

Level of physical activity and caloric expenditure of individuals with diabetes mellitus during leisure activities

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Abstract

The aim of this study was to analyze the level of physical activity and caloric expenditure, measured in metabolic equivalents (METs), during leisure activities of individuals with diabetes mellitus being cared for at a district basic health unit in a city in the State of São Paulo, Brazil. The convenience sample comprised 134 subjects with type 2 diabetes mellitus who received treatment between May and August 2009. Data were collected with a form containing demographic and clinical variables and the International Physical Activity Questionnaire (IPAQ). Level of physical activity was calculated using the IPAQ Guidelines for Data Processing and Analysis. For data analysis, descriptive statistics and the chi-squared test were used. Mean age of participants was 63.5 ± 10.27 years and time of diagnosis, 11.71 ± 7.94 years. Regarding level of physical activity, 11.9% were inactive; 50% and 17.9% were classified as active and very active, respectively. The results showed that 56% did not exercise during their leisure time. Mean sitting time surpassed five hours per day. Half of the subjects did not perform physical activity during their leisure time and only 20.1% reached the recommended level of physical activity to obtain health benefits. Only 20.5% of the participants reached the recommended level of caloric expenditure (kcal) to obtain health benefits. Domestic physical activity presented the highest caloric expenditure, calculated in METs, followed by work activities.

KEY WORDS: Diabetes mellitus type 2; Exercise; Motor activity; IPAQ; Leisure.

Introduction

Physical exercise is an important therapeutic tool to prevent and treat several noncommunicable chronic diseases. Since the 18th century, exercise has been recommended as a beneficial activity in treating individuals with type 2 diabetes mellitus (DM2) due to increased peripheral utilization of glucose, which persists for 12 hours or more after exercising¹.

There is evidence that physical exercise improves glycemic control, contributes to weight loss, and improves quality of life. It also helps improve lipid profile, increasing HDL cholesterol and lowering triglyceride levels and, consequently, cardiovascular risk factors, which impact on the morbidity of individuals with type 1 diabetes mellitus (DM1) and DM2¹⁻³.

According to the American College of Sports and Medicine and the American Heart Association, 30 minutes of moderate to intense exercise per day, five times a week, can mitigate the risk of cardiovascular diseases and contributes to reducing body weight and blood pressure⁴⁻⁵.

When prescribing physical exercise, professionals must consider not only the factors mentioned above, but also personal preferences, in addition to physical exams and ergometric stress tests. However, it is difficult for most people with diabetes mellitus (DM) to schedule medical appointments and, consequently, ergometric tests⁶⁻⁸. There is also a paucity of instruments that can estimate

levels of physical activity among populations from different countries and sociocultural contexts to prescribe exercise to individuals with DM in terms of type, frequency, duration and intensity. In this sense, the International Physical Activity Questionnaire (IPAQ), developed by the World Health Organization and the Center for Disease Control and Prevention⁹⁻¹⁰ is a valuable tool to assess physical activity levels in this population.

On considering the importance of physical activity and the need to assess it quickly and economically, the researchers employed the IPAQ to

measure levels of physical activity of individuals with DM registered with a district basic health center in the city of Ribeirão Preto, São Paulo, Brazil, considering the cost-benefit relationship. We hope that this study can help identify levels of physical activity of individuals with DM as a resource for promoting healthy habits and as one of the pillars for achieving glycemic control in diabetes patients.

Thus, the aim of this study was to analyze the level of physical activity and caloric expenditure, in metabolic equivalents (METs), of DM patients during leisure activities.

Method

This was a cross-sectional study conducted in a district basic health unit in a city in the State of São Paulo. The population consisted of DM2 patients receiving care at this unit from a multiprofessional health team.

The inclusion criteria for this study were having a confirmed diagnosis of DM2 on their patient chart and being an adult or older adult capable of responding to the researcher's questions. Patients who were present at the health service between May 27 and August 13 of 2009 were invited to participate in the study.

Of the 159 patients receiving care at the unit during the established timeframe, three refused to participate; twelve denied a diagnosis of DM2, even though it was recorded in their chart; three had DM1; three were excluded because they went in for their appointment and did not return for the interview, four did not understand the items and did not provide answers, due to the inherent complexity of the questionnaire, and two were excluded due to data inconsistency on analyzing the IPAQ.

Thus, the convenience sample comprised 132 patients with DM2 that met the inclusion criteria.

Data collection was conducted using a form for demographic and clinical variables and the IPAQ.

The data were obtained through directed interviews conducted individually by the researcher before the medical appointment. Patients were sitting in the waiting room of the district basic health unit. During the interview, the participants' answers were recorded by the researcher on the data collection instrument. The data were later organized in a spreadsheet, via double entry verification, and imported to the SPSS 13.0 program after database validation.

Descriptive statistics were used to analyze answers related to sociodemographic and clinical variables. Categorical and ordinal qualitative variables were submitted to analysis via the chi-squared test. Data related to levels of physical activity were analyzed as per the Guidelines for Data Processing and Analysis of the International Physical Activity Questionnaire - Short and Long Forms¹¹, taking into account criteria such as frequency, duration and METs.

The study proposal was approved by the research ethics committee of the Ribeirão Preto College of Nursing at University of São Paulo on September 19, 2007, under protocol n. 0827/2007.

Results

Of the 132 (100%) investigated participants, 78 (59.1%) were women with a mean age of 63.5 ± 9.5 years and 54 (40.9%) were men with a mean of 64.2 ± 10.8 years. Among the men, mean education level was 5.5 ± 4.5 years and, among the women, 5.0 ± 4.9 years. It is worth mentioning that 67 (50.8%)

patients had up to four years of formal education and 18 (13.6%) did not have any formal education. Mean years of formal education in the 30 to 49 age group was 7.9 ± 3.5 years, and in the 50 to 69 and 70 or older groups, 6.0 ± 4.9 and 2.8 ± 3.9 years, respectively. Six (7.8%) participants between 50

and 69 years old and 12 (28.6%) participants in the range of 70 years old or older did not have any formal education and were illiterate.

Of the investigated participants, 59% were married or lived with a partner. The mean number of people per household was 2.8. Regarding the participants' occupation, 36 (27.3%) had paid work. In terms of time of disease, participants reported discovering their condition 11.7 ± 7.9 years before the time of the study. The men had been diagnosed for a mean of 11.9 ± 8.1 years, and the women for 11.6 ± 7.9 years. Of the 59 (44.7%) who exercised, the mean frequency was 4.2 ± 1.7 days per week. Furthermore, of the 44.7% who exercised, 47 (79.7%) reported walking.

According to the IPAQ classification, 50.8% were active, 18.2% very active and 31.0% were inactive or insufficiently active, as shown in TABLE 1.

In terms of gender, 14.8% of the men and 10.3% of the women were inactive. Furthermore, 13% of the men and 21.8% of the women were very active. The older the age group, the less individuals were classified as very active. In the age group of 30 to 49 years old, 38.4% were classified as very active, whereas this percentage was 11.9% among those 70 years old or older, representing the highest and lowest percentages, respectively. There were records of HbA1c levels in the charts of ninety-six participants. Of these, 29 (30.2%) presented good glycemic control and 67 (69.8%) had poor control, as shown in TABLE 1.

TABLE 1 - Numeric and percentage distribution of participants according to IPAQ classification and gender, age group, and HbA1c. Ribeirão Preto, São Paulo, Brazil, 2009.

	IPAQ										*n = 96 participants; % relative to the number of participants.
	Total		Inactive		Insufficiently active		Active		Very active		
	n	%	n	%	n	%	n	%	n	%	
	132	100	16	12.1	25	18.9	67	50.8	24	18.2	
Gender											
Men	54	40.9	8	14.8	15	27.8	24	44.4	7	13.0	
Women	78	59.1	8	10.3	10	12.8	43	55.1	17	21.8	
Age group											
30-49	13	9.9	2	15.4	2	15.4	4	30.8	5	38.4	
50-69	77	58.3	6	7.8	12	15.6	45	58.4	14	18.2	
+70	42	31.8	8	19.0	11	26.2	18	42.9	5	11.9	
HbA1c*											
≤ 7.0%	29	30.2	3	10.3	6	20.7	17	58.7	3	10.3	
> 7.0%	67	69.8	10	14.9	7	10.5	39	58.2	11	16.4	

TABLE 2 shows mean waist circumference and body mass index (BMI) values according to the IPAQ classification. As levels of physical activity increased, mean waist circumference among women and mean BMI decreased.

In terms of metabolic equivalents per week at work, in transportation, in domestic and leisure activities, the results showed that domestic activities represented the greatest expenditure in METs/week, with 1246.1 ± 3405.2 , followed by work with 526.4 ± 299.8 , leisure activities with 438.3 ± 749.4 , and transportation 338.2 ± 1203.9 .

Regarding caloric expenditure of the participants with leisure physical activity, only 20.1% of them reached more than 1000 kcal/week, as recommended in order to be health enhancing, as shown in TABLE 3.

Considering caloric expenditure in leisure activities by gender (TABLE 3), there was a statistically significant difference between gender and caloric expenditure of 500-999 kcal/week and >1000 kcal/week ($p = 0.02$), of which 11.1% of the men and 26.9% of the women obtained more than 1000 kcal/week of leisure activities.

TABLE 2 - Mean distribution of participants according to the IPAQ classification, waist circumference (WC) and BMI. Ribeirão Preto, São Paulo, Brazil, 2009.

	IPAQ									
	Total	Inactive		Insufficiently active		Active		Very active		p
	Mean (SD)	n	%	n	%	n	%	n	%	
WC (cm)										
Overall mean	104.8 (13.3)	16	106.8	25	107.6	67	104.0	24	102.8	p = 0.52
Men (n = 54)	107.5 (12.3)	8	101.9	15	110.0	24	108.6	7	104.6	p = 0.42
Women (n = 78)	103.0 (13.7)	8	111.7	10	104.2	43	101.4	17	102.1	p = 0.27
BMI (kg/m²)										
Mean (n = 132)	31.0 (6.1)	16	31.4	25	31.1	67	31.0	24	30.9	p = 0.99

TABLE 3 - Numeric and percentage distribution of weekly caloric expenditure (kcal) in leisure activities classified by IPAQ of participants by gender. Ribeirão Preto, São Paulo, Brazil, 2009.

Caloric expenditure (kcal) in weekly leisure activities	Gender					
	Men		Women		Total	
	n	%	n	%	n	%
0	32	42.7	43	57.3	75	100
1-499	4	33.3	8	66.7	12	100
500-999	12	66.7	6	33.3	18	100
≥ 1000	6	22.2	21	77.8	27	100
Total	54	40.9	78	59.1	132	100

Regarding caloric expenditure (kcal) in leisure activities, the highest percentage of participants who reached 1000 kcal/week or more were 50-69 years old (26%). Among those aged 70 or older, only 11.9% of participants expended 1000 kcal/week or more in leisure activities. Among those with caloric expenditure over 1000 kcal/week, 13 participants (9.7%) reached values higher than 2000 kcal/week.

Mean sitting time per weekday was 301 minutes (5 hours) per day, and on the weekend, 321 minutes (5.4 hours). Individuals with greater caloric expenditure during leisure activities were also those who spent less time sitting.

Participants with a caloric expenditure of 0 kcal during leisure activities presented a mean of 328.1 minutes sitting, those with expenditure between 1-499 kcal a mean of 279.6 minutes, those with 500-999 kcal, 337.1 minutes, and those with an expenditure ≥1000 kcal a mean of 252.3 minutes (p = 0.05). Furthermore, the older the participant, the greater time spent sitting. Individuals between 30 and 49 years old spent a mean of 199.6 minutes, those between 50 and 69 years old, 301.4 minutes, and those aged 70 or older, 352.5 minutes (p < 0.001).

Discussion

The data regarding gender are in accordance with the results of four studies that used the IPAQ, whose participants were mostly women. However, it is worth mentioning that two studies were conducted with the population in general, in two states in the southeast and south region of Brazil^{9, 12}, and the other two with individuals with high blood pressure and depressive disorder¹³⁻¹⁴.

In the present study, 11.9% of the patients with DM2 were inactive, 50% were active and 17.9% very active. This finding is not in accordance with that of another study conducted in the city of Fortaleza, Brazil, in which 40% of the sample was inactive, 20% active and 8% very active¹⁵.

On analyzing distribution by gender according to the IPAQ classification, most participants with DM2 were active or very active; specifically, 57.4% of the men and 60% of the women. Fewer women than men were classified as inactive, 10.3% and 14.8% respectively. Likewise, more women than men were classified as very active, 21.8% and 13% respectively. These findings contradict those of other studies, in which men represented the greatest percentage of subjects classified as very active^{9, 16}. A study that assessed the prevalence of physical activity in 20 countries indicated that women were more active than men in only three countries, Argentina, Portugal and Saudi Arabia¹⁶.

On analyzing the IPAQ classification by age, the greatest percentage of inactive and insufficiently active individuals were 70 years old or older (19%). This age group also presented the lowest percentage of participants classified as very active (11.9%). These findings corroborate those of other studies that showed that age was inversely correlated with level of physical activity¹³⁻¹⁶. The intermediate age group of 50 to 69 years obtained the highest percentage of active individuals. Participants between 30 and 49 years represented the greatest percentage of individuals classified as very active.

In this study, the men classified as inactive according to the IPAQ presented poor glycemic control. Of the participants with good glycemic control, regardless of BMI, 68.9% were classified as active or very active. Of the participants with poor glycemic control, 51.5% were obese. Furthermore, according to the IPAQ classification, 76.9% of the inactive participants presented poor glycemic control. Of those classified as very active, a high percentage also presented poor glycemic control. However, the

absence of individuals classified as very active with a BMI < 25 kg/m² hindered a comparison between very active obese and eutrophic individuals.

There was no statistically significant difference between physical activity level and BMI. However, there was a discrete reduction in BMI means with increased levels of physical activity ($p = 0.99$). The study conducted in Fortaleza showed a reduction in BMI with increased levels of physical activity¹⁵.

Among the participants classified as very active and with good glycemic control (21.4%), there were only pre-obese and level I obese individuals, a finding that reinforces the hypothesis that obesity can interfere with glycemic control due to reduced insulin sensitivity¹⁷. Furthermore, there was a significant and independent effect between physical activity and obesity when compared to insulin sensitivity. Eutrophic individuals with satisfactory or health enhancing levels of physical activity presented lower levels of insulin resistance in comparison to obese individuals with satisfactory levels of physical activity or inactive eutrophic individuals¹⁸.

Of the 57 DM2 patients that exercised during leisure time, 27 (20.1%) reached 1000 kcal/week or more. The findings also show that 13 (9.7%) of the 27 participants expended more than 2000 kcal/week. Another important piece of data was that none of the participants did vigorous exercise. There are indications that the benefits of reaching a caloric expenditure of 100 kcal/week in vigorous activities are similar to the benefits of 1000 kcal/week in low to moderate intensity activities¹⁹.

Of the subjects that did not exercise during leisure activities, 53.3% were obese. Obesity itself represents a risk factor for other comorbidities, including insulin resistance²⁰. Low levels of physical activity and high BMI levels have been associated with inflammatory and lipid biomarkers and consequently, with the development of atherosclerosis and cardiovascular disease²¹; while higher levels of physical activity have been associated with lower plasma lipid values²². The literature has shown that physical activity results in reduced weight and BMI, in addition to fewer deaths due to cardiovascular diseases²³⁻²⁵.

Sitting time was high, 5 hours per weekday and 5.4 hours on the weekend, and the greater the caloric expenditure in leisure activities, the less time spent sitting ($p = 0.05$). Moreover, the older the participant, the more time spent sitting ($p < 0.001$). A study conducted with African Americans showed

that participants spent a mean 4.5 hours sitting per day. This study showed that sitting time was related to inactive work activities, contributing to health problems such as increased BMI, greater percentage of body fat and raised diastolic blood pressure²⁶.

In sum, the results of the present study showed a high percentage of inactive DM2 patients, i.e., who did not carry out any physical activity in any of the IPAQ domains. The women were less sedentary than the men and were very active.

Of the investigated subjects, 20.1% reached the recommended levels of caloric expenditure to be health enhancing. The women presented higher caloric expenditure than the men. Most participants who did not exercise during their leisure time were obese. Domestic physical activity presented the highest caloric expenditure, calculated in METs, followed by work activities.

The results of this study can inform the systematization of more effective interventions to encourage physical activity to promote the health of

the population cared for at the primary health care level and improve the lives of DM patients. Studies of this nature favor the creation of public health policies in accordance with the guiding principles of the Brazilian Unified Health System.

One limitation of the present study was the difficulty of the participants to respond the questions related to intensity of physical activity. The IPAQ has been validated in several countries, including Brazil, to assess physical activity in multiple domains. However, the self-reported method may have led the subjects to overestimate their answers regarding level of physical activity.

Future studies should carefully examine the appropriateness of the location in which data collection occurs before applying the IPAQ, in addition to the participants' level of education. Despite its simplicity, the instrument requires attention in order to minimize any comprehension difficulties about the number of days, intensity, and duration of physical activity per day in each domain.

Resumo

Nível de atividade física e gasto calórico em atividades de lazer de pacientes com diabetes mellitus

O objetivo deste estudo foi analisar o nível de atividade física e o gasto calórico, em METs, em atividades de lazer de pacientes com diabetes mellitus, atendidos em uma Unidade Básica Distrital de Saúde de uma cidade do interior do estado de São Paulo. A amostra de conveniência foi constituída por 134 pacientes com diabetes mellitus tipo 2, atendidos no período de maio a agosto de 2009. Para coleta de dados foram utilizados um formulário contendo variáveis demográficas e clínicas e o Questionário Internacional de Atividade Física (IPAQ). Para cálculo do nível de atividade física foi utilizado o Guidelines for Data Processing and Analysis, do IPAQ. Para análise dos dados utilizou-se estatística descritiva e Qui-quadrado. A média de idade dos sujeitos foi de $63,5 \pm 10,27$ anos e o tempo de diagnóstico de $11,71 \pm 7,94$ anos. Em relação ao nível de atividade física, 11,9% eram sedentários; 50% e 17,9% foram classificados como ativos e muito ativos, respectivamente. Verificou-se que 56% não realizavam atividade física no período de lazer. A média de tempo despendido na posição sentada foi superior a cinco horas ao dia. A metade dos sujeitos não realizava atividade física no período de lazer e apenas 20,1% alcançaram os níveis de atividade física recomendados para obtenção de benefícios à saúde. Apenas 20,5% dos sujeitos investigados alcançaram os níveis recomendados de gasto calórico (kcal) para obtenção de benefícios à saúde. A atividade física doméstica apresentou maior gasto calórico, calculado em METs, seguido pelas atividades de trabalho.

PALAVRAS-CHAVE: Diabetes mellitus tipo 2; Exercício; Atividade motora; IPAQ; Lazer.

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