasing age, high blood pressure, ethnicity, physical inactivity, glucose intolerance, gestational DM history and malnutrition during pregnancy [11]. There is no unified standardization for the risk fac-

tors of DM2 used in practice, in this review the objective was to discuss the factors found, emphasizing the population in each study.

Given the studies analyzed in the review of T2DM, two addressed the factors of risk in children. The first [12] brought as a factor of risk a family history of type 2 diabetes, high BMI and high blood pressure. On the other hand [13], in line with the first, investigated overweight and high blood pressure; however, it did not investigate family history with DM as a risk factor. Those results corroborate the ones standardized by the American Diabetes Association (ADA) [12]. The Ministry of Health calls attention to the increasing number of cases of T2DM in children and adolescents [10]. This reality is not only Brazilian, but worldwide [14-15].

Regarding adolescents, a study identified the following factors of risk for T2DM: high blood pressure, overweight, high blood glucose, physical inactivity and family history of DM in a population of adolescents in Fortaleza, Brazil, showing that 39% had at least two factors of risk for T2DM [16]. That was the only study found on this population based on the data used in this review. However, an intervention study with adolescents at risk for T2DM detected those same factors, which promoted a discussion about the importance of educational actions in health instead of promoting knowledge for the target audience, contributing, thus, to changes in lifestyle of that risk group [17]. Thus, this review suggests there are still few publications on T2DM in adolescents and children, but the progression of the disease becomes a major concern worldwide.

As for college student, there were several factors of risk for T2DM [18-19]. Stressing [18] physical inactivity, overweight, obesity, high blood glucose and arterial hypertension, pointing to physical inactivity as the most prevalent risk. Lately, one may observe that university students have a vulnerability to develop T2DM caused by a sedentary lifestyle, overweight, limited physical exertion, due to the use of technologies and adherence to fast and few

healthy food habits [20]. Another study [19] reveals that physical inactivity was a risk factor responsible for 75% of the sample, the most prevalent, validating the previous data. For other risk factors investigated in college students through two studies, only one study [19] pointed out the family history of diabetes in 45% of the sample; whereas other study [18] did not investigate that risk factor. Having a first-degree relative with diabetes means a risk ten times greater of developing T2DM [21]. In another study, that factor represented a double risk in the development of T2DM [22].

From the point of view of the prevalence of factors of risk in health workers, studies [23-24] indicate nursing as the most vulnerable profession to develop T2DM. Articles attribute this to workload, which hampers both the practice of healthy eating habits, as the incorporation of physical activity [22-23]. Statistically significant risk factors were overweight/obesity in a study [23] and abdominal obesity, physical inactivity and abnormal waist circumference [24], factors observed in other studies [4,25]. On the other hand, an international study with health workers observed that the risk for T2DM in nurses was relatively low, due to health and lifestyle knowledge acquired in their educational background [26].

A study with patients of an emergency room found that advanced age, heredity and abdominal obesity are risk factors for T2DM [22], also found in other studies [27-28], which point to hunger and malnutrition in childhood as possible reasons for T2DM, different from those found in the literature [22]. The International Diabetes Association points out the bad nutrition in pregnancy as a factor of risk for T2DM, but does not refer to that nutrition during childhood [11].

A study with FHS users found that 10.3% had high risk to develop T2DM [4]. In Amarante, Portugal, the risk was similar, 11.3% [29]. On the other hand, in southern Brazil, the high risk was 17%, almost the double [30]. All those studies used the

FINDRISC instrument [Finnish Diabetes Risk Score] as a predictor to evaluate the T2DM risk. It assesses the risk based on the following factors: age, BMI, waist circumference, dietary habits, physical activity, antihypertensive use, a history of hyperglycemia and family history of T2DM [4]. Other studies have widely used that tool [27, 30-31]. The International Diabetes Federation recommends the use of that tool for it is practical and quick in the screening of the risk for T2DM [11].

A study with Japanese industrial workers found that participants with a family history of T2DM had 80% of risk to develop the disease compared to those without a heredity history, so there is no association of that risk with obesity and physical inactivity [32]. A study with workers at a Brazilian industry showed that the sedentary lifestyle, poor diet, weight gain and the history of T2DM in the family represented the most striking factors of the study for the development of T2DM [25].

Studies [33-36] analyzed the factors of risk in a population of adults and observed that the risk for developing T2DM mainly relates to gender, age, family history of T2DM, physical inactivity, hypertension, high BMI, modified triglycerides, obesity/overweight and urban residence, factors also found in the Arab population described in an integrative review [14]. This review identified and discussed most of those factors; however, two must have a better emphasis. Living in urban areas is a higher risk for T2DM, compared to rural population due to the fact that their populations have sedentary lifestyles and unhealthy eating habits [14]. Nevertheless, a study with the rural population identified that participants had 21% of high risk of developing T2DM [28], which leads us to infer that there is also a vulnerability in that population. Regarding the high level of triglycerids, it is a parameter that can only be confirmed in laboratory tests, being modified by changes in lifestyle; thereby another study also mentioned triglycerids as a statistically significant risk factor for DM2 in the research [37].

Literature evinces that the risk factors of modifiable nature for DM2 are the primary responsible for the high risk of developing DM2 [28].

Conclusion

The studies on type II diabetes mellitus enabled identifying and discussing a wide range of factors of risk, clearly showing which may favor the development of the disease and the possible means to build preventive and promotional strategies to groups prone to develop the problem.

Thus, the analysis reflect relevant aspects that can guide health professionals, especially nursing professionals engaged in the Basic Health Unit who keep direct contact with patients at risk of developing such disease.

There should be development of further studies to examine the factors of risk in different populations in order to identify more associations between the analyzed factors, especially those of modifiable nature.

References

1. Oliveira JEP, Vencio S (organizer). Diretrizes da Sociedade Brasileira de Diabetes: 2015–2016. Sociedade Brasileira de Diabetes. São Paulo: AC Farmacêutica [Internet]. 2015 [Cited 2016 Jun 12]. Available from: <<http://www.diabetes.org.br/sbdonline/images/docs/DIRETRIZES-SBD-2015-2016.pdf>>.
2. International Diabetes Federation. Atlas do Diabetes 2015 – Atualização. Sociedade Brasileira de Diabetes adapted. 7th ed. [Internet]. 2015 [Cited 2016 Jun 20]. Available from: <<http://www.diamundialdodiabetes.org.br/media/uploads/atlasidf-2015.pdf>>.
3. Bittencourt A, Vinholes DB. Assessing the risk for type 2 diabetes mellitus in bank employees from the city of Tubarao, Santa Catarina state, Brazil. *Sci Med* [Internet]. 2013 [Cited 2016 Jul 28]; 23(2):82-9. Available from: <<http://revistaseletronicas.pucrs.br/ojs/index.php/scientiamedica/article/view/12756/9660>>.
4. Marinho NBP, Vasconcelos HCA, Alencar AMPG, Almeida PC, Damasceno MMC. Risco para diabetes mellitus tipo 2 e fatores associados. *Acta Paul Enferm* [Internet]. 2013 [Cited 2016 Aug 5]; 526(6):569-74. Available from: <http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0103-21002013000600010>.

5. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Atenção Básica. Política Nacional de Atenção Básica/ Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Atenção Básica. Brasília (DF): Ministério da Saúde, 2012.
6. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Atenção Básica. Estratégias para o cuidado da pessoa com doença crônica. Brasília: Ministério da Saúde. [Internet]. 2014 [Cited 2016 Aug 5]: [about 162 p.]. Available from: <http://bvmsms.saude.gov.br/bvs/publicacoes/estrategias_cuidado_pessoa_doenca_cronica_cab35.pdf>.
7. Silva DB, Souza TA, Santos CM, Jucá MM, Moreira TMM, Fota MA, et al. Associação entre hipertensão arterial e diabetes em centro de saúde da família. Rev Bras Promoc Saude [Internet]. 2011[Cited 2016 Jul 25]; 24(1):16-23. Available from: <<http://ojs.unifor.br/index.php/RBPS/article/view/2046/2340>>.
8. Lobato BC, Teixeira CRS, Zanetti GG, Zanetti ML, Oliveira MD. Evidências das implicações do diabetes mellitus no trabalho: uma revisão integrativa. Rev Eletrônica Enferm [Internet]. 2014 [cited 2016 jun 16]; 16(4): [about 10 p.]. Available from: <<https://www.fen.ufg.br/revista/v16/n4/pdf/v16n4a15.pdf>>.
9. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Atenção Básica. Diabetes Mellitus. Brasília: Ministério da Saúde. [Internet] 2006 [Cited 2016 Jul 20]: [about 64 p.]. Available from: <http://bvmsms.saude.gov.br/bvs/publicacoes/diabetes_mellitus.PDF>.
10. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Atenção Básica. Estratégias para o cuidado da pessoa com doença crônica: diabetes mellitus. Brasília: Ministério da Saúde. [Internet]. 2013 [Cited 2016 Aug 5]: [about 160 p.]. Available from: <http://bvmsms.saude.gov.br/bvs/publicacoes/estrategias_cuidado_pessoa_diabetes_mellitus_cab36.pdf>.
11. International Diabetes federation. Diabetes Risk Factors. 2015 [updated 2015 May; cited 2016 Aug 05]. Available from: <<http://www.idf.org/about-diabetes/risk-factors>>.
12. Montgomery M, Jhonson P, Ewell P. The presence of risk factors for type 2 diabetes mellitus in underserved preschool children. Nurs Clin North Am [Internet] 2015 [Cited 2016 Jul 17]; 50(3):585-94. Available from: <<http://www.ncbi.nlm.nih.gov/pubmed/26333612>>.
13. Macedo SF, Araujo MF, Marinho NP, Lima AC, Freitas RW, Damasceno MM. Risk Factors for type 2 diabetes mellitus in children. Rev Latinoam Enferm [Internet] 2010 [Cited 2016 Jul 17]; 18(5):936-42. Available from: <<http://www.ncbi.nlm.nih.gov/pubmed/26333612>>.
14. Abuyassin B, Laher I. Diabetes epidemic sweeping the Arab world. World J Diabetes [Internet] 2016 [Cited 2016 Jul 15]; 7(8):165-174. Available from: <<http://www.wjgnet.com/1948-9358/full/v7/i8/165.htm>>.
15. Tieh P, Dreimane D. Type 2 Diabetes Mellitus in Children and Adolescents. Indian J Pediatr [Internet] 2014 [Cited 2016 Aug 2]; 81(2):165–169. Available from: <<http://www.ncbi.nlm.nih.gov/pubmed/24379917>>.
16. Vasconcelos HC, Araujo MF, Damasceno MM, Almeida PC, Freitas RW. Risk factors for type 2 diabetes mellitus among adolescents. Rev Esc Enferm USP [Internet] 2010 [Cited 2016 Aug 5]; 4(4):881-7. Available from: <http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0080-6234201000400004>.
17. Moura IH, Silva AN, Anjos JS, Castro THU, Almeida PC, Silva ARV. Educational strategies with adolescents at risk from diabetes type 2: comparative study. Online braz j nurs [internet] 2015 [Cited 2016 Aug 31]; 14(1):25-31. Available from: <<http://www.objnursing.uff.br/index.php/nursing/article/view/4585>>.
18. Lima ACS, Araújo MFM, Freitas RWJF, Zanetti ML, Almeida PC, Damasceno MMC. Fatores de risco para diabetes mellitus tipo 2 em universitários: associação com variáveis sociodemográficas. Rev. Latino Americ Enferm [Internet] 2014 [Cited 2016 Aug 31]; 22(3):484-90. Available from: <http://www.scielo.br/pdf/rlae/v22n3/pt_0104-1169-rlae-22-03-00484.pdf>.
19. Vilarinho RM, Lisboa MT, Thiré PK, França PV. Prevalência de fatores de risco de natureza modificável para a ocorrência de diabetes mellitus tipo. Esc Anna Nery Rev Enferm [Internet] 2008 [Cited 2016 Aug 1]; 12(3):452-6. Available from: <http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1414-81452008000300009>.
20. Medeiros CCM, Bessa GG, Coura AS, França ISX, Souza FS. Prevalência dos fatores de risco para diabetes mellitus de servidores públicos. Revista Eletrônica de Enfermagem [Internet] 2012 [Cited 2016 Jun 1]; 14(3):559. Available from: <<http://www.periodicos.capes.gov.br>>.
21. Magalhães AT, Silva BAK, Ribeiro JA, Bisneto JFA, Pereira LPI, Machado NV, et al. Avaliação do risco de desenvolver diabetes mellitus tipo 2 em população universitária. Rev Bras Promoc Saude [Internet] 2015 [Cited 2016 Jun 8]; 28(1):5-15. Available from: <<http://ojs.unifor.br/index.php/RBPS/article/view/3198/pdf>>.
22. Chegue, M. Risk factors for type 2 diabetes mellitus among patients attending a rural Kenyan hospital. African Journal of Primary Health Care & Family Medicine [Internet] 2010 [Cited 2016 May 2]; 2(1). Available from: <<http://www.phcfm.org/index.php/phcfm/article/view/96/76>>.
23. Lovera MN, Castillo MS, Malarczuk C, Olivera CC, Bonneau GA, Ceballos BH et al. Incidence of type 2 Diabetes Mellitus and associated risk factors in a cohort of health workers. Acta bioquím. clín. latinoam [Internet] 2014 [Cited 2016 Jun 02]; 48(1). Available from: <http://www.scielo.org.ar/scielo.php?script=sci_arttext&pid=S0325-29572014000100007&lng=es>.

24. Almeida VC, Zanetti ML, Almeida PC, Damasceno MM. Occupation and risk factors for type 2 diabetes: a study with health workers. *Ver Latino Am Enferm* [Internet] 2011 [Cited 2016 Jun 24]; 19(3):476-84. Available from: <http://www.scielo.org.ar/scielo.php?script=sci_arttext&pid=S0325-29572014000100007>.
25. Zardo M, Bassan MB, Farias KCM, Diefenthaeler HS, Graziotin NA. Rastreamento de fatores de risco para diabetes tipo 2 em trabalhadores de uma indústria da cidade de Concórdia-SC. *Rev Perspectiva* [Internet]. 2015 [Cited 2016 Aug 6]; 145(39):85-95. Available from: <http://www.uricer.edu.br/site/pdfs/perspectiva/145_484.pdf>.
26. Huang HL, Pan CC, Wang SM, Kung PT, Chou WY, Tsai WC. The incidence risk of type 2 diabetes mellitus in female nurses: a nationwide matched cohort study. *BMC Public Health* [Internet] 2016 [Cited 2016 Aug 6]; 16:443. Available from: <<http://www.ncbi.nlm.nih.gov/pubmed/27230065>>.
27. Moura BP, Amorim PRS, Franceschini SCC, Reis JS, Marins JCB. Validation of a screening tool for identifying Brazilians with impaired glucose tolerance. *Int J Diabetes Dev Ctries* [Internet] 2012 [Cited 2016 Jul 31]; 32(3):116–121. Available from: <<http://link.springer.com/article/10.1007/s13410-012-0074-2>>.
28. Viveiros AS, Borges M, Martins R, Anahory B, Cordeiro MS. Estudo LIDIA: risco de diabetes mellitus tipo 2 numa população rural dos Açores. *Revista Portuguesa de Endocrinologia, Diabetes e Metabolismo* [Internet] 2015 10(2):124-127. Available from: <http://www.spedm.org/website/download/1856-RPEDM_Rev20_V10N2_FinalsemPUB.pdf>.
29. Valente T, Azevedo L. Estudo radar: risco aumentado de diabetes em Amarante. *Rev Port Med Geral Fam* [Internet] 2012 [Cited 2016 Jul 21]; 28(1):18-24. Available from: <<http://www.rpmgf.pt/ojs/index.php/rpmgf/article/view/10913>>.
30. Araújo LO, Silva ES, Mariano JO, Moreira RC, Prezotto KH, Fernandes CAM, et al. Risco para desenvolvimento do diabetes mellitus em usuários da atenção primária a saúde: um estudo transversal. *Rev Gaúcha Enferm* [Internet] 2015 [Cited 2016 Aug 1]; 36(4):77-83. Available from: <http://www.scielo.br/pdf/rgenf/v36n4/pt_1983-1447-rgenf-36-04-00077.pdf>.
31. Mohsen J, Hasanali A, Masoud A. Finnish Diabetes Risk Score to predict type 2 diabetes in the Isfahan diabetes prevention study. *Diabetes Research and Clinical Practice* [Internet] 2013 [Cited 2016 Jun 23] 102:202-209. Available from: <[http://www.diabetesresearchclinicalpractice.com/article/S0168-8227\(13\)00360-4/abstract](http://www.diabetesresearchclinicalpractice.com/article/S0168-8227(13)00360-4/abstract)>.
32. Sakurai M, Nakamura K, Miura K, Takamura T, Yoshita K, Sasaki S, Naruse Y. Family history of diabetes, lifestyle factors, and the 7-year incident risk of type 2 diabetes mellitus in middle-aged Japanese men and women. *Journal of diabetes investigation* [Internet] 2013 [Cited 2016 Jul 23] 4(3):261-268. Available from: <<http://onlinelibrary.wiley.com/doi/10.1111/jdi.12033/abstract>>.
33. Ding D, Chong S, Jalaludin B, Comino E, Bauman AE. Risk factors of incident type 2-diabetes mellitus over a 3-year follow-up: Results from a large Australian sample. *Diabetes research and clinical practice* [Internet] 2015 [Cited 2016 Jun 12] 108(2):306-315. Available from: <<http://www.ncbi.nlm.nih.gov/pubmed/25737033>>.
34. Almdal T, Scharling H, Jensen JS, Vestergaard H. Higher prevalence of risk factors for type 2 diabetes mellitus and subsequent higher incidence in men. *European journal of internal medicine* [Internet] 2008 [Cited 2016 Aug 2] 19(1):40-45. Available from: <<http://www.ncbi.nlm.nih.gov/pubmed/18206600>>.
35. Nguyen CT, Pham NM, Lee AH, Binns CW. Prevalence of and Risk Factors for Type 2 Diabetes Mellitus in Vietnam A Systematic Review. *Asia-Pacific Journal of Public Health* [Internet] 2015 [Cited 2016 Jun 3] 27(6):588-600. Available from: <<http://www.ncbi.nlm.nih.gov/pubmed/26187848>>.
36. Columbié YL, Soca PEM, Vázquez DR, Chi YB. Risk factors associated to occurrence of type 2 diabetes mellitus in adults. *Rev Cubana de Endocrinología* [Internet]. 2016 [Cited 2016 Aug 5]; 27(2):123-133. Available from: <<http://www.scielo.sld.cu/pdf/end/v27n2/end02216>>.
37. Mazzini MCR, Blumer MG, Hoehne EL, Guimarães KRLSLQ, Caramelli B, Fornari L, Malheiros SVP. Rastreamento do risco de desenvolvimento de diabetes mellitus em pais de estudantes de uma escola privada na cidade de Jundiá, São Paulo. *Rev Assoc Med Bras* [Internet]. 2013 [Cited 2016 oct 20]; 59(2):136-42. Available from: <<http://www.scielo.br/pdf/ramb/v59n2/v59n2a12.pdf>>.

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