Walking Faster

Distilling a complex prescription for type 2 diabetes management through pedometry

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With the growth of pedometry, physical activity recommendations have been distilled to a simple focus on ambulatory volume (i.e., 10,000 steps/day). Although energy balance may be most affected by volume, the concomitant lack of focus on physical activity intensity may undermine realization of intensity-dependent outcomes for those with type 2 diabetes, particularly cardiorespiratory fitness because of its inverse association with HbA_{1c} (A1C) (1) and its predictive power for cardiovascular mortality and morbidity in this population (2–4).

Historically, a multicomponent framework, commonly known as FITT (frequency, intensity, time, and type) was used to prescribe how often (frequency per week), at what intensity (typically as indicated by heart rate), for how long (duration or time), and what type of activity (typically aerobic) one should pursue for health or performance outcomes. At a population level, there has been a secular trend in the emphasis on the interrelated factors of FITT. For example, in 1975, physical activity recommendations promoted aerobic exercise (type) at 3–5 days/week (frequency) at 70–90% of heart rate reserve (intensity) for 20–45 min (time). By 2000, recommendations had evolved to promote aerobic activity 7 days/week at an intensity of 40–85% of heart rate reserve for ≥20 min (5). The variables that compose this framework for prescription are contained within the clinical practice guidelines from both the American Diabetes Association and the Canadian Diabetes Association (5,6). Regardless of the details of the framework underlying these recommendations, however, the challenge remains how to *1*) feasibly translate all FITT factors outside of the exercise physiology laboratory and *2*) motivate lifelong physical activity in the type 2 diabetic population. Pedometers may help meet both these challenges.

We recently reported that individuals with type 2 diabetes naturally walk at a speed (intensity) that is slower than that associated with the minimal intensity (i.e., moderate) required to derive health benefit, despite increasing their number of steps taken per day (8). Hence, we evaluated a simple educational framework designed to help individuals with type 2 diabetes called Pick up the Pace (PUP; i.e., increasing the intensity by increasing the speed of walking), which recommends 30 min/day on at least 3 days/week within the context of a pedometer-based program. We hypothesized that increased walking speed would result in an improved metabolic risk profile among people with established type 2 diabetes, specifically targeting glycemia and cardiorespiratory fitness.

RESEARCH DESIGN AND METHODS — A convenience sample of 11 individuals with type 2 diabetes were recruited. A total of eight (five male and three female subjects) completed the 12-week program. Reasons for withdrawal included illness ($n = 2$) and work commitments ($n = 1$). All participants had recently (within 6 months) completed a 16-week pedometer-based lifestyle program for individuals with type 2 diabetes called the First Step Program, which was designed to increase steps per day (9,10). Eligible participants were diagnosed with type 2 diabetes, were aged 40–70 years, were not taking insulin, were without physical limitations, were not currently enrolled in another physical activity program, and were accumulating ~8,000 pedometer-determined steps per day. The self-reported 3-day average pedometer determined that steps per day following the First Step Program were 10,936 ± 4,836.

Participants determined their normal pace by counting steps taken during a 10-min walk with a pedometer and used this to establish a training cadence that was 10% above their usual stepping rate, 30 min/day for 3 days/week. For example, if a participant's preferred pace was 90 steps/min, they increased their pace to 100 steps/min. Participants practiced their PUP pace in 4 weekly meetings initially but were unsupervised on their other prescribed PUP walks. During weeks 5–8, participants attended two supervised PUP walking sessions, while in weeks 9–12, they were required to attend only one supervised session. Participants wore heart rate monitors (Polar Electro, Oy, Finland) and carried stopwatches to monitor time during PUP walking. They also wore accelerometers (AMP 331; Dynastream, Calgary, AB, Canada) to detect and record free-living ambulatory characteristics for 7 consecutive days during waking hours on weeks 1, 4, and 12 of the study. Cardiorespiratory fitness was measured using a modified Bruce-graded treadmill protocol before and after the 12-week PUP program (11).

RESULTS — Participant characteristics were as follows: 5 male and 3 female subjects, (mean ± SD) aged 54.4 ± 7.5 years, BMI 31.5 ± 4.0 kg/m^2, resting

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Abbreviations: FITT, frequency, intensity, time, and type; PUP, Pick up the Pace.
A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.
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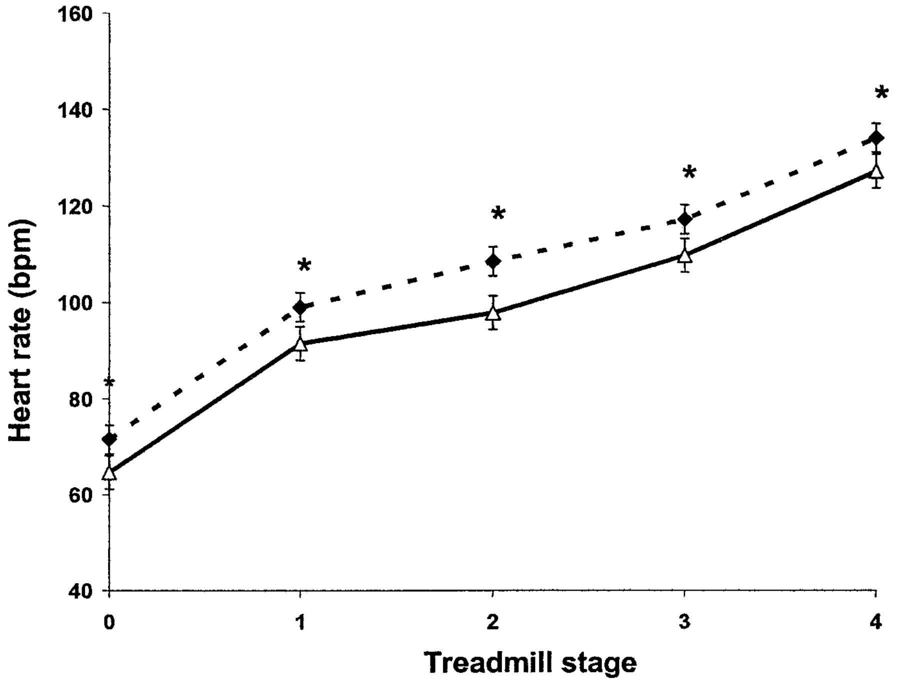

Figure 1—*Heart rate response to a graded treadmill protocol following participation in a pedometer-based walking program.* ◆, *baseline;* △, *after 12 weeks.* *Significant difference $P < 0.05$.

heart rate 71.5 ± 8.7 bpm, and A1C 6.9 ± 1.2%. Average speeds (in km/h) for PUP walking, for non-PUP walking on PUP days, and for walking on non-PUP days for week 1 were 5.2 ± 0.7, 3.2 ± 0.5, and 3.1 ± 0.4, respectively. At week 4, speeds were 5.4 ± 0.7, 3.2 ± 0.5, and 3.1 ± 0.3, respectively. At week 12, speeds were 5.7 ± 0.8, 3.0 ± 0.5, and 3.3 ± 0.4, respectively. Average heart rates during PUP walking were 125 ± 8, 130 ± 12, and 127 ± 8 bpm, respectively, which equated to 74.0 ± 2.0, 77.2 ± 2.0, and 76.7 ± 2.8% of age-predicted heart rate maximum during weeks 1, 4, and 12 of the study, respectively. Participants consistently rated their perceived exertion during PUP walking as hard (12). Heart rate response to exercise improved significantly over the course of the PUP program, as shown in Fig. 1. A1C did decrease after the intervention (−0.35 ± 0.55%); however, this did not reach statistical significance.

CONCLUSIONS— The main finding of this study is that a pedometer and a stopwatch can serve to facilitate increased walking intensity for people with type 2 diabetes when introduced within an educational framework designed for increasing physical activity. To our knowledge, this is the only study designed to address walking speed through the use of a pedometer and a stopwatch in a type 2 diabetic population.

The PUP program prescribed increased walking speeds, and therefore intensity of walking during 30-min bouts, to a level that elicited significant improvements in cardiorespiratory fitness over 12 weeks in a group already walking >10,000 steps/day. Overall, participants incorporated all FITT factors, most notably intensity, into their ambulatory activity, thereby meeting clinical practice guidelines suggested by the American Diabetes Association and Canadian Diabetes Association (6,7). The program used simple tools (pedometer and stopwatch) and a simple message to pick up the pace. It provided opportunity for skill building and continued support through limited semistructured meetings with minimal resource input. Our findings highlight the importance of each component of the FITT framework and provide proof of principle that a simple educational strategy can be used to help to translate the complex, foundational principles of exercise physiology prescription into a walking routine that can be promoted by healthcare providers and implemented by people with type 2 diabetes with relative ease.

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