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Computer-supported indirect-form lifestyle-modification support program using Lifestyle Intervention Support Software for Diabetes Prevention (LISS-DP) for people with a family history of type 2 diabetes in a medical checkup setting: A randomized controlled trial

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ABSTRACT

Aims: To investigate the effect of a computer-supported indirect-form lifestyle-modification program using Lifestyle Intervention Support Software for Diabetes Prevention (LISS-DP), as a clinically feasible strategy for primary prevention, on diet and physical activity habits in adults with a family history of type 2 diabetes.

Methods: This was a two-arm, randomized controlled trial: (1) lifestyle intervention (LI) group ($n = 70$); (2) control ($n = 71$). Healthy adults aged 30–60 years with a history of type 2 diabetes among their first-degree relatives were recruited. LI group received three times of lifestyle intervention using LISS-DP during six-month intervention period via mail.

Results: Lifestyle intervention group showed significantly greater decrease in energy intake six months after baseline, compared to control (−118.31 and −24.79 kcal/day, respectively, $p = 0.0099$, Cohen's $d = 0.22$), though the difference disappeared 1 year after from baseline. No difference was found in physical activity energy expenditure.

Conclusions: A computer-based, non-face-to-face lifestyle intervention was effective on dietary habits, only during the intervention period. Further examination of the long-term effects of such intervention and physical activity is required.

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1. Background

The clinical effectiveness of intensive lifestyle interventions in preventing or delaying the development of diabetes in people at high risk has been established from randomized controlled trials using structured, intensive interventions [1–5]. However, despite convincing evidence in research settings, a recent systematic review has shown that translation into routine practice exerts somewhat less of an impact on diabetes risk reduction [6]. In terms of feasibility, it is therefore a challenge for clinicians to translate the results of intensive lifestyle-intervention trials into a general practice setting.

Intensive lifestyle intervention is often time-consuming for both medical professionals and the subjects themselves. An excessive time burden encumbers medical professionals in being able to provide standard health care. It also weakens the compliance of subjects to the intervention. In a general practice setting, medical professionals should quickly and comprehensively assess subjects and deliver personalized information. Intervention carried out in this manner can be achieved efficiently using computer-tailored health education [7,8]. Computer-tailored lifestyle intervention is a promising health education technique, particularly in nutrition education based on printed materials [9] and it is well suited to modification of complex health-related behaviors (e.g., by providing feedback). Previous studies have shown that computer-tailored interventions involving questionnaires and tailored messages can result in behavioral changes and weight loss in healthy people [10–12]. Furthermore, computer-tailored interventions have emerged as a new, cost-effective type of health-promotion program because they enable personalization of health education without the high costs of personal counseling [9]. Computerized behavioral programs are therefore expected to be an effective, feasible intervention tool.

To maintain compliance with lifestyles, the intervention should be easily available for participants. It is particularly difficult to motivate participants in primary care to undertake preventive intervention since they are generally healthy and have other demands on their time. A previous study has indicated that healthy participants prefer correspondence-format programs to face-to-face format programs for the delivery of health education [13]. In addition, several studies have shown the efficiency and compliance of preventive interventions using indirect forms [10,13,14]. Indirect forms (i.e., telephone consultations, mailings, and consultations via the Internet) can be more suitable for delivering preventive interventions to a potentially high-risk population because these methods are low in cost, demand fewer human resources, and allow the treatment of a large number of people compared with face-to-face methods. The mail format, which is easily available, likely to be read and saved, and perceived as personally relevant [14–16], is considered suitable for maintaining compliance with preventive interventions.

The authors developed Lifestyle Intervention Support Software for Diabetes Prevention (LISS-DP) [17]. LISS-DP can easily provide education regarding the incorporation of healthy dietary and physical activity behavior into participants' daily life by indirect intervention.

Other than intervention feasibility, one characteristic of the high-risk diabetes population particular to Japan is a difficulty when attempts are made to generalize to that country existing evidence of diabetes prevention in Western countries. The target population in preventive research trials usually has a body mass index (BMI) of $\geq$30 kg/m^2 in Western countries but about 25 kg/m^2 in Asia [18]. A recent global epidemiological meta-analysis has shown that BMI is strikingly lower in Asia than in Oceania, Europe, and North America [19]. Among populations in developed countries, Japanese males have the lowest mean male BMI (23.5 kg/m^2), and the mean female BMI (21.4 kg/m^2) of Japanese females is also one of the lowest [19]. Moreover, Japanese patients with diabetes characteristically have a relatively low BMI [20]. Previous studies have shown that waist circumference, which is indicator of visceral fat, is a better predictor for diabetes than BMI [21]. However, the validity of waist circumference varies with ethnicity. In Japanese population, the utility of waist circumference for individual diagnosis had been skeptic [22]. Actually, recent cohort study in Japan has shown that the utility of the waist circumference was attenuated by gender and age [23]. The obesity indexes, both BMI and waist circumference, are therefore less specific diabetes predictor for diabetes in Japanese population. It is necessary therefore to consider risk factors other than obesity.

Etiologically, type 2 diabetes results from a complicated combination of genetic and environmental factors. Accordingly, individuals genetically predisposed to type 2 diabetes also represent an important target for preventive strategies. Family history is a well-known risk factor for type 2 diabetes, and it has been used to screen high-risk populations [24,25] from both genetic and environmental considerations. The offspring of patients with type 2 diabetes have a higher risk of developing the disease since they are likely to share the same genetic predispositions as and have similar lifestyle habits to their parents [26]. Individuals with an affected first-degree relative have a 2.3- to 5.5-fold higher risk of developing type 2 diabetes—independent of sex, age, race or ethnicity, BMI, and other demographic characteristics [27,28]. Family history is thus a useful tool for detecting genetically high-risk populations in this post-genomic era [28,29].

The objective of the present trial was to investigate the effects of print-delivered, computer-tailored lifestyle interventions using LISS-DP on favorable lifestyle change in relatives of type 2 diabetes patients.

2. Methods

2.1. *Design*

Details on the protocol and the participants' baseline characteristics have been described previously [17] and thus are briefly reviewed here.

This study formed part of 3 armed, an unmasked, randomized longitudinal trial at a single medical check-up center in the Tokyo metropolitan area. The trial has two objectives: to investigate the effect of genetic counseling and to assess indirect lifestyle intervention supported by LISS-DP. In this paper, the authors report on the latter objective. This study was approved by the institutional review board of the School