

# Remedial Actions for the Physical Inactivity of Hospitalized Patients With Type 2 Diabetes

SANDRINE PEZZINO, PD  
STÉPHANE FLORENTY, MD  
CÉDRIC FAGOUR, MD

HENRI GIN, MD, PHD  
VINCENT RIGALLEAU, MD, PHD

**OBJECTIVE**— Physical inactivity is often suspected in hospitalized patients with type 2 diabetes but has yet to be quantified.

**RESEARCH DESIGN AND METHODS**— We measured the level of physical activity of 36 hospitalized (H) and 36 free-living nonhospitalized (NH) type 2 diabetic subjects with actimeters (SenseWear Arm-Band).

**RESULTS**— The number of steps (H:  $4,381 \pm 3,742$  steps/24 h, NH:  $7,220 \pm 4,763$  steps/24 h;  $P < 0.01$ ), duration of physical activity (H:  $45 \pm 57$  min/24 h, NH:  $148 \pm 116$  min/24 h;  $P < 0.005$ ), and physical activity expenditure (H:  $287 \pm 390$  kcal/24 h, NH:  $1,035 \pm 1,006$  kcal/24 h;  $P < 0.005$ ) were two- to threefold lower in the hospitalized patients. Simple advice enabled us to increase their recorded levels of physical activity by  $\sim 50\%$  ( $P < 0.005$ ), and a further  $50\%$  ( $P < 0.05$ ) was obtained by the use of a pedometer.

**CONCLUSIONS**— The physical inactivity of hospitalized patients with type 2 diabetes is significant and remediable, although the advice given must take into account the existence of sensory neuropathy and silent myocardial ischemia.

*Diabetes Care* 33:1960–1961, 2010

The potential benefits of physical activity for patients with type 2 diabetes are widely recognized (1), but their application to daily clinical practice remains to be determined (2). Physical inactivity is often suspected in hospitalized type 2 diabetic patients, but to our knowledge, this has not been quantified: traditional physical activity questionnaires are not an ideal tool for such an evaluation. Using actimeters (3), we compared the physical activity of 36 hospitalized (H) versus 36 ambulatory, free-living, nonhospitalized (NH) patients with type 2 diabetes. The physical activity of the hospitalized patients was further recorded during a two-stage remedial procedure: physical activity counseling followed by the use of a pedometer.

## RESEARCH DESIGN AND METHODS

The hospital admissions were indicated for poor glucose control (A1C for H:  $8.8 \pm 1.8\%$ ; NH:  $7.0 \pm 1.0\%$ ;  $P < 0.001$ ) and paraclinical investigations; patients with acute diseases requiring rest were excluded. Sex (H: 24/36 men, NH: 22/36 men), age (H:  $55 \pm 10$  years, NH:  $60 \pm 10$  years), and BMI (H:  $34 \pm 6$  kg/m<sup>2</sup>; NH:  $31 \pm 5$  kg/m<sup>2</sup>) did not differ between the two groups.

The physical activity levels were recorded with actimeters (SenseWear Arm-Band, Body Media, Stanford, CA), which have been validated versus doubly labeled water for the assessment of total energy expenditure in patients with type 2 diabetes (4). Both groups carried the actimeters for 1 week. The ambulatory patients were

not advised about physical activity but were informed that it was recorded.

The hospitalized group underwent a two-stage remedial procedure with physical activity measurement before (T1) and after advice on physical activity (T2) according to French recommendations (5) and finally wore a pedometer (T3). Each period lasted at least 24 h. The French recommendations for physical activity for patients with type 2 diabetes include a medical examination to detect contraindications, awareness of the favorable role of exercise in the management of diabetes, and tailored counseling suggestions to change lifestyle, owing to daily exercise sessions ( $>30$  min) (5). In practice, the advice was simple (“take a walk instead of staying seated”), but it was customized as a function of the antidiabetic treatment (risk of hypoglycemia) and complications (peripheral neuropathy). The results are expressed as means  $\pm$  SD and compared by ANOVA and *t* tests.

**RESULTS**— The actimeters were carried during  $97 \pm 2\%$  of the study. As shown in Table 1, the levels of physical activity were particularly low for the hospitalized patients two- to threefold lower than for the ambulatory group. The counseling led to a 50% increase, followed by a further 50% with the use of the pedometer; both were significant increases. Although they did not reach the ambulatory results (except for the number of steps), the levels of physical activity were doubled after the intervention.

**CONCLUSIONS**— Our study shows and quantifies the marked sedentariness of hospitalized patients with type 2 diabetes, as suspected by clinicians. This phenomenon probably concerns other patients, with other type of diabetes or without diabetes, but its practical implications are of specific importance in the case of type 2 diabetes, since physical activity can be considered a part of the treatment. The deleterious effect of physical inactivity on glucose control are probably hidden by the controlled diet during hospitalization.

From the Nutrition-Diabétologie, Hôpital Haut-Lévêque, Avenue de Magellan, Pessac, France.

Corresponding author: Vincent Rigalleau, vincent.rigalleau@chu-bordeaux.fr.

Received 6 May 2010 and accepted 6 June 2010. Published ahead of print at <http://care.diabetesjournals.org> on 14 June 2010. DOI: 10.2337/dc10-0806.

© 2010 by the American Diabetes Association. Readers may use this article as long as the work is properly cited, the use is educational and not for profit, and the work is not altered. See <http://creativecommons.org/licenses/by-nc-nd/3.0/> for details.

The costs of publication of this article were defrayed in part by the payment of page charges. This article must therefore be hereby marked “advertisement” in accordance with 18 U.S.C. Section 1734 solely to indicate this fact.

Table 1—Levels of physical activity in 72 patients with type 2 diabetes: 36 hospitalized versus 36 nonhospitalized

	Hospitalized type 2 diabetic patients (n = 36)			Nonhospitalized patients (n = 36)
	Before counseling	After counseling	With pedometer	
Physical activity energy expenditure (kcal/24 h)	287 ± 390‡	449 ± 400‡#	626 ± 422*#	1,035 ± 1,006
Total energy expenditure (kcal/24 h)	2,136 ± 706‡	2,452 ± 530‡#	2,584 ± 589*§	2,968 ± 932
Duration of physical activity (min/24 h)	45 ± 57‡	65 ± 59‡#	95 ± 62*#	148 ± 116
Number of steps/24 h	4,381 ± 3,742‡	6,567 ± 3,943# (NS)	8,682 ± 5,136# (NS)	7,220 ± 4,763

\* $P < 0.05$ , † $P < 0.01$ , ‡ $P < 0.005$  between the two groups. § $P < 0.05$ , # $P < 0.005$  vs. preceding measurement in the hospitalized group.

The ability to remedy this inactivity by a simple intervention is encouraging. However, physical activity counseling must take into account the clinical picture as mentioned by others (5). This is especially true for hospitalized patients, who usually have a long history of diabetes with long-term complications: we checked the sensitivity of the feet and the absence of proliferative retinopathy and envisaged the existence of silent ischemic heart disease before advising our patients to walk. No significant adverse event occurred during our study, but one of our patients had to stop walking for a short time because of a cutaneous lesion of the foot. Further work will be required to find out whether the doubling in level of physical activity we obtained could be safely maintained in the long term. For outpatients with type 2 diabetes, durable (1- to 2-year) increases in physical activity have been reported after counseling, based on questionnaires (6) or accelerometer records (7), with approximately  $-0.5\%$  A1C reductions, and benefits on blood pressure and serum lipids.

The increased number of steps while wearing the pedometer (+2,115 steps/day at T3,  $P < 0.001$  vs. T2) is in line with the improvement observed when a pedometer is used for a longer period: +2,491 steps/day after 18 weeks (8). A walking-based simple and low-cost intervention can lead to significant improvements (A1C, BMI) at 1 year (9), although more sophisticated interventions may be

preferred for some patients. The fact that simple well-accepted actimeters, as we used, can readily detect the effect of an intervention is also encouraging for future studies.

**Acknowledgments**—This work was supported by a grant from Association de Langue Française pour l'Etude du Diabète et des Affections Métaboliques (ALFEDIAM)-Glaxo-SmithKline and a Projet Hospitalier de Recherche Clinique.

No other potential conflicts of interest relevant to this article were reported.

S.P. collected data and wrote the manuscript. S.F., C.F., and H.G. collected data and participated in the study design. V.R. conceived the study and participated in its design and coordination and wrote the manuscript. All authors read and approved the final manuscript.

The authors would like to thank Dr. Simon Jarman, retired member of the University Victor Segalen-Bordeaux 2, for revision of the English manuscript.

## References

1. 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;29:1433–1438
2. Praet SF, van Loon LJ. Exercise: the brittle cornerstone of type 2 diabetes treatment. *Diabetologia* 2008;51:398–401
3. St-Onge M, Mignault D, Allison DB, Rabasa-Lhoret R. Evaluation of a portable device to measure daily energy expenditure in free-living adults. *Am J Clin Nutr* 2007;85:742–749
4. Mignault D, St-Onge M, Karelis AD, Allison DB, Rabasa-Lhoret R. Evaluation of the Portable HealthWear Armband: a device to measure total daily energy expenditure in free-living type 2 diabetic individuals. *Diabetes Care* 2005;28:225–227
5. Gautier JF, Berne C, Grimm JJ, Lobel B, Coliche V, Mollet E. [Physical activity and diabetes]. *Diabète Metab* 1998;24:281–290
6. Di Loreto C, Fanelli C, Lucidi P, Murdolo G, De Cicco A, Parlanti N, Ranchelli A, Fatone C, Taglioni C, Santeusano F, De Feo P. Make your diabetic patients walk: long-term impact of different amount of physical activity on type 2 diabetics. *Diabetes Care* 2005;28:1295–1302
7. Kirk A, Mutrie N, MacIntyre P, Fisher M. Effects of a 12-months physical activity counselling intervention on glycemic control and on the status of cardiovascular risk factors in people with type 2 diabetes. *Diabetologia*; 2004;47:821–832
8. Bravata DM, Smith-Spangler C, Sundaram V, Gienger AL, Lin N, Lewis R, Stave CD, Olkin I, Sirard JR. Using pedometer to increase physical activity and improve health: a systematic review. *JAMA* 2007; 298:2296–2304
9. Praet SF, van Rooij ES, Wijtvlief A, Boonman-de Winter LJ, Enneking T, Kuipers H, Stehouwer CD, van Loon LJ. Brisk walking compared with an individualised medical fitness programme for patients with type 2 diabetes: a randomised controlled trial. *Diabetologia* 2008;51:736–746