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Letter to the Editor

Pedometer use is beneficial for type 2 diabetes mellitus patients if included in educational programs

To the Editor:

In a 2008 article in *Metabolism*, Bjorgaas MR and colleagues [1] studied the effect of pedometers on the spontaneous physical activity increase and its consequent positive metabolic effects in type 2 diabetes mellitus patients.

In this study, 70 subjects were randomized into 2 groups and followed for 6 months: only the intervention group used the device. The number of steps was registered for 3 consecutive days twice a week; Vo_2 peak, self-reported fitness, and activity were also calculated.

The dropout was high (22 subjects, 31.4%); the number of steps did not change during the follow-up, and the Vo_2 peak improved in the control group.

No significant difference in weight, hemoglobin A_{1c} (HbA_{1c}), fasting blood glucose, triglycerides, diastolic blood pressure, and high-density lipoprotein cholesterol (HDL-C) was observed in those subjects who completed the study ($P > .38$).

The authors concluded that providing a pedometer did not improve walking behavior and metabolic and fitness outcomes, and that subjects who needed more exercise were just less compliant.

Unstructured daily physical activity induces a significant energy expenditure increase (nonexercise activity thermogenesis) and contributes to weight control [2], whereas light-moderate physical activity is an effective strategy in the management of type 2 diabetes mellitus and cardiovascular risk factors, probably more than a hard activity [1,3].

It is very difficult to prescribe and monitor interventions to promote an "active" lifestyle in clinical practice.

Physical activity monitoring is often based on self-report: large population studies [4] were carried out with diaries that reported time spent in each activity. These diaries are limited by their own subjectivity. Intervention studies require objective measurements to better understand psychologic mechanisms and behavioral patterns related to spontaneous activity to give realistic advice (nowadays, it is recommended that a person spend 30 minutes a day doing moderate physical activity to maintain body weight and 60 minutes to lose it) [5-7].

Pedometers and accelerometers are useful to obtain objective data in field studies without overestimation errors due to recall (especially in obese subjects [8]).

In the Australian Diabetes, Obesity, and Lifestyle Study in 2008 [9], physical activity duration and intensity in nondiabetic subjects were studied by an accelerometer; a correlation was found between time spent in sedentary activities and metabolic risk factors. In the study, a uniaxial accelerometer worn for 7 days was used; the percentage of time spent in 3 different activity levels was evaluated: sedentary, light, and moderate-vigorous. Furthermore, the average activity during the observation period (total counts) was considered. A positive correlation between sedentary habits and cardiovascular risk factors (waist circumference, triglycerides) and a negative correlation between vigorous activity and the same factors were found. The public health implications are that replacement of sedentary activity with a light one has beneficial consequences in terms of prevention.

In the last years, it was demonstrated that the use of these simple devices is useful to increase the therapeutic education efficacy. We have evaluated the efficacy of the pedometers in an intensive educational program to encourage physical activity in 40 type 2 diabetes mellitus patients with metabolic syndrome (MS) to control diabetes and the other MS cardiovascular risk factors. Twenty type 2 diabetes mellitus patients (duration of disease, 28 years; age, 45-70 years), treated with diet and metformin, without hypertension and cardiovascular disease started an individual monthly controlled counseling program managed by a diabetology team focused on education and motivation to diet and physical activity. This group received a pedometer (Oregon Scientific, Milano, Italy) that counted the total steps; another group of 20 patients with similar characteristics was treated with traditional dietary advice and checked every 3 months. One hundred percent of the patients satisfied the MS diagnostic criteria according to the Adult Treatment Panel III and the International Diabetes Federation. At the first visit (T0) and after 6 months (T1), weight, height, body mass index (BMI), fasting blood glucose, hemoglobin A_{1c} (HbA_{1c}), triglycerides, and total, high-density lipoprotein, and low-density lipoprotein cholesterol were collected. Statistical analysis was made through *t* test for paired and independent data.

At T1, all parameters improved, much more in the intensive therapy group than in the control one (Tables 1 and 2). In particular, waist circumference and HbA_{1c} were reduced significantly vs the control group (93.6 ± 12.3 vs 102.2 ± 10.2 cm, $P < .04$; 7.5% ± 1.2% vs 8.8% ± 1.31%, $P = .0019$, respectively), whereas BMI and blood glucose showed

Table 1
General characteristics of the control group

	T0	T1	*P*
Weight (kg)	85.9 ± 12.8	84.0 ± 14.4	NS
BMI	29.7 ± 3.2	29.6 ± 3.7	NS
Waist circumference	105.4 ± 9.7	102.2 ± 10.2	.020
Glucose	139.9 ± 28.1	130.2 ± 19.8	NS
Triglyceride	165.1 ± 89.0	186.2 ± 95.3	NS
Cholesterol	199.34 ± 41.4	194.3 ± 36.4	NS
HDL-C	39.9 ± 6.8	42.3 ± 7.5	NS
HbA_{1c}	8.3 ± 2.7	7.9 ± 1.1	.010

NS indicates not significant.

a reduction trend (27.1 ± 4.7 vs 29.6 ± 3.7 and 129.90 ± 20.8 vs 130.2 ± 19.8, respectively).

In the intensive therapy group, total steps increased from 3449 to 8207; at the end of the study, 17% no longer met the MS criteria (both Adult Treatment Panel III and International Diabetes Federation).

We concluded that pedometers can be usefully included in an educational intensive program with advantages on anthropometric and laboratory cardiovascular risk factors. Even if the promotion of physical exercise structured programs is an unchallengeable message for the public health, the reduction of sedentary activities and the increase of daily moderate activity are efficient strategies to counteract obesity and cardiovascular risk. A regular unstructured physical activity is more effective than structured physical activity programs to lose weight and maintain the long-term results [10].

Diaries are subjective: pedometers supply objective data on physical activity prescription and compliance monitoring, without recall overestimation [11]. In the systematic review of Bravata et al [12], some pedometer limitations such as short time of use, few data for long-time use, and dishomogeneous participants are pointed; furthermore, in intervention studies, other methods and tools, such as diaries, counseling, and defined targets, are used together with pedometers. There are no studies that consider only pedometers, blinded without the possibility to see the number of the steps on the display, although the study of Bjorgaas et al [1] gave an important contribution in this debate. In the last years, before they were introduced in the market, most of the studies were made with devices without functions of memory and intensity analyzers integrated. The main pedometer value is the ability to reinforce, with a feedback, the awareness of movement, motivation, and self-control; and in the end, they can increase the total physical activity volume.

Table 2
General characteristics of the intensive therapy group

	T0	T1	*P*
Weight (kg)	86.4 ± 16.7	79.6 ± 16.5	NS
BMI	29.5 ± 4.4	27.1 ± 4.7	.050
Waist circumference	104.5 ± 10.8	93.6 ± 12.3	.010
Glucose	142.5 ± 32.1	129.0 ± 20.8	.050
Triglyceride	176.1 ± 102.0	173.9 ± 103.4	NS
Cholesterol	209.43 ± 45.2	199.1 ± 43.9	NS
HDL-C	42.4 ± 10.2	46.2 ± 14.2	NS
HbA_{1c}	8.4 ± 1.2	7.5 ± 1.2	.010
Steps	5576.7 ± 2549.1	8207.6 ± 2549.1	.002
Km	2.2 ± 1.0	3.2 ± 0.8	.002
Kcal	195.7 ± 90.0	286.1 ± 115.4	.015

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