

LEVEL OF KNOWLEDGE OF PHYSICAL EDUCATION STUDENTS ON PHYSICAL EXERCISE FOR PEOPLE WITH DIABETES MELLITUS

CONHECIMENTO DOS ALUNOS DE GRADUAÇÃO EM EDUCAÇÃO FÍSICA SOBRE EXERCÍCIO FÍSICO PARA INDIVÍDUOS COM DIABETES MELLITUS

CONOCIMIENTOS DE LOS ALUMNOS DE GRADO EN EDUCACIÓN FÍSICA SOBRE LA ACTIVIDAD FÍSICA PARA INDIVIDUOS CON DIABETES MELLITUS

Thaís Mara Alexandre Bertazone¹
Flávia Fernanda Luchetti Rodrigues²
Cassiano Merussi Neiva³
Carla Regina de Souza Teixeira⁴
Érika do Carmo Bertazone⁵
Maria Lucia Zanetti⁶

¹ Physical Education. Doctoral student of Post-Graduation Programme of the School of Nursing of Ribeirão Preto of the University of São Paulo – EERP/USP. Ribeirão Preto, SP – Brazil.

² RN. PhD. Clinical Hospital of the School of Medicine of Ribeirão Preto – HCFMRP/USP. Ribeirão Preto, SP – Brazil.

³ Physical Education. PhD in Functional and Molecular Biology. Associated professor at the School of Science of the Júlio de Mesquita Filho State University – UNESP. Professor of the University of Ribeirão Preto Medical School – FMRP. Ribeirão Preto, SP – Brazil.

⁴ RN. PhD. Associated professor at the EERP/USP. Ribeirão Preto, SP – Brazil.

⁵ RN. PhD. Associate professor at the University of Ribeirão Preto – UNAERP. Ribeirão Preto, SP – Brazil.

⁶ RN. PhD. Associate professor III at the EERP/USP. Ribeirão Preto, SP – Brazil.

Corresponding Author: Maria Lucia Zanetti. E-mail: zanetti@eerp.usp.br

Submitted on: 2013/10/23

Approved on: 2015/03/20

ABSTRACT

This is a cross-sectional study that aims at analysing the level of knowledge of Physical Education undergraduate students on diabetes and physical exercise. The random sample consisted of 69 students from three physical education university courses in 2011. Data were collected through a questionnaire consisting of 27 questions related to concepts of the disease, its signs and symptoms and physical exercise. Results showed that the students had satisfactory marks in physical exercise questions and inadequate in concepts, signs and symptoms. Regarding the number of answers, the average of correct answers was 11.1 ± 3.4 ; the average of incorrect answers was 15.0 ± 2.8 . Twenty-three students failed to answer all questions (average of 2.4 ± 2.7). The researchers recommend that concepts, signs and symptoms and physical exercise applied to people with diabetes *mellitus* should be added to the course curriculum; therefore, the physical education teacher will be able to contribute to comprehensive health care delivery.

Keywords: Diabetes Mellitus; Exercise; Knowledge; Motor Activity; Patient Education as Topic.

RESUMO

Este estudo transversal teve como objetivo analisar o conhecimento de alunos de bacharelado em Educação Física sobre diabetes e exercício físico. A amostra foi constituída de 69 alunos de três cursos de bacharelado em Educação Física, em 2011. Para a coleta de dados foi elaborado questionário com 27 questões relacionadas ao conhecimento sobre conceitos da doença, sinais e sintomas e exercício físico. Os resultados mostraram que os alunos apresentaram índice satisfatório de acertos na categoria exercício físico e insatisfatório na categoria conceitos, sinais e sintomas. Das 27 questões, obteve-se média de $11,1 \pm 3,4$ para as respostas corretas e de $15,0 \pm 2,8$ para as incorretas; 23 alunos deixaram de responder alguma questão, média de $2,4 \pm 2,7$. Recomenda-se agregar às disciplinas da grade curricular conteúdos sobre conceitos, sinais e sintomas e exercício físico relacionado à doença. Assim, o educador físico poderá contribuir para a integralidade da atenção à saúde.

Palavras-chave: Diabetes Mellitus; Exercício; Conhecimento; Atividade Motora; Educação de Pacientes como Assunto.

RESUMEN

Este estudio de corte transversal se propuso analizar el conocimiento de los estudiantes de Educación Física sobre diabetes y actividad física. La muestra estuvo compuesta por 69 estudiantes de tres cursos de grado en Educación Física, en 2011. Los datos fueron recogidos por medio de un cuestionario con 27 preguntas relacionadas con el conocimiento sobre los conceptos, señales y síntomas de la enfermedad y el ejercicio físico. Los resultados mostraron que el conocimiento de los estudiantes era suficiente en ejercicio físico e insuficiente en conceptos, señales y síntomas. De las 27 preguntas, hubo un promedio de $11,1 \pm 3,4$ de respuestas correctas y de $15,0 \pm 2,8$ de respuestas incorrectas. Veintitrés estudiantes no contestaron alguna de las preguntas, lo cual representa un promedio de $2,4 \pm 2,7$. Se recomienda incluir en las asignaturas del plan de estudios contenidos sobre conceptos, señales y síntomas y ejercicio físico relacionado con la Diabetes Mellitus. De esta manera, el educador físico podrá contribuir a la integralidad de la atención de la salud.

Palabras clave: Diabetes Mellitus; Ejercicios; Conocimiento; Actividad Motora; Educación del Paciente como Asunto.

INTRODUCTION

Comprehensiveness of health care is one of the constitutional principles of the Unified Health System (SUS). It advocates, amongst others, a multidisciplinary approach to chronic diseases. Physical education is an academic and professional area of knowledge that involves the promotion, prevention, protection and rehabilitation of health.¹

Diabetes *mellitus* (DM) is a chronic disease that, due to the complexity of its treatment, requires a multidisciplinary approach aiming at an optimal metabolic control of the condition in order to delay and/or prevent its acute and chronic complications.²⁻⁴ It is the responsibility of the health professional to instil in people with diabetes the importance of a proper diet, a regular physical exercise programme and the correct use of medication, when necessary.⁵⁻¹⁰

There is consistent evidence that regular physical exercise contributes to the prevention and control of diabetes.¹¹⁻¹⁶

Training of Physical Education teachers to meet the population's needs at the different healthcare levels is still a challenge for improving diabetes care in Brazil's public healthcare system. Such professionals should be adequately trained in how to deal with diabetic people, learning about the disease and its complexities and the relevance of physical exercise.

Prescription of physical exercise should be based on scientific evidence as to its type, frequency, duration and intensity, according to guidelines of the *American College of Sports Medicine*, the *European College of Sports Sciences*, the *American Diabetes Association*, the *American Heart Association* and the *Sociedade Brasileira de Diabetes*.^{7,17-21} Metabolic control and chronic complications already developed, as well as schedule, type of footwear, monitoring of blood glucose and adjustment of hypoglycaemia should be taken into account.

There is scarce literature on the level of information that the Physical Education student has on exercise for adults with DM²². This fact points out to the need of more research on the subject in order to improve the care of diabetics.

The role of physical educators in a multidisciplinary team is essential because they are responsible for advising patients on the activities they can perform, depending on their clinical condition. The prescription of these exercises should be based on scientific evidence. Such professional should emphasize that physical exercises are beneficial to maintain good health and improve quality of life.

For that to happen, physical education teachers should receive proper training as how to act in different situations, depending on the condition, signs and symptoms, pathophysiological mechanisms, type of exercise, acute and chronic effects of physical training and possible risks.

Therefore, this study aimed at analysing the level of information of Physical Education undergraduate degree students

on diabetes and physical activity. The authors hope this study may help to identify the students' gaps in knowledge related to this issue.

METHODOLOGY

This is a cross-sectional descriptive study carried out in three private institutions in the state of São Paulo, amongst Bachelor's degree students, from April to August 2011. For the purpose of this study, participants were selected based on the following criteria: students in their third and fourth year of study; students attending classes on the day of data collection. Students of the Bachelor's degree were selected due to specific aspects about that field of expertise. The research population consisted of 75 students, six of whom refused to participate. Thus, the convenience sample comprised 69 undergraduate degree students of Physical Education: sixty-five third year students, and three fourth year students.

Two questionnaires were developed in order to collect data on the student's identification (full name and address, city, post code, telephone number, educational institution and course year); sociodemographic characteristics (gender, age, marital status and family income); and the student's knowledge about DM, its signs and symptoms and the importance of physical activity. The questionnaire design was based on current literature^{5,6,8,17,19,20,23-27} on the subject and contained twenty-seven questions: nineteen multiple choice questions and eight true-false questions. Such questions were subdivided into three categories: concept (questions 1, 3, 4, 5, 6, 7, 10, 11, and 23); signs and symptoms (2, 8, and 9); and physical exercise (12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 24, 25, 26 and 27).

The instrument was not validated by the study population, but it was assessed by four highly experienced Physical Education experts in working with individuals with diabetes. The professionals assessed the data collection tool as to form, content, intelligibility of questions, readability, understanding, form of presentation; they agreed or not with the removal, addition or modification of questions.

Data collection was carried out in the classrooms after classes in order not to interfere with the student's normal daily activities. First, students were explained the nature and purpose of the study, and the importance of their participation. Those who agreed to participate signed the consent form. The questionnaire was answered individually in 20 minutes on average.

The researchers created a database in Microsoft Excel 2010 program. They implemented a double entry, and subsequently validated it in order to avoid possible errors in data transcription. Data were later transported into the Statistical Package for Social Sciences (SPSS 14.0), grouped into categories and summarized using descriptive statistics. The eight true-false questions had dif-

ferent number of options: questions with six options were considered correct if they presented at least four correct answers; questions with five options, at least three correct answers; and questions with four options were considered correct with at least three accurate answers. A satisfactory rate of correct answers was 50% or more for each of the three categories investigated.

This project was approved by the Ethics Committee of the Ribeirão Preto School of Nursing, University of São Paulo, Protocol No. 1090/2009.

RESULTS

A total of 59.4% of the study participants were male; the average age was 23.9 ± 3.7 years; 88.4% were single; and 55.0% had family income of one to six minimum wages (Table 1).

Table 1 - Socio-demographic characterization of Physical Education students of a private university in the state of São Paulo. Ribeirão Preto, 2011

Variables		N°	%
Sex	Male	41	59.4
	Female	28	40.6
Age (years)	20 to 24	47	68.1
	25 to 29	15	21.7
	30 to 34	4	5.8
	35 to 39	1	1.5
	Declined to answer	2	2.9
Marital Status	Single	61	88.4
	Married	6	8.6
	Divorced	1	1.5
	Declined to answer	1	1.5
Family income (minimum wage)	1 to 3	18	26.1
	4 to 6	20	28.9
	7 to 9	4	5.8
	10 to 12	3	4.4
	13 to 15	2	2.9
	Declined to answer	22	31.9

In the questions about DM concepts the highest number of correct answers dealt with the characteristics of type 2 diabetes (53.6%); the questions with more incorrect answers had to do with the classification of DM and the level of random capillary blood glucose that indicates hypoglycaemia (10.1%) (Table 2).

Regarding the category of Signs and symptoms the highest percentage of correct answers was in questions related to classic signs and symptoms of hypoglycaemia (39.1%). The questions with the lowest rate of correct answers were related

to classic symptoms of diabetes, signs and symptoms of hyperglycaemia (15.9) (Table 3).

Regarding the questions about physical exercise, the highest rate of correct answers was related to physical activity recommendations for people suffering from vascular complications of diabetes (peripheral neuropathy, retinopathy and diabetic nephropathy) (79.7%). Most incorrect answers were related to the amount of carbohydrates recommended in a pharmacotherapy during prolonged and intense physical exercises (5.8%) (Table 4).

DISCUSSION

The students gave incorrect answers to conceptual questions about diabetes, its classification, characteristics, and reference values for laboratory tests, among others. Physical education teachers should understand such concepts so they can help to demystify the belief that diabetes is triggered by emotional factors, give advice on diet, emphasize the importance of regular health checks, especially regarding people over forty years old,^{28,29} and the consequences of not controlling the disease properly.^{5-8,17,19-21,23,24,26} Such knowledge is the basis upon which that professional will draw up an individualized physical exercise programme for the diabetic.

Most students lacked the knowledge about the classic symptoms of the disease, hyperglycaemia and hypoglycaemia. The physical education teacher, when prescribing exercise to individuals with type 1 DM (DM1) and type 2 DM (DM2) using insulin, should be aware of hypoglycaemic events, and the importance of self-monitoring of blood glucose as a tool to identify such events, and treat it immediately before, during and after exercise.^{8,30-32}

The data available on this study are consistent with another study carried out in southern Brazil, which found that most Physical Education students were aware of the benefits of exercise for prevention and treatment of diabetes.²²

The majority of students obtained a good percentage of correct answers to questions related to prescriptions of physical exercise for people with diabetes. On the other hand, most students gave incorrect answers to questions about the minimum duration of aerobic exercise recommended and the frequency of resistance training.

The study found that physical education bachelor's degree programme included the subject Diabetes and physical exercise in chronic conditions; however, recommendations on duration and frequency of exercise for people with diabetes should be more thorough. Questions related to the most common problems in persons with DM who do physical exercise obtained a high percentage of correct answers in hypoglycaemia and insulin production. A Turkish study carried out with 1,500 teachers who worked with children also showed that the teachers' knowledge of diabetes was limited.³³

Table 2 - Distribution of physical education undergraduate students at a private university in the state of São Paulo, according to the index of correct and incorrect answers in the category of Concepts. Ribeirão Preto, São Paulo, 2011

Variables	Correct answers	%	Incorrect answers	%	Did not answer	%	Total (%)
Concepts							
1 – Concept of DM	11	15.9	58	84.1	–	–	69 (100)
3 – Classification of DM	07	10.1	61	88.5	1	1.4	69 (100)
4 – Characteristics of type 1 DM	28	40.6	39	56.5	2	2.9	69 (100)
5 – Characteristics of type 2 DM	37	53.6	31	45.0	1	1.4	69 (100)
6 – Level of plasma fasting glucose in subjects with and without DM	26	37.7	43	62.3	–	–	69 (100)
7 – Impaired fasting glucose	12	17.4	57	82.6	–	–	69 (100)
10 – Random blood sugar level indicating hypoglycaemia	07	10.1	62	89.9	–	–	69 (100)
11 – Bases of DM treatment	31	44.9	38	55.1	–	–	69 (100)
23 – Foot care for individuals with DM	10	14.5	45	65.2	14	20.3	69 (100)

Table 3 - Distribution of Physical Education undergraduate students at a private university in the state of São Paulo, according to the index of correct and incorrect answers in the category of Signs and symptoms. Ribeirão Preto, São Paulo, 2011

Variables	Correct answers	%	Incorrect answers	%	Did not answer	%	Total (%)
Signs and symptoms							
2 – Classic symptoms	11	15,9	56	81,2	2	2,9	69 (100)
8 – Classic signs and symptoms of hyperglycaemia	11	15,9	58	84,1	–	–	69 (100)
9 – Classic signs and symptoms of hypoglycemia	27	39,1	42	60,9	–	–	69 (100)

Table 4 - Distribution of physical education undergraduate students at a private university in the state of São Paulo, according to the index of correct and incorrect answers in the category of Physical exercise. Ribeirão Preto, São Paulo, 2011

Variables	Correct answers	%	Incorrect answers	%	Did not answer	%	Total (%)
Physical exercise							
12 – Physical exercise and DM	50	72.5	15	21.7	4	5.8	69 (100)
13 – Physical exercise recommendation for individuals with DM	55	79.7	10	14.5	4	5.8	69 (100)
14 – Minimum duration of aerobic exercise recommended for all individuals	17	24.6	52	75.4	–	–	69 (100)
15 – Frequency of resistance training recommended for people with DM	07	10.1	62	89.9	–	–	69 (100)
16 – Most common complication in people with DM that do physical exercises	47	68.1	22	81.9	–	–	69 (100)
17 – Relationship between physical exercise, hypoglycaemia and insulin production	51	73.9	13	18.8	5	7.3	69 (100)
18 – Capillary blood glucose levels that require the teacher's attention to avoid episodes of hypoglycaemia during physical exercise	38	55.0	31	45.0	–	–	69 (100)
19 – Blood glucose levels in which physical exercise should be avoided	18	20.1	51	79.9	–	–	69 (100)
20 - Recommended pre-exercise capillary blood glucose levels for intake of additional carbohydrates	35	50.7	34	49.3	–	–	69 (100)
21 – Carbohydrate intake recommended for people with DM in pharmacotherapy during prolonged and intense exercise	4	5.8	65	94.2	–	–	69 (100)

Continued...

... continuation

Table 4 - Distribution of physical education undergraduate students at a private university in the state of São Paulo, according to the index of correct and incorrect answers in the category of Physical exercise. Ribeirão Preto, São Paulo, 2011

Variables	Correct answers	%	Incorrect answers	%	Did not answer	%	Total (%)
Exercício Físico							
22 – Physical exercise for people with peripheral neuropathy	55	79.7	8	11.6	6	8.7	69 (100)
24 – Physical exercise for individuals with retinopathy and diabetic nephropathy	55	79.7	10	14.5	4	5.8	69 (100)
25 – Intervention of the physical education teacher during physical exercise of people with DM	54	78.3	11	15.9	4	5.8	69 (100)
26 – Blood glucose control during very intense physical exercise in individuals with DM	33	47.8	31	44.9	5	7.3	69 (100)
27 – Control of blood glucose during recovery from very intense physical exercise in individuals with DM	32	46.4	33	47.8	4	5.8	69 (100)

Most students gave incorrect answers to the random level of capillary blood glucose reflecting hypoglycaemia in the category of Concepts. Half of them, however, were aware of the level of capillary blood glucose which required the physical educator’s attention to prevent episodes of hypoglycaemia during physical exercise. A study carried out in Recife with 27 gym instructors showed that they had insufficient knowledge on prescription of exercise for individuals with diabetes.³⁴

Capillary blood glucose monitoring as well as recognizing the signs and symptoms of hypoglycaemia while performing the exercise are indispensable and people should be aware of them. This enables the professional to distinguish the glycaemic response to different exercise conditions and make the appropriate adjustments of insulin dosage and/or nutritional intake.^{8,17,20,24,31}

Most students gave incorrect answers to the level of capillary blood glucose which could put diabetic people at risk when doing exercise. However, concerning the levels of pre-exercise capillary blood glucose and the intake of additional carbohydrates, approximately half of the students knew the correct answer. Unawareness about the levels of blood glucose pre-physical exercise can be a health hazard to people with diabetes.^{6,7} There was as well a large number of incorrect answers to the recommended amount of carbohydrates individuals taking medication for diabetes should have during prolonged and intense physical exercise.

Most participants gave correct answers to questions related to chronic complications. Physical education students should be informed about the importance of medical evaluations in order to detect macrovascular and microvascular complications before starting a more intense exercise program, particularly amongst those over 40 years of age. In addition to age, history of physical activity should also be considered.^{17,19,21,24}

A study carried out in Fortaleza investigating the level of knowledge on diabetes of 400 gym instructors demonstrated that 26% of them did not ask diabetics to do a cardiovascular evaluation before exercise.³⁵

Almost half of the students had knowledge of blood glucose control during strenuous exercise and recovery.

A research carried out in Pelotas assessing 221 physical education undergraduate students regarding their perceptions of their preparedness to work with diabetic people demonstrated that their knowledge of the subject was satisfactory. Most of them, however, said that they did not feel sufficiently prepared to work with diabetic people.²² Such results corroborate other studies.³³⁻³⁸

Higher education institutions should include programme contents that make the interface between physical exercise and chronic diseases, particularly DM, given the great amount of individuals affected by the condition.

The limitations of this study were the absence of a data collection instrument designed specifically to the Brazilian context in order to investigate physical education students’ knowledge of DM. The lack of studies with similar methodologies for the researcher to compare data obtained in this investigation was another limitation of the present study. Consequently, the authors recommend further studies should be carried out to expand knowledge on the matter investigated.

CONCLUSION

The results revealed that Physical Education degree students’ percentage of correct answers was satisfactory in the category of Physical exercise. However, their performance in the category of Concepts and of Signs and symptoms was unsatisfactory. These results highlight the need for training activities focussed on physical exercise for individuals with DM.

The authors recommend expanding the existing content of the course programme with respect to concepts, signs and symptoms and physical exercise applied to DM, in order that the physical educator may work with a multidisciplinary team using a comprehensive approach.

Given the above, health professionals specialized in DM can contribute to the improvement of the delivery of diabetes care, as happens in developed countries.

REFERENCES

1. Conselho Federal de Educação Física-CONFEF. Recomendações sobre condutas e procedimentos do profissional de educação física na atenção básica à saúde. Rio de Janeiro: CONFEF; 2010. 48 p.
2. Finch EA, Kelly MS, Marrero DG, Ackermann RT. Training YMCA Wellness Instructors to deliver an adapted version of the Diabetes Prevention Program lifestyle intervention. *Diabetes Educ.* 2009; 35(2):224-32.
3. Scain SF, Friedman R, Gross JL. A structured educational program improves metabolic control in patients with type 2 diabetes: a randomized controlled trial. *Diabetes Educ.* 2009; 35(4):603-11.
4. Torres HC, Souza ER, Lima MHM, Bodstein RC. Intervenção educativa para o autocuidado de indivíduos com Diabetes Mellitus. *Acta Paul Enferm.* 2011; 24(44): 514-9.
5. American College of Sports Medicine (ACSM). Exercise and type 2 diabetes: the American College of Sports Medicine and the American Diabetes Association - Joint Position Statement. Exercise and type 2 diabetes. *Med Sci Sports Exerc.* 2010; 42(12):2282-303.
6. American Diabetes Association (ADA). Standards of medical care in diabetes – 2011. *Diabetes Care.* 2011; 34(Suppl 1):S11-S61.
7. American Diabetes Association (ADA). Standards of medical care in diabetes – 2013. *Diabetes Care.* 2013; 36(Suppl 1):S11-S66.
8. Gulve EA. Exercise and glycemic control in diabetes: benefits, challenges, and adjustments to pharmacotherapy. *Phys Ther.* 2008; 88(11):1297-321.
9. Look Ahead Research Group. Long-term effects of a lifestyle intervention on weight and cardiovascular risk factors in individuals with type 2 Diabetes Mellitus. Four-year results of the Look AHEAD Trial. *Arch Intern Med.* 2010; 170(17):1566-75.
10. Umpierre D, Ribeiro PAB, Kramer CK, Leitão CB, Zucatti ATN, Azevedo MJ, et al. Physical activity advice only or structured exercise training and association with HbA1c levels in Type 2 Diabetes. A systematic review and meta-analysis. *JAMA.* 2011; 305(17):1790-9.
11. Church TS, Blair SN, Cocroham S, Johannsen N, Johnson W, Kramer K, et al. Effects of aerobic and resistance training on Hemoglobin A1c levels in patients with type 2 Diabetes. A randomized controlled trial. *JAMA.* 2010; 304(20):2253-62.
12. Figueira FR, Umpierre D, Casali KR, Tetelbom PS, Henn NT, Ribeiro JP, et al. Aerobic and Combined Exercise Sessions reduce glucose variability in Type 2 Diabetes: Crossover Randomized Trial. *Plos One.* 2013; 8(3):e57733.
13. Larose J, Sigal RJ, Khandwala F, Prud'homme D, Boulé NG, Kenny GP. Associations between physical fitness and HbA1c in type 2 diabetes mellitus on behalf of the Diabetes Aerobic and Resistance Exercise (DARE) trial investigators. *Diabetologia.* 2011; 54:93-102.
14. Seeger JPH, Thijssen DHJ, Noordam K, Cranen MEC, Hopman MTE, Nijhuis-Van Der Sanden MWG. Exercise training improves physical fitness and vascular function in children with type 1 diabetes. *Diabetes Obes Metab.* 2011; 13(4):382-4.
15. Sigal RJ, Kenny GP, Boulé NG, Wells GA, Prud'Homme D, Fortier M. Effects of aerobic training, resistance training, or both on glycemic control in type 2 Diabetes. A randomized trial. *Ann Intern Med.* 2007; 147: 357-69.
16. Tuomilehto J, Lindstrom J, Eriksson JG, Valle TT, Hamalainen H, Illane-Parikka P, et al. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *N Engl J Med.* 2001; 344(18):1343-50.
17. American College of Sports Medicine (ACSM). Diretrizes do ACSM para os testes de esforço e sua prescrição. 7ª ed. Rio de Janeiro: Guanabara Koogan; 2007. 266 p.
18. American College of Sports Medicine (ACSM). Position stand: appropriate physical activity intervention strategies for weight loss and prevention of weight regain for adults. *Med Sci Sports Exerc.* 2009; 41(2):459-71.
19. Sociedade Brasileira de Diabetes. Diretrizes da Sociedade Brasileira de Diabetes 2012-2013. Rio de Janeiro: Guanabara Koogan; 2011. 388 p.
20. Sigal RJ, Kenny GP, Wasserman DH, Castaneda-Sceppa C, White RD. Physical activity/exercise and type 2 diabetes. *Diabetes Care.* 2004; 27(10):2518-39.
21. Sigal RJ, Kenny GP, Wasserman DH, Castaneda-Sceppa C, White RD. Physical activity/exercise and type 2 diabetes: a consensus statement from the American diabetes Association. *Diabetes Care.* 2006; 29(6):1433-8.
22. Knuth AG, Borges TT, Hallal PC, Azevedo MR. Conhecimento dos acadêmicos de Educação Física sobre os efeitos da atividade física na prevenção e tratamento do diabetes. *Rev Bras Ciênc Mov.* 2007; 15(4):7-14.
23. Albright A, Franz M, Hornsby G, Kriska A, Marrero D, Ullrich I, et al. American College of Sports Medicine. Position Stand: Exercise and type 2 diabetes. *Med Sci Sports Exerc.* 2000; 32(7):1345-60.
24. Colberg S. Atividade física e diabetes. São Paulo: Manole; 2003. 304 p.
25. Colberg S. Use of clinical practice recommendations for exercise by individuals with type 1 diabetes. *Diabetes Educ.* 2000; 26(2):265-71.
26. Colberg SR, Swain DP. Exercise and diabetes control: a winning combination. *Phys Sportsmed.* 2000; 28(4):63-81.
27. Peirce NS. Diabetes and exercise. *Br J Sports Med.* 1999; 33:161-73.
28. Péres DS, Santos MA, Zanetti ML, Ferronato AA. Dificuldades dos pacientes diabéticos para o controle da doença: sentimentos e comportamentos. *Rev Latino-Am Enferm.* 2007; 15(6):1105-12.
29. Santos ECB, Zanetti ML, Otero LM, Santos MA. O cuidado sob a ótica do paciente diabético e de seu principal cuidador. *Rev Latino-Am Enferm.* 2005; 13(3):397-406.
30. Cryer PE. Hypoglycaemia: the limiting factor in the glycaemic management of type 1 and type 2 diabetes. *Diabetologia.* 2002; 45:937-48.
31. Jimenez CC, Corcoran MH, Crawley JT, Hornsby WG, Peer KS, Philbin RD, et al. National Athletic Trainers' Association Position Statement: Management of the athlete with type 1 diabetes mellitus. *J Athl Train.* 2007; 42 (4):536-45.
32. Arutchev V, Heise T, Dellweg S, Elbroend B, Minns I, Home PD. Plasma glucose and hypoglycaemia following exercise in individuals with Type 1 diabetes: a comparison of three basal insulins. *Diabet Med.* 2009; 26:1027-32.
33. Aycan Z, Önder A, Cetinkaya S, Bilgili H, Yildirim N, Baş VN, et al. Assessment of the Knowledge of Diabetes Mellitus Among School Teachers within the Scope of the Managing Diabetes at School Program. *J Clin Res Pediatr Endocrinol.* 2012; 4(4):199-203.
34. Teixeira LEC, Cruz PWS, Soares MMA, Santos HLBA, Borges J, Vancea DMM. Grau de conhecimento dos profissionais de Educação Física sobre a prescrição de exercício físico para diabéticos. *Rev Bras Ciênc Saúde.* 2011; 9(29):25-30.
35. Monteiro LZ, Spinato IL, Silva CAB, Pinheiro MHNP, Santos ZMSA, Montenegro Júnior RM. Conhecimento do profissional de educação física frente à atuação com portadores de diabetes mellitus nas academias de ginástica de Fortaleza, CE. *Rev Bras Educ Fis Esp.* 2009; 23(2):135-42.
36. Halpern LA, Agwu JC. Physical education teachers' knowledge of type 1 diabetes. *Arch Dis Child.* 2009; 94(6):483-4.
37. Monteiro LZ, Spinato IL, Pinheiro MHNP, Silva CAB, Montenegro Junior RM. Exercício físico em crianças com diabetes mellitus tipo 1: conhecimento do profissional de Educação Física. *Rev Bras Ciênc Mov.* 2011; 17(2):1-23.
38. Oliveira APC, Leone GB, Nunes HEG, Fernandes MFB, Ferreira BE. Nível de conhecimento dos acadêmicos de curso de Educação Física da Universidade Federal de Mato Grosso do Sul sobre a doença diabetes mellitus. *Lecturas Educ Fis Deport: Rev Digital.* 2009; 14(139):1. [Cited 2011 Nov. 14]. Available from: <http://www.efdeportes.com/efd139/nivel-de-conhecimento-sobre-diabetes-mellitus.htm>
39. Tahirovic H, Toromanovic A. How far are physical education teachers from elementary school prepared to help pupils with diabetes while they are at school? *Minerva Pediatr.* 2007; 59(6):767-73.