



Electronic dietary recording system improves nutrition knowledge, eating attitudes and habitual physical activity: A randomised controlled trial



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ABSTRACT

Objective: This study's objective was to investigate whether use of an electronic dietary recording system improves nutrition knowledge, eating attitudes and habitual physical activity levels compared to use of a food diary and no self-monitoring.

Methods: Sixty adults aged 20–60 with a body mass index ≥ 25 were recruited and randomly assigned to one of three groups: a group using an electronic system (EG), a group using a food diary (FD) and a control group using nothing (CG) to record food intake. All participants took part in three 60–90 nutrition seminars and completed three questionnaires on general nutrition knowledge, habitual physical activity levels and eating attitudes at the beginning and end of the 12-week study. The pre- and post-test scores for each questionnaire were analysed using a paired sample *t*-test.

Results: Significant improvements in the domain of 'dietary recommendations' were found in the EG ($p = 0.009$) and FD groups ($p = 0.046$). Great improvements were found in 'sources of nutrients', 'choosing everyday foods' and 'diet–disease relationships' in EG and FD groups. EG group showed greater improvement in the work index and sport index.

Conclusion: An electronic dietary recording system may improve eating and exercise behaviour in a self-monitoring process.

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1. Introduction

Behavioural change that affects healthier eating habits and more exercise requires education and self-monitoring. Self-monitoring can involve paper and pencil (Burke et al., 2008; Helsel, Jakicic, & Otto, 2007; West, Gore, DiLillo, Greene, & Bursac, 2007) or an online journal (Chung, Chung, & Wong, 2009; Harvey-Berino et al., 2010), but tailoring assessment feedback has been shown to be effective in promoting dietary change (Kroeze, Werkman, & Brug, 2006; Wright, Sherriff, Dhaliwal, & Mamo, 2011). The development of an electronic dietary recording system (Chung et al., 2009), the eDietary Intake Portal (the portal hereafter), makes it easier to integrate the process of health

education, self-monitoring, self-efficacy, motivated action and behavioural change in a single platform. The portal is an online programme with six major advantages: (1) individuals can record their dietary intake with digital images rather than the text used in conventional diet logs; (2) programmes can be accessed by any Internet browser with personal authentication, allowing an instant dietary record to be completed and avoiding mistakes during recall; (3) nutritional professionals can provide evaluations through an online review; (4) nutrient analysis can be input for each food item for participants' review, allowing them to learn from the analysed results; and (5) individualised energy and nutrient reports can be automatically generated with embedded formulas, making online reports readily available in a timely fashion. (6) Exercise output in terms of energy expenditure can be compared with energy intake from food. The portal's usability, reliability and accuracy (ICC = 0.916, $F = 17.001$, $p < 0.001$) have been reported in previous publications (Chung & Chung, 2010; Chung et al., 2009). The aim of the study reported herein was to investigate whether the system improves nutrition knowledge, eating attitudes and habitual physical activity levels in self-reported questionnaires.

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2. Methods

2.1. Sampling and samples

Sixty adults were recruited from the general Hong Kong population. The inclusion criteria were an age between 20 and 60 and a body mass index over 25. Exclusion criteria were an acute disease in the past three months. Recruitment took place through radio broadcasts and emails to staff and students of a local university.

3. Design

The study constituted a randomised controlled trial. Simple randomisation was applied by assigning the participant numbers, writing the numbers on slips of paper and then selecting numbers randomly. The first 20 numbers drawn were assigned to an electronic system (EG) group, the second 20 to a food diary (FD) group and the remaining 20 to a control (CG) group. The drawing of numbers and group assignment were completed by a research assistant. The participants did not know their group allocation.

4. Outcome measures

4.1. General Nutrition Knowledge (GNK)

The GNK is a questionnaire developed to provide researchers with a useful tool for better understanding the general public's nutrition knowledge (Parmenter & Wardle, 1999). It covers four knowledge domains: dietary recommendations, sources of nutrients, choosing everyday foods and diet–disease relationships. Higher scores indicate more correct answers and thus better nutrition knowledge. The GNK has high degrees of internal consistency and test–retest reliability (Hendrie, Cox, & Coveney, 2008).

4.2. Habitual Physical Activity Level (HPAL)

The physical activity questionnaire designed by Baecke, Burema, and Frijters (1982) was adopted to measure participants' habitual physical activity level. It contains three indices, work, sport and leisure, giving a comprehensive account of activity-related energy expenditure. The HPAL solicits one of five responses to each question – never, seldom, sometimes, often and very often – with an ordinal scale of 1 to 5 (from lower to higher). Higher scores indicate a higher physical activity level. The HPAL has been validated as a physical activity measurement tool, and high test–retest reliability (Philippaerts, Westerterp, & Lefevre, 1999, 2001; Pols et al., 1995).

4.3. Eating Attitudes Test (EAT-26)

The EAT-26's scoring system is 3, 2, 1, 0, 0 and 0, referring to 'always', 'usually', 'often', 'sometimes', 'rarely' and 'never', respectively, except for question 25, which applies the reverse-frequency order with the same scores. The scores for the 26 eating habits are totalled to give a final score (Garner, Olmsted, Bohr, & Garfinkel, 1982). The lower the total score, the fewer eating problems the individual has. Because the 26 eating habits in the EAT-26 are common eating problems for those who are greatly concerned with body image, the research team administered the test to evaluate participants' eating attitudes before and after the intervention.

5. Procedure

This research study was incorporated with a clinical trial of the effectiveness of an electronic food diary in facilitating weight reduction (clinical trial registration: ISRCTN12929749). Participants' demographic characteristics, including age, sex, highest educational attainment, job

nature and marital status, were collected by a self-administered questionnaire. Three questionnaires, the GNK, HPAL and EAT-26, were administered before the intervention. All of the participants took part in three nutrition seminars conducted in separate groups to prevent them from learning their group assignment. The aim of these seminars was to provide the participants with basic nutrition knowledge and practical weight reduction skills.

After commencement of the first seminar, the participants in the experimental groups were instructed to record their food consumption in either a food diary or the electronic recording system (the portal), depending on their group assignment. Those in the CG group attended the seminars but were not asked to record their food consumption. Participants in the FD group were asked to input their food intake into a workbook on a daily basis. They were asked to document their food consumption, portion size, time of consumption, cooking method, type and amount of sauce added and place of consumption. Those in the FD group submitted their food diaries weekly to the nutritionists for review. The nutritionists wrote comments on the log books and returned them to participants by post. The food records of the EG group were stored in the database of a web server. The nutritionists assessed them on a daily basis and evaluated the nutrient profile of each food item using Nutritionist Pro (Assya Systems LLC, 2009), nutrient analysis software with a database of more than 51,000 foods and ingredients. Reports on each food item with the values of these nutrients were generated online, including whether the participants were eating a balanced diet. The difference was that participants in the FD group changed their dietary intake based on the written comments from nutritionists, whereas those in the EG group changed it based on the online report feedback. After 12 weeks, the participants in all three groups were asked to complete the three questionnaires again.

6. Statistical analysis

Descriptive statistics were used to describe the participants' characteristics. Paired sample *t*-tests on all scores from the pre- and post-tests were performed to evaluate whether there was any improvement in participants' general nutrition knowledge, habitual physical activity level and eating attitudes. Repeated measure ANOVA was performed to compare the variables between EG, FD and CG groups.

7. Results

The age range of the 60 participants was 20–58. The mean (standard deviation) age in the EG, FD and CG groups was 36.5 (2.3), 36.9 (2.6) and 38.7 (2.6), respectively. The statistical results of the chi-square test indicate no significant differences between them in sex, highest educational attainment, job nature or marital status.

The paired sample *t*-test results revealed significant improvements in dietary recommendation knowledge in the EG ($p = 0.009$) and FD groups ($p = 0.046$), with the former displaying a greater magnitude of improvement (Table 1). Considerable improvements in knowledge of sources of nutrients were found in the EG and FD groups, although only the latter showed a significant difference. No statistically significant between-test differences in knowledge of choosing everyday foods were found for any of the groups. Finally, there was also no significant post-intervention change in knowledge of diet–disease relationships, although the CG group displayed a greater magnitude of change (Table 1).

No significant changes were found in the HPAL work, sport or leisure indices between the pre- and post-test results of the three groups. However, participants in the EG group displayed greater improvement in the work and sport indices than those in the other groups, and those in the CG group showed greater improvement in the leisure index (Table 1). The mean difference in the EAT-26 analysed by the paired sample *t*-test revealed significant improvements in the FD group ($p = 0.017$) but not in the EG group. A significant deterioration in EAT-26 scores was found in the CG group ($p = 0.014$).

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