PHYSICAL ACTIVITY IS ASSOCIATED WITH KNOWLEDGE AND ATTITUDES TO DIABETES TYPE 2 IN ELDERLY

ATIVIDADE FÍSICA ESTÁ ASSOCIADA COM CONHECIMENTO E ATITUDE DA DIABETES TIPO 2 EM IDOSOS

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ABSTRACT
The aim this study was examined the association between physical activity, sociodemographic variables, health conditions and disease knowledge and attitudes in older adults with type 2 diabetes (DM2). A questionnaire for the collection of sociodemographic data and health conditions, the International Physical Activity Questionnaire (IPAQ), Diabetes Knowledge Scale (DKN-A), and Diabetes Attitude Questionnaire (ATT-19) were applied to 204 older adults. The absolute and relative frequencies was obtained and the results were analyzed by the chi-square test for proportions, bivariate analysis and logistic regression (p≤0.05). Significant associations were observed between being physically active and age above 70 years (OR=0.40; 95%CI: 0.22-0.90), having good knowledge of DM2 (OR=12.7; 95%CI: 6.8-30.1), and having a positive attitude towards DM2 self-care (OR=10.1; 95%CI: 6.34-20.1). Physical activity is associated with greater knowledge and a positive attitude towards DM2 self-care.
Keywords: Motor Activity; Health Education; Aging; Chronic Disease.

RESUMO
O objetivo deste estudo foi analisar a associação entre atividade física, variáveis sociodemográficas, condições de saúde e conhecimento e atitudes em idosos com diabetes tipo 2 (DM2). Foi aplicado um questionário para coleta de dados sociodemográficos e condições de saúde, o Questionário Internacional de Atividade Física (IPAQ), a Escala de Conhecimento sobre Diabetes (DKN-A) e o Questionário de Atitudes sobre Diabetes (ATT-19) para 204 adultos mais velhos. As frequências absolutas e relativas foram obtidas e os resultados foram analisados pelo teste do qui-quadrado para proporções, análise bivariada e regressão logística (p≤0,05). Foram observadas associações significativas entre a atividade física e a idade acima de 70 anos (OR=0,40; IC95%: 0,22-0,90), bons conhecimentos de DM2 (OR=12,7; IC95%: 6,8-30,1) e positivos Atitude em relação ao autocuidado com DM2 (OR=10,1; IC95%: 6,34-20,1). A atividade física está associada a um maior conhecimento e uma atitude positiva em relação ao autocuidado com DM2.
Palavras-chave: Atividade motora; Educação em Saúde; Envelhecimento; Doenças Crônicas.

Introduction

The increase in the life expectancy of the population has attracted public health attention, particularly because of the increasing incidence of degenerative chronic diseases such as diabetes mellitus (DM) in the elderly population[1]. Among preventive strategies, specific programs such as health education programs permit to raise awareness, to increase knowledge and to change attitudes towards disease management[2].

Diabetes mellitus affects 8.3% of the adult population, corresponding to 382 million people in the world. Of these, 24 million are found in South American countries and 80% live in low- and middle-income countries[3]. In Brazil, the National Health Survey (NHS, 2013) estimated that 6.2% of the population aged 18 years and over had a medical diagnosis of DM, with a higher prevalence in the age group of 65 to 74 years. The prevalence of DM was 19.6% among those 75 years of age and over[4].

The daily life of people with DM changes dramatically. These changes are related to basic activities of daily living, ranging from the diagnosis of the disease – with feelings of

anguish and despair – to its poor control, with a consequent loss of quality of life. This situation may lead the person to require full health care, involving biological, cultural, social, economic, and psychological aspects, among other[5]. In addition, DM is associated with vascular complications, comorbidities, an increased prevalence of geriatric syndromes and fragility, and an association has been reported between type 2 DM (DM2) and obesity and physical inactivity[5].

The encouragement of physical activity is of fundamental importance in DM2 prevention programs. In this respect, the intensity and volume of physical activity in different life domains (transport, domestic tasks, work, and leisure time) should be increased to reach 150 minutes of moderate activities per week[6].

Public health education programs for the population with DM2 promoted by multidisciplinary teams may be an efficient tool to reduce risk factors by raising the awareness of individuals about the disease[7]. Patients with DM2 participating in these health education programs may benefit by increasing their knowledge of the disease and, thus, develop a positive attitude towards health risk factors that could be reduced[8].

Within this context, the objective of the present study was to verify the association of physical activity, sociodemographic characteristics and health conditions with disease knowledge and attitudes in older adults with DM2 from a city in South Brazil.

Methods

Context and Participants

A quantitative, cross-sectional, population-based study was conducted at four Family Health Units (USF in the Portuguese acronym) that have monitoring programs for older adults with DM2. The study was approved by the Ethics Committee on Research Involving Humans of University of Passo Fundo (Protocol 804.654/2014).

In Passo Fundo, the Family Health Strategy (FHS) is the main regulatory organ of the primary care system. The FHS attends a population of 2,500 to 4,000 individuals, which is delimited by the mapping of areas of greatest vulnerability. The teams perform home visits and offer the formation of specific groups for hypertensive and diabetic patients, pregnant women and older adults, as well as basic outpatient care, referring patients to specialities as needed. The municipality of Passo Fundo has 15 USF located in 15 different neighborhoods, as shown in Figure 1[9].
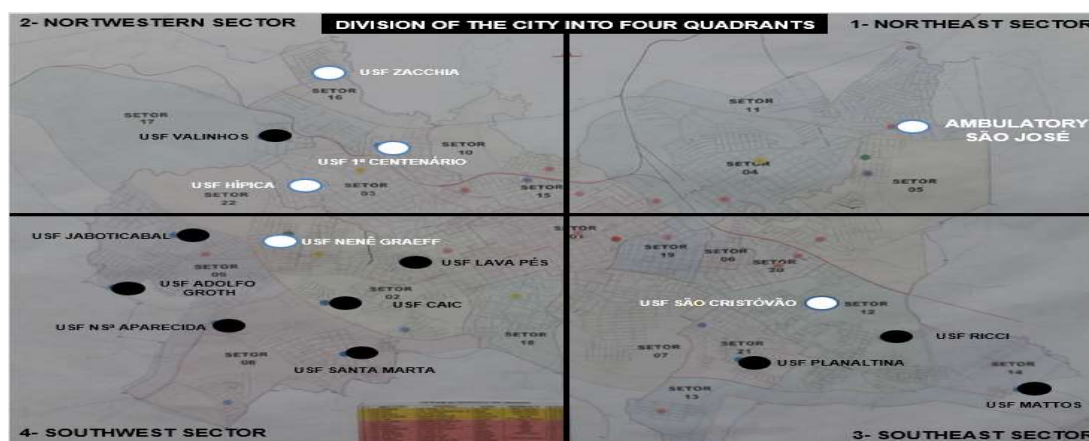
Figure 1. Map of the urban area of Passo Fundo divided into four quadrants with 15 Family Health Units (USF in the Portuguese acronym), adapted by the author[9]

Note: ● USF without DM2 programs for older adults.   ○ USF with DM2 programs for older adults

The municipality of Passo Fundo is located in the plateau region of Rio Grande do Sul at 690 m above sea level, comprising a territorial area of 783.421 km^2, with a demographic density of 235.92 inhabitants/km^2. The population estimated by the demographic census in 2015 was 196,749 inhabitants[10]. There were 23,352 older adults, corresponding to 12.63% of the population. Of these, 3,542 were registered in the USF, i.e., most older adults (16,521) did not use the health services of the Unified Health System and were covered by the family healthcare programs[11].

The urban territorial division established by the Social Protection Department of Passo Fundo, was used for selection of the sample[9]. This organ provided the quadrants of operation of each Social Assistance Reference Center, which were divided into four large sectors: Sector 1 – Northeastern Region; Sector 2 – Northwestern Region; Sector 3 – Southeastern Region; Sector 4 – Southwestern Region.

The first quadrant, Northeastern Region, comprises 14 neighborhoods divided into three census sectors with 31,081 inhabitants; 3,250 of them older adults[11]. There are no USF in this quadrant, but the São José outpatient clinic attends on average 150 older adults with different diseases per month. This outpatient clinic has 12 employees, with the team consisting of nurse technicians, a nurse, a nutritionist, a physiotherapist, and physicians. This team provides outpatient care, immunization, nutritional follow-up, physiotherapy and geriatric, gynecologic and obstetric care to children, pregnant women, older adults, and hypertensive and diabetic patients, among others. The São José outpatient clinic was included in this study because of the services provided through a program for older adults with DM2 and because it met the criteria of the study.

The Northwestern Region located in the second quadrant is divided into six sectors and 25 neighborhoods with a population of 35,402 inhabitants; of these, 1,142 are older adults registered in the USF[11]. There are four USF in this quadrant, three of them offering programs for people with DM that attend 630 older adults with the disease. The programs conducted in these USF are monitored and controlled by the FHS and offer the following services through weekly visits scheduled at the units: nutritional management, periodic examinations, and information about daily DM2 management.

The third quadrant, Southeastern Region, comprises nine sectors and 31 neighborhoods, has a population of 19,022 inhabitants, and the number of older adults registered in the USF is 2,017[11]. There are four USF in this region, but only one has a DM2 program. This program consists of weekly meetings, with interventions of the healthcare team through lectures and control of glucose levels.

The fourth quadrant, Southwestern Region, comprises four sectors and 29 neighborhoods with a population of 56,519 inhabitants, including 3,542 older adults registered in the USF[11]. There are seven USF in this region, but only one offers a DM2 program. This program consists of follow-up by professionals of the USF who perform preventive laboratory tests and hold weekly meetings, including health education lectures.

After identification of the programs for older adults with DM2, one USF per quadrant offering this care was sampled. The São José outpatient clinic was included in the first quadrant since this quadrant had no USF providing programs for older adults with DM2. In the Northwestern region, the unit was chosen by drawing lots among the three USF that provide this care to people with DM2. USF Hípica was selected for this study.

For sample size calculation, a prevalence of DM of 20% among older adults estimated by the PNS was assumed[4]. The minimum sample size was 185 participants with DM and 10% were added for possible losses (e.g., non-eligibility, refusals).

Procedures

A questionnaire was applied to obtain information about sociodemographic data and health conditions. The sociodemographic variables included age (60 to 69 years, > 70 years), sex (male and female), marital status (married, single, widowed, and divorced), occupation (with and without occupation), education level (0 to 4 years, > 5 years), and income (retirement income, pension/others). The heath condition variables included smoking (yes or no in the last year), alcohol consumption (yes or no in the last year), falls (yes or no), and diseases other than DM2 (yes or no).

Physical activity levels in the leisure-time domain were assessed using the International Physical Activity Questionnaire (IPAQ)-Long Form, which has been tested and validated for the elderly Brazilian population[12,13]. The questionnaire is easy to administer, inexpensive and provides acceptable validity for this type of evaluation. The results were summed to provide the minutes spent per week in moderate or vigorous physical activities (MVPA). Older adults performing less than 150 minutes of MVPA were classified as insufficiently active and those performing 150 minutes or more of MVPA were classified as active[14].

For the evaluation of knowledge and attitudes about DM, the participants responded in interviews to the Diabetes Knowledge Scale (DKN-A) and Psychological Attitude Questionnaire (ATT-19) validated for Brazil[15].

The DKN-A is a 15-item multiple choice questionnaire that evaluates different aspects related to DM knowledge. It is divided into five broad categories: a) basic physiology, including insulin action; b) hypoglycemia; c) food groups and substitutions; d) diabetes management during intercurrent diseases, and e) general principles of diabetes care. Each of the 15 questions of the scale is scored as 1 for the correct answer and as 0 for the incorrect answer. Items 1 to 12 require a single correct answer. For items 13 to 15, two answers are correct and both must be checked to obtain score 1. Thus, a score of 0 to 8 indicates poor knowledge of DM and a score higher than 8 indicates good knowledge.

The ATT-19 is an instrument that measures psychological adjustment in people with DM. The questionnaire was developed as a response to the need to evaluate psychological and emotional aspects of the disease. It consists of 19 items divided into six factors: a) stress associated with diabetes; b) receptivity to treatment; c) confidence in treatment; d) personal efficacy; e) health perception, and f) social acceptance. Items 11, 15 and 18 are reverse scored. The main application of this attitude scale is related to the evaluation of educational interventions. Each response to the ATT-19 is rated on a 5-point Likert scale (1 = totally disagree to 5 = totally agree). The total score ranges from 19 to 95 points, with a score < 70 indicating a poor attitude and > 70 a positive attitude towards the disease.

Statistical analysis

The distribution of absolute and relative frequencies and the chi-square test for proportions were used for description of the variables stratified by sex. After bivariate analysis, the association between physical activity and the sociodemographic and health variables was tested by multiple logistic regression. For logistic regression, crude analysis was first performed followed by adjusted analysis, adopting a 95% confidence interval and a level of significance of $p \leq 0.05$. All analyses were performed with the Stata 10.0 program.

Results

The municipality of Passo Fundo had 817 older adults with DM2 registered in the USF, including 80 in the Northeastern Region, 630 in the Northwestern Region, 75 in the

Southeastern Region and 112 in the Southwestern Region. Of these, 204 older adults with DM2 of both sexes participated in the study. There were 62.7% women and 64.2% were in the 60 to 69-year age group. Table 1 shows the characteristics of the sample according to sex. Significant associations were observed for age of 60 to 69 years in both sexes, being married, being a smoker, and alcohol consumption mainly in men.

Table 1. Sociodemographic characteristics of older adults with DM2. Passo Fundo – RS 2015 (n=204)

Variable	Men		Women		X^2	P
	n	%	n	%		
Age					4.726	0.030*
60 to 69 years	56	73.7	75	58.6		
> 70 years	20	26.3	53	41.4		
Marital status					33.370	<0.001*
Married	64	84.2	55	43.0		
Single/widowed	12	15.8	73	57.0		
Education level					0.815	0.367
0 to 4 years	39	51.3	74	57.8		
> 5 years	37	48.7	54	42.2		
Occupation					3.233	0.072
With occupation	50	65.8	99	77.3		
Without occupation	26	34.2	29	22.7		
Income					0.112	0.738
Retirement	58	76.3	95	74.2		
Pension/others	18	23.7	33	25.8		
Smoking					15.854	<0.001*
Yes	51	67.1	49	38.3		
No	25	32.9	79	61.7		
Alcohol consumption					22.869	<0.001*
Yes	29	38.2	13	10.2		
No	47	61.8	115	89.8		
Falls					0.574	0.449
Yes	41	53.9	76	59.4		
No	35	46.1	52	40.6		
Other diseases					0.390	0.532
Yes	66	86.8	107	83.6		
No	10	13.2	21	16.4		
PAL					1.457	0.227
Insufficiently active	62	81.6	95	74.2		
Active	14	18.4	33	25.8		
Knowledge of DM					0.108	0.742
Poor	51	67.1	83	64.8		
Good	25	32.9	45	35.2		
Attitude towards DM					1.217	0.270
Negative	61	80.3	94	73.4		
Positive	15	19.7	34	26.6		

Note: PAL: physical activity level; DM: diabetes mellitus. * Statistically significant difference ($P<0.005$)
Source: Authors

Analysis of the association between physical activity level and the sociodemographic variables, health conditions, knowledge and attitude (Table 2) revealed significant associations with age of 60 to 69 years, greater DM2 knowledge, and a positive attitude towards DM2 treatment.

Table 2. Association between physical activity, sociodemographic variables, health conditions, knowledge, and attitude in older adults with DM2. Passo Fundo – RS 2015 (n=204)

Variable	Insufficiently active		Active		X^2	P
	n	%	n	%		
Sex					1.457	0.227
Male	62	81.6	14	18.4		
Female	95	74.2	33	25.8		
Age					9.356	0.002*
60 to 69 years	92	70.2	39	29.8		
> 70 years	65	89.0	8	11.0		
Marital status					1.649	0.199
Married	87	73.7	31	26.3		
Single/widowed	70	81.4	16	18.6		
Education level					0.000	0.991
0 to 4 years	87	77.0	26	23.0		
> 5 years	70	76.9	21	23.1		
Occupation					0.063	0.801
With occupation	114	76.5	35	23.5		
Without occupation	43	78.2	12	21.8		
Income					0.452	0.502
Retirement	116	75.8	37	24.2		
Pension/others	41	80.4	10	19.6		
Smoking					0.460	0.498
Yes	79	79.0	21	21.0		
No	78	75.0	26	25.0		
Alcohol consumption					0.077	0.781
Yes	33	78.6	9	21.4		
No	124	76.5	38	23.5		
Falls					0.123	0.726
Yes	89	76.1	28	23.9		
No	68	78.2	19	21.8		
Other diseases					0.984	0.321
Yes	131	75.7	42	24.3		
No	26	83.9	5	16.1		
Knowledge of DM					58.680	<0.001*
Poor	125	93.3	9	6.7		
Good	32	45.7	38	54.3		
Attitude towards DM					182.513	<0.001*
Negative	154	99.4	1	0.6		
Positive	3	6.1	46	93.9		

Note: PAL: physical activity level; DM: diabetes mellitus. X^2: chi-square. * Statistically significant difference ($P<0.005$)
Source: Authors

Table 3 shows the crude and adjusted associations of the sociodemographic variables, health conditions and knowledge and attitude about DM2 with physical activity level. The variables that continued to show an association among active older adults after adjusted analysis were age of 70 years and over, good DM2 knowledge, and a positive attitude towards DM2 treatment.

Table 3. Crude and adjusted association of the sociodemographic and health variables with physical activity level in older adults with DM2. Passo Fundo – RS, 2015 (n=204)

Variable	Active		Crude analysis		Adjusted analysis	
	N	%	OR	95%CI	OR	95%CI
Sex						
Male	14	18.4	1		1	
Female	33	25.8	1.40	1.12-4.50	1.38	1.10-4.51
Age						
60 to 69 years	39	29.8	1		1	
> 70 years	8	11.0	0.36	0.21-0.78	0.40	0.22-0.90*
Marital status						
Married	31	26.3	1		1	
Single/widowed	16	18.6	0.71	0.59-1.23	0.69	0.50-1.02
Education level						
0 to 4 years	26	23.0	1		1	
> 5 years	21	23.1	0.99	0.78-1.20	1.01	0.67-1.22
Occupation						
With occupation	37	24.2	1		1	
Without occupation	10	19.6	0.81	0.67-1.48	0.80	0.60-1.79
Income						
Retirement	35	23.5	1		1	
Pension/others	12	21.8	0.92	0.56-1.60	0.83	0.45-1.39
Smoking						
Yes	21	21.0	1		1	
No	26	25.0	1.19	0.89-2.45	1.10	0.80-2.30
Alcohol consumption						
Yes	9	21.4	1		1	
No	38	23.5	1.09	0.45-2.34	1.04	0.56-1.34
Falls						
Yes	28	23.9	1		1	
No	19	21.8	0.91	0.76-1.23	0.89	0.56-1.20
Other diseases						
Yes	42	24.3	1		1	
No	5	16.1	0.66	0.40-1.34	0.56	0.34-1.32
Knowledge of DM						
Poor	9	6.7	1		1	
Good	38	54.3	16.4	7.23-37.5	12.7	6.8-30.10*
Attitude towards DM						
Negative	1	0.6	1		1	
Positive	46	93.9	14.9	8.9-35.9	10.1	6.34-20.1*

Note: Adjusted by physical activity level (active). DM: diabetes mellitus. OR: Odds ratio. *Statistically significant difference by logistic regression
Source: Authors

Discussion

This study identified a positive association of active older adults aged 70 years and over with good disease knowledge and a positive attitude towards DM2 management. Physical activity was associated with age of 70 years and over, in agreement with the study of Justine et al.[16] in that study, older adults evaluating barriers to the participation in physical activity programs reported age not to be a limiting factor for physical activity. The subjects presented other external and internal factors that prevented their participation in physical activity such as pain, non-communicable chronic diseases, and lack of motivation.

The adherence to physical activity is of fundamental importance for the process of aging, especially among patients with DM2. Physical activity provides health benefits as demonstrated in a prospective cohort study conducted in the United States and Europe. The study showed a reduction of 31% in mortality rates among individuals participating once or twice a week in physical activity, totaling at least 150 minutes of MVPA, when compared to their less active peers. The benefits were greater in individual aged 60 years and over without DM2[17].

Interventions designed to encourage behavioral changes in inactive older adults with DM2 have been widely studied and used to promote regular physical activity. Sazlina et al.[18] proposed individual personalized feedback and peer support interventions to improve physical activity levels in 69 Malay older adults aged 60 years and over. The authors observed that raising the awareness of older adults with DM2 alone or through peer support is efficient in improving physical activity levels and may help to more effectively control glucose levels.

The beneficial effect of physical activity has been widely demonstrated in current scientific studies. Gebel et al.[19] evaluated 204.542 Australian adults aged 45 to 75 years from an 8-year cohort study. The objective was to verify the association between physical activity and a reduction in mortality. The results showed an inverse relationship between vigorous physical activity and mortality, suggesting the creation of public health guidelines for vigorous physical activities to benefit the population.

In the present study, participation in physical activity was associated with better knowledge and a positive attitude in older adults with DM2. In a study conducted in Nigeria, Awotidebe et al.[20] evaluated the knowledge, attitude and practice of systematized physical activity for blood glucose control in 299 patients with DM2 (mean age of 51.9 years). The authors found that good knowledge of exercise can favor blood glucose control. Kueh et al.[21] studying 291 Australian patients with DM2 (mean age of 55.8 years), demonstrated an association between self-management in terms of systematized physical activity and good knowledge and attitude in DM2 treatment.

In Brazil, Seramin et al.[22] evaluated DM2 knowledge and attitude in 44 adults and older adults ranging in age from 30 to 80 years who used the public health system in Bebedouro-SP. The scores were satisfactory for disease knowledge (> 8 points), while the participants had difficulties in coping with DM2, exhibiting attitude scores < 70 points.

The positive association observed in the present study highlights the importance of disease knowledge and of a positive attitude towards DM2 treatment. The results found in this study may lead older adults with DM2 to benefit from disease self-care using regular physical activity as a non-pharmacological intervention in the treatment of DM2.

Limitations of the present study include the lack of estimation of the incidence of diseases associated with physical activity and of a clear timeline between the exposure to and occurrence of risk factors that could interfere with the participation in physical activity. Strengths of the study were its practicality and low cost and that it was able to verify the interaction between factors associated with physical activity level.

Conclusions

Being physically active was associated with age of 70 years and over, having good disease knowledge, and having a positive attitude towards DM2 self-care. Physical activity may therefore favor the treatment and control of glucose levels in older adults with DM2. Thus, DM2 prevention and treatment programs should focus on changes in eating habits and physical activity. In addition, courses providing information about DM2 are necessary so that older adults can change their attitude towards the disease.

References

1. Wu F, Guo Y, Chatterji S, Zheng Y, Naidoo N, Jiang Y, et al. Common risk factors for chronic non-communicable diseases among older adults in China, Ghana, Mexico, India, Russia and South Africa: the study on global ageing and adult health (SAGE) wave 1. BMC Public Health 2015;6(15):1-13. Doi: 10.1186/s12889-015-1407-0.
2. World Health Organization. World report on ageing and health. (NLM classification: WT 104). Geneva: WHO Library; 2015.
3. International Diabetes Federation. IDF diabetes atlas. 6th. ed. International Diabetes Federation; 2013.
4. Instituto Brasileiro de Geografia e Estatística. Pesquisa nacional de saúde 2013: percepção do estado de saúde, estilos de vida e doenças crônicas. Rio de Janeiro: Ministério do Planejamento, Orçamento e Gestão; 2014.
5. Oliveira KCS, Zanetti ML. Conhecimento e atitude de usuários com diabetes mellitus em um serviço de atenção básica à saúde. Rev Esc Enferm USP 2011;45(4):862-868.
6. Vagetti GC, Barbosa Filho VC, Moreira NB, Oliveira V, Mazzardo O, Campos W. The association between physical activity and quality of life domains among older women. J Aging Phys Act 2015;23(4):524-533. Doi: 10.1123/japa.2013-0070.
7. Prezio EA, Cheng D, Balasubramanian BA, Shuval K, Kendzor DE, Culica D. Community diabetes education (CoDE) for uninsured Mexican Americans: randomized controlled trial of culturally tailored diabetes education and management program led by a community health worker. Diabetes Res Clin Pract 2013;100(1):19-28. Doi: 10.1016/j.diabres.2013.01.027.
8. Ryan JG, Jennings T, Vittoria I, Fedders M. Short and long-term outcomes from a multisession diabetes education program targeting low-income minority patients: a six-month follow up. Clin Ther 2013;35(1):A43-53. Doi: 10.1016/j.clinthera.2012.12.007.
9. Prefeitura Municipal de Passo Fundo. Plano Municipal de Saúde: 2014-2017. Passo Fundo: Secretária de Saúde; 2014.
10. Instituto Brasileiro de Geografia e Estatística [Internet]. Estimativas da população residente no Brasil e unidades da federação com data de referência de 1 de julho de 2015. [access at date December 15, 2015]. Avialable at: https://www.ibge.gov.br/estatisticas-novoportal/sociais/populacao/9103-estimativas-de-populacao.html?=&t=o-que-e
11. Departamento de Informática do Sistema Único de Saúde [Internet]. Estimativas de 2000 a 2012 utilizadas na publicação "saúde no Brasil - 2012, segundo faixa etária e sexo. [access at date December 15, 2015]. Available at: //tabnet.datasus.gov.br/cgi/tabcgi.exe?popestim/cnv/poprs.def. Accessed March 18, 2015.
12. Benedetti TB, Mazo GZ, Barros MVG. Aplicação do questionário internacional de atividades físicas para avaliação do nível de atividades físicas de mulheres idosas: validade concorrente e reprodutibilidade teste-reteste. Rev Bras Cienc Mov 2004;12(1): 25-34.
13. Benedetti TRB, Antunes PC, Rodriguez-Añez CR, Mazo GZ, Petroski EL. Reprodutibilidade e validade do Questionário Internacional de Atividade Física (IPAQ) em homens idosos. Rev Bras Med Esporte 2007;13(1):11-16.
14. American College of Sports Medicine. Exercise and physical activity for older adults. Med Sci Sports Exerc 2009;41(7):1510-1530. Doi: 10.1249/MSS.0b013e3181a0c95c.
15. Torres HC, Hortale VA, Shall VT. Validação dos questionários de conhecimento (DKN-A) e atitude (ATT-19) de diabetes mellitus. Rev Saude Publica 2005;39(6):906-911. Doi: http://dx.doi.org/10.1590/S0034-89102005000600006.
16. Justine M, Azizan A, Hassan V, Salleh Z, Manaf H. Barriers to participation in physical activity and exercise among middle-aged and elderly individuals. Singapore Med J 2013;54(10):581-586.
17. Arem H, Moore SC, Patel A, Hartge P, Berrington de Gonzalez A, Visvanathan K. et al. Leisure time physical activity and mortality: a detailed pooled analysis of the dose-response relationship. JAMA Internation Med 2015;175(6):959-967. Doi: 10.1001/jamainternmed.2015.0533.
18. Sazlina SG, Browning CJ, Yasin S. Effectiveness of personalized feedback alone or combined with peer support to improve physical activity in sedentary older Malays with type 2 diabetes: a randomized controlled trial. Front Public Health 2015;13(3):178. Doi: 10.3389/fpubh.2015.00178.
19. Gebel K, Ding D, Chey T, Stamatakis E, Brown WJ, Bauman AE. Effect of moderate to vigorous physical activity on all-cause mortality in middle-aged and older Australians. JAMA Internation Med 2015;175(6): 970-977. Doi: 10.1001/jamainternmed.2015.0541.
20. Awotidebe TO, Adedoyin RA, Afolabi MA, Opiyo R. Knowledge, attitude and practice of exercise for plasma blood glucose control among patients with type-2 diabetes. Diabetes Metab Synd 2016;15(1):1-6. Doi: 10.1016/j.dsx.2016.01.006.

21. Kueh YC, Morris T, Borkoles E, Shee H. Modelling of diabetes knowledge, attitudes, self-management, and quality of life: a cross-sectional study with an Australian sample. Health Qual Life Outcomes 2015;13(129): 1-11. Doi: 10.1186/s12955-015-0303-8.
22. Seramin CMS, Danze L, Oliveira KCS. Conhecimento e atitude: componentes para educação em diabetes mellitus nas unidades básicas de saúde de Bebedouro, SP. Rev Fafibe 2013;6(6):130-139.

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