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RESEARCH

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Using a Personal Digital Assistant for Self-Monitoring Influences Diet Quality in Comparison to a Standard Paper Record among Overweight/Obese Adults

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ABSTRACT

Self-monitoring has traditionally been done using a paper record, which can be tedious and burdensome. A personal digital assistant (PDA) with dietary software can provide an alternative to a paper record. The study aimed to describe the differences in dietary changes at 6 months between participants randomly assigned to use a paper record or PDA for self-monitoring in a clinical trial of weight-loss treatment. Self-monitoring adherence and changes in weight and diet were assessed between 2006 and 2009. The sample (n=192) was 84% female and 78% white, with a mean age of 49 years and body mass index (calculated as kg/m^2) of 34.1. At baseline, the groups did not differ in energy intake, percent calories from fat, and number of servings of the examined food groups. At 6 months, both groups had significant reductions in weight, energy intake, and percent calories from total fat and saturated fatty acids ($P<0.001$); no between-group differences were found. Compared to the paper record group, the PDA group significantly increased consumption of fruit ($P=0.02$) and vegetables ($P=0.04$) and decreased consumption of refined grains ($P=0.02$). Interactions among self-monitoring and the two groups were found in relation to changes in percent calories from total fat ($P=0.02$), monounsaturated fatty acids ($P=0.002$), and *trans*-fatty acids ($P=0.04$). Frequent self-monitoring was significantly associated with total sugar ($P=0.02$) and added sugar ($P=0.01$) intake in both groups. Our findings suggest that use of a PDA for self-monitoring might improve self-awareness of behavior and dietary changes.

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Self-monitoring one's daily dietary intake has been recognized as an important component for successful outcomes in behavioral weight-loss treatment (1,2). It allows individuals to become aware of their eating behaviors, the amount of food consumed, and situations that create obstacles to positive behavior changes. It also promotes corrective actions to help ensure that they meet their dietary goals (3). The most often used method of self-monitoring continues to be the paper record. However, use of a paper record and its associated work of looking up nutrient content of foods and calculating totals can become tedious and time-consuming for the user (2).

Recent advancements in technology have provided a few alternative approaches to using a paper record, eg, use of an online diary or a personal digital assistant (PDA). A pilot study suggested that a PDA with a dietary software program was a potential tool for facilitating self-monitoring food intake, possibly enhancing dietary goal attainment (4). Other researchers have used PDAs for collecting 24-hour energy intake (5) and keeping food records (6).

Several studies have reported that more frequent and consistent self-monitoring was substantially associated with greater weight loss and maintenance (1,7-9) and with successful achievement of dietary goals (10-12). However, little is known about the associations between dietary modifications and different approaches to self-monitoring. A case study reported the PDA-based dietary self-monitoring to be effective in reducing sodium intake among patients receiving in-center hemodialysis treatment (13). No differences in weight loss were observed in a study that compared use of a PDA with a paper record; differences in dietary intake between these groups were not reported (14). In a pilot study, a substantial increase in vegetable intake was found in the group that used the PDA compared to the control group, which received only printed nutrition materials (15). No previous studies have compared the differences in dietary changes with the use of a PDA and a paper record. Because of the critical role that self-monitoring plays in successful weight loss and maintenance, easing the self-monitoring task is particularly important for overweight/obese individuals trying to lose weight. If use of a PDA for self-monitoring provides better self-awareness of behaviors, it may facilitate the dietetics practitioner's ability to sup-

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port dietary improvements; the results can be improved outcomes with dietary or lifestyle changes. Hence, the study purpose was to describe and compare dietary changes between paper record and PDA groups at 6 months in a behavioral weight-loss treatment in overweight/obese adults. It was hypothesized that self-monitoring with a PDA would be more effective than self-monitoring with a paper record for improving overall diet quality.

METHODS

This was a secondary analysis of the 6-month evaluation from a 24-month randomized clinical trial that used a three-group design to determine the effects of different methods of self-monitoring on weight loss and adherence to self-monitoring. As described in detail elsewhere (16), the study sample included overweight/obese adults aged 18 to 59 years old who had adequately completed a 5-day diary at screening. The mean body mass index (calculated as kg/m^2) was 34.1 and they had completed, on average, 15 years of education. Individuals with conditions that required medical supervision of diet or exercise and those who participated in a weight-loss program in the 6 months before recruitment were excluded. The study protocol was approved by the University of Pittsburgh Institutional Review Board; all participants provided written informed consent.

Because of the critical role that self-monitoring plays in successful weight loss and maintenance, easing the self-monitoring task is particularly important for overweight/obese individuals trying to lose weight.

The study randomized 210 individuals to using a standard paper record, a PDA with dietary and exercise software, or a PDA with the same software plus a customized feedback program (PDA+feedback). Because no differences were found in adherence to self-monitoring and the changes in dietary intake between the two PDA groups (PDA and PDA+feedback) at 6 months, the two PDA groups were combined and analyses compared the changes in dietary intake between the two groups: paper record users and PDA users (PDA and PDA+feedback groups).

Intervention

All three treatment groups received the same standard behavioral intervention; the only difference was in the method of self-monitoring assigned to each group. The cognitive-behavioral intervention included 20 group sessions during the first 6 months. All participants were instructed to self-monitor their diet daily during the study period and were trained in using their self-monitoring tool during the first 2 weeks of intervention. The paper record group was instructed to record all the foods consumed with the corresponding number of energy and fat grams. They also calculated subtotals periodically throughout the day to compare intake values to their daily goals. They were provided with a reference booklet and were taught how to find information when food labels were unavailable. Participants in the PDA groups were provided with Palm Tungsten E2 PDAs with dietary self-monitoring software, Dietmate Pro (PICS, Inc, version 1, 2003, Reston, VA), which tracked and provided values for energy, total fat grams, percent calories from saturated fat, carbohydrate, protein, and fiber intake. The PDA also provided subtotals in relation to daily goals automatically after each dietary entry.

At each session, paper record participants turned in their diaries and the PDA participants turned in their PDAs. The PDAs were downloaded to the study database; the interventionists then received printed reports that looked similar to the paper record for their review. All groups received the interventionist's written feedback at the next session. The prescribed daily energy intake was between 1,200 and 1,800 calories, depending on sex and baseline weight. The fat intake goal was 25% of the total daily calories for all subjects. The intervention emphasized restricting calories and replacing total fat intake, especially saturated fatty acids, with increased intake of fruit, vegetables, and whole-grain products.

Measures

At baseline and 6 months, dietary intake was measured in all groups with the two unannounced 24-hour dietary recalls (weekday and weekend day) guided by the Nutrition Data System Research software program (Nutrition Coordinating Center, University of Minnesota, Minneapolis). Food group serving counts were used in the analysis. Adherence to self-monitoring was measured on a weekly basis and analyzed as a binary variable based on whether a participant completed daily recordings (adherent: self-monitored vs nonadherent: did not self-monitor). If the weekly record indicated that a participant consumed $\geq$50% of the weekly calorie goal, the participant was defined as adherent to self-monitoring for that week. For example, a participant with a daily calorie goal of 1,200 (weekly goal=8,400 kcal) would be adherent to self-monitoring if the person recorded consuming $\geq$4,200 calories for that week. Body weight was measured with a digital scale (Tanita Corporation of America, Inc, Arlington Heights, IL) with the person wearing light clothing and no shoes.

Statistical Analysis

Data are expressed as mean$\pm$standard deviation or median (25th, 75th percentile) for continuous variables or as frequency counts (proportions) for categorical variables. Comparisons between the paper record and PDA groups were examined using an independent samples t test or a Mann-Whitney test for continuous variables and a χ^2 test of independence for categorical variables. Analysis was also conducted as a single sample to assess the effect of different self-monitoring methods on dietary changes using the simple and multiple regression models. Possible interactions were explored between the adherence to self-monitoring

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