Characteristics of physical activity habits in type-2 diabetes patients in Spain

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Abstract
The aim of the study was to investigate physical activity habits in type-2 diabetes population in Spain. We surveyed a randomly stratified sample of 967 type-2 diabetes patients’ inhabitants of Spain. Physical activity levels were calculated using the IPAQ short version questionnaire. Results obtained were compared to Spanish and European general population data. Total physical activity for Spanish type-2 diabetes patients was 2267±135 MET·minuts·week. The lowest values of physical activity were found in those individuals who had the poorest glycaemic control (1765±202 MET·minuts·week in individuals with HbA1c >9% vs 2423±448 MET·minuts·week in individuals with HbA1c <7%, p< 0.05). Furthermore, sedentary individuals were more prevalent women (60%), older (66.5±1.2 vs 63.5±11 years, p= 0.003) and had higher BMI (30.3±5.6 vs 28.6±4.3 kg/m², p= 0.011) than active individuals. Physical activity levels were higher than those reported from Spanish general (1834±122 MET·minuts·week, p< 0.05) and European populations (2058±33 MET·minuts·week p< 0.05) also, highly percentage of diabetic population walk daily compared to other groups (90% vs 83% vs 83% , p< 0.001).

In conclusion, Spanish type-2 diabetes population show high levels of physical activity, greater than Spanish and European general population. This may be attributed to a higher frequency of walking as usual physical activity.

Keywords: exercise, IPAQ questionnaire, MET, walking.

Introduction
In the last few decades, both the decline of physical activity (PA) and the rise of caloric intake, have contributed to a rapid increase in the prevalence of overweight, obesity and type-2 diabetes (T2DM) in developed countries. Some epidemiological studies1-7 have demonstrated the importance of promoting the increase of PA levels to the general population as a strategy for the treatment and prevention of T2DM.

The general benefits of exercise are well documented and mostly result in improvement of quality of life8 and a delay of cardiovascular events and general mortality.9 In relation to diabetes, the benefits include optimization of glycaemic control and enhancement of the insulin sensitivity.10-12 These effects have been described in studies that use the practice of regular PA as a treatment for T2DM.13,14 The American Diabetes Association (ADA) indicates the importance of taking regular physical exercise in the treatment of T2DM, even in those patients who have chronic complications.10

Some recent studies15-18 have found that adults with T2DM have lower levels of PA than those without diabetes. It is suggested that diabetic individuals could be less active than non-diabetics due to the limitations caused by chronic complications of the disease. The presence of retinopathy, nephropathy, neuropathy or cardiovascular diseases could diminish the adherence to exercise programs, especially when patients are limited by amputations, loss of visual acuity, or muscle pain. Considering complications, it is recommended to limit or avoid participation in some types of activity, such as those involving moderate or high intensity exercises or certain sporting competitions.19 In other cases, T2DM keeps a close relationship with age and body weight, factors that also reduce the individual’s capacity to practice regular PA.
Until now, there is not enough information about the degree of PA that populations with T2DM develop in Spain. Although exercise recommendations are implemented in primary care centres, knowledge of the quantity and quality of the PA practiced by diabetic population would allow the development of exercise programs specifically adapted to these patients.

Thus, the main objective of the present study was to determine the PA habits, including quality and quantity, of the Spanish population with T2DM. As secondary objectives, we study the relation between PA levels and glycaemic control and we compared PA values with data from Spanish and European populations without diabetes.

**Subjects, material and methods**

The target population was Caucasian patients with T2DM, older than 18 years and residents in Spain. A total of 2,100 individuals were selected by means of a simple randomized stratified sampling design including 17 of the 19 Spanish provinces. Two provinces (Canary Islands and Ceuta & Melilla Autonomic City) were excluded because they are located in African places.

Data were obtained by means of a personal interview including a total of 191 primary care teams for a recruitment period of six months.

The self-administered last 7-days short version of the IPAQ (International Physical Activity Questionnaire) questionnaire was used to ask about the frequency and the time dedicated to different levels of PA (intense, moderate, or walking as a mild PA) in the last 7 days.

Additionally, primary care teams collected demographic and medical data from their clinical records, including age, sex, weight, height, years of diabetes evolution, treatments, control of glycaemia (evaluated by the Haemoglobin A1c value of each health centre) smoking habit and the presence of some disease that prevents to practice PA.

Total PA was calculated as the sum of the values obtained at each level of PA (intense, moderate and walking) and total results were expressed in MET per minutes per week (MET·min·wk⁻¹). The metabolic equivalents (METs) estimate the ratio of energy expended during a certain physical activity comparing to sitting quietly. For the different intensities of physical activity covered by the IPAQ, the following MET estimates were used: 8 METs for vigorous physical activity, 4 METs for moderate physical activity, and 3.3 METs for walking as a form of sedentary PA.

In a more in depth analyses, individuals were classified according to their total PA as sedentary (<600 MET·min·wk⁻¹), moderate (600-3000 MET·min·wk⁻¹), or intense (>3,000 MET·min·wk⁻¹).

Total results of the PA and behaviour patterns were compared to those published in Eurobarometer 58.2 report of the European Union (20), including Spanish population data.

Statistical analyses Calculations were performed with SPSS 11.0 software (SPSS, Chicago, IL). For normally distributed variables, parametric tests were used. Otherwise, nonparametric test (Kruskal-Wallis) or logarithmic transformations were used. For categorical variables, a \( \chi^2 \) test was used.

Values are presented as means ± SD. Results were considered to be statistically significant for \( p \) values <0.05.

**Results**

Table 1 shows clinical data from total population and according to their degree of physical activity, classified as sedentary, moderate or intense.

For all patients, the mean age was 64.8±11.0 years and the average of BMI was 29.4±4.8 kg/m². Moreover, a 44.1% of the individuals were classified as overweight and a 41.2% were considered obese.

The most frequent treatment was oral hypoglycaemiant agents, used alone (63.8%) or in association with insulin (6.9%). Insulin alone was used in 11.8% of patients.

With regard to the glycaemic control, 79% of patients had HbA₁c below 8%, 13.5% between 8.1 and 9.0% and 4.8% over 9.1%.

In the analyses according to the degree of PA, individuals included in the sedentary group showed a greater percentage of women (60.3%), were older than those in the moderate group (66.5±1.24 vs 64.4±10.3 years, \( p=0.012 \)) and the intense group (66.5±12.4 vs 63.5±11 years, \( p=0.003 \)). Also, the BMI of individuals belonging
to the sedentary group was higher than the moderate (30.3±5.6 vs 29.2±4.3 kg/m², p= 0.012) or intense groups (29.2±4.3 vs. 28.6±4.3 kg/m², p= 0.011).

Furthermore, from the total population surveyed a 17.7% of the subjects indicated that they suffered from some disease that prevented PA. The greatest percentage (49.1%) corresponded to muscular-skeletal pathologies (especially arthritis), a 16.7% to cardiovascular diseases and less than 3% correspond to complications that individuals related to diabetes. Others diseases that avoid physical exercise were neurological and respiratory diseases, especially asthma.

The mean total PA assessed by mathematical score in IPAQ questionnaire was 2267±135 MET-min-wk⁻¹. Figure 1 shows the values of PA expressed in MET-min-wk⁻¹, in relation to different HbA₁c intervals. The lowest values of PA were found in those individuals who had the poorest glycaemic control especially for individuals who had HbA₁c levels up to 9% in comparison to those with HbA₁c levels under 7% (p< 0.05).

Table 2 shows the percentages of individuals that practice PA regularly and their weekly frequency and duration of sessions into each level of PA. More than a 90% of individuals walk about 1 hour a day an average of 5.8 days a week.

### Table 1. Clinical data of total population and according to the physical activity levels, established as sedentary (<600 MET-min-wk⁻¹), moderate (600-3,000 MET-min-wk⁻¹) or intense (>3,000 MET-min-wk⁻¹).

<table>
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<th>Sedentary &lt;600 MET·min·wk⁻¹</th>
<th>Moderate 600-3,000 MET·min·wk⁻¹</th>
<th>Intense &gt;3,000 MET·min·wk⁻¹</th>
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<tr>
<td></td>
<td>n</td>
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<td>% Cases</td>
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<tr>
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OHA: oral hypoglycaemiant agents; *patients treated with both insulin and oral hypoglycaemiant agents.
The comparison of our data to the results published in Eurobarometer 20 shows that total PA values in the diabetic population (mean 2267 ± 135 MET·min·wk⁻¹) were greater than those of the general Spanish (mean 1834 ± 122 MET·min·wk⁻¹) and the European Union (mean 2058 ± 33 MET·min·wk⁻¹) populations.

In the analyses of physical activity habits we found that Spanish type-2 diabetic population walks most frequently than no diabetic populations. Thus, the percentage of individuals that walking four or more days a week is greater in Spanish type-2 diabetic population (75.3%) than in the general population of Spain (69.4%) or the European Union (59%) and moreover, the percentage of individuals that never walk was less in the Spanish type-2 diabetic population (figure 2).

In addition, figure 3 shows the percentage of individuals that perform moderate physical activities compared to the Spanish and European population data. We observe that the percentage of individuals who usually practice moderate physical activity is lower in the Spanish type-2 diabetic population than in the general population of Spain or the European Union and, moreover, the percentage of individuals that no practice moderate physical activities is higher in the DM2 population group.

Furthermore, we observe that the percentage of individuals who practice intense physical activities were lower in Spanish type-2 diabetic population.

**Discussion**

Physical exercise is recommended as one of the most important treatments for type-2 diabetes. In this sense, most scientific societies recommend more than 30 minutes a day of low or moderate intensity PA. As it has...
been documented, the energy expenditure produced by exercise provides an increase of glucose consumption in muscle and an improvement of insulin sensitivity in peripheral tissues.\textsuperscript{13,14}

There is plenty information about the benefits of exercise programs applies to general population and chronic diseases, in particular diabetes. In 2001, Boulé et al.\textsuperscript{13} published a meta-analysis showing beneficial effects of exercise training on glucose control in type-2 diabetic patients, evaluated by a decrease of HbA\textsubscript{1c} levels of 0.66\% at the end of the period of training. Recently, Snowling et al.\textsuperscript{14} have published a meta-analysis including data from 27 trials in which authors found that all forms of exercise, aerobic, resistance or combined exercise produce a small to moderate beneficial effects on glucose control in type 2 diabetic patients and additional benefits effects on some related risk factors for complications of diabetes. Moreover, these effects were similar to those of dietary, drug or insulin treatments.

All these works related beneficial effects for physical exercise in type-2 diabetes patients but are controlled clinical trials that included limited number of individuals. Furthermore, we do not have data evaluating the degree to which exercise recommendations are followed by patients with type-2 diabetes. The present work evaluates the quantity and quality of the PA practiced by patients with type-2 diabetes.

While previous studies\textsuperscript{9,15,16,18} indicated that diabetics do less physical activity than the general population, in the present study, total PA accomplished by Spanish diabetic population was greater than those reported in the general population of Spanish and in the European Union.\textsuperscript{20} Also, the percentage of individuals performing some type of PA on a regular basis was greater in diabetic population.

Since intense and moderate activities involve much higher energy consumption than walking (considered as 8 and 4 MET for intense and moderate respectively and 3.3 MET for walking) it is likely that diabetic population was able to compensate this default of high intensity activities by walking more often, and thus reaching higher values of total PA. In this sense, the questionnaire used in this study might have contributed to this great PA results obtained in the Spanish DM2 individuals group. This tool ask only about three PA intensity levels and applied a small difference between walk (as light PA) and moderate PA (3.3 vs 4.0 MET).

Furthermore, this noticeable tendency to perform low intensity activities could be related to some of the clinical characteristics of the diabetic population. There are a higher proportion of overweight and obese patients than in the general population. It is remarkable the percentage of obese individuals in our series, which is a 41.2\% in comparison to a 14.5\%, described by other epidemiological studies in the Spanish general population.\textsuperscript{24} Moreover, this percentage of obesity is higher than other previous studies reported in diabetic populations from the same geographic zone (Benito et al.\textsuperscript{25} reported in 2004 a 34\% of obesity and previously Sender et al.\textsuperscript{26} found a 26\% in 2002) but it is seemed to that of a more recent study of Arroyo et al.\textsuperscript{27} who found an eighty percent of overweight subjects in their population.

According to the data from Neira et al.\textsuperscript{24} obesity in Spain is rising since 1987 and it could be the reason of the high prevalence of obesity in our work, greater than in other previous studies with diabetic population. We can emphasize that excess weight clearly limits physical exercise practice, especially for mod-
erate or intense activities which require a greater muscular effort and involve high oxygen consumption. In any case, we did not found a bias for the questionnaire, which has been validated previously for obese individuals. 28

Second, age is another limiting factor that would contribute to the greater tendency to perform low-intensity activities. There is a loss of strength, speed and flexibility with advancing age, which are basic conditions for training at high intensity. We found a high proportion of aged subjects in our series which can contribute to the high proportion of low-intensity exercise. The mean age of individuals in our population was older than described in Eurobarometer 58.2 report. This may be another explanation for the high prevalence of low-activities as walking in our diabetic population.

Third, contrary to that might be expected, we did not found that chronic-related complications of diabetes could represent a limitation to maintain moderate levels of PA. The percentage of patients with physical limitations that prevent them for practicing exercise was low. These limitations would only avoid intense or moderate activities and not low intensity activities such as walking.

Finally, the lowest HbA1c values corresponded to those individuals who had the highest levels of total PA. This result could be attributable, in part, to the recognized hypoglycaemic effect of exercise in the glycaemic control of individuals with type-2 diabetes. This effect has been demonstrated by different clinical studies13 in a small number of patients using exercise programs including aerobic or resistance exercise three to five times a week during a period of six-to-twelve months.

Our results agree these previous clinical and epidemiological studies about this beneficial relation between physical exercise and glycaemic control in type-2 diabetics. Moreover, these results can be used to design and encourage new community programs to promote physical exercise in type-2 diabetes patients.

Although the present study has not been designed as a trial using exercise programs as a strategy of intervention, we consider that these high levels of PA found in type-2 Spanish diabetes population can be attributable to the great effort made by primary care teams in the diabetes education’s patients. In this education process, walking is the form of exercise most habitually prescribed because of safety and adaptability for all kinds of patients. On the other hand, many campaigns are aimed to promoting the practice of walking as a form of regular PA, not only for the treatment of diabetes, but as a tool for maintaining general health and the prevention of disease, especially cardiovascular disease.

In conclusion, Spanish type-2 diabetic population presents a higher level of overall PA than the Spanish general population. This may be attributed to the implementation of low-intensity activities, as walking, in primary care settings.

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Declaration of potential conflict of interest
S. Murillo, J.E. Campillo, A. Pérez, A. Gutiérrez, A. Caballero and A. Novials declare they have no conflict of interest related to the content of this article.

References


