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Positional Statement

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Effectiveness of Information and Communications Technology-Based Interventions for Obesity and Metabolic Syndrome

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The rapid increase in the obese population is a problem indicates the need for measures to prevent and treat obesity. Since the early 2000s, worldwide digital health has focused on obesity management. Information and communication technology (ICT)-based obesity intervention can be an efficient method for treating obesity and metabolic syndrome, has no time limitations, and is an inexpensive and easily accessible treatment modality for both physicians and patients. Previous studies have confirmed the effects of ICT-based interventions for obesity and metabolic syndrome management for behavioral improvement in lifestyle modification. In addition, ICT-based interventions in obese and metabolic syndrome patients are recommended as part of a comprehensive strategy for weight loss and maintenance. The Committee of IT-convergence Treatment of Metabolic Syndrome was established by the Korean Society for the Study of Obesity in 2021, and had been gathering theoretical and clinical evidence in digital therapeutics fields and developing new methods for managing obesity and metabolic syndrome. As part of this effort, if the "obesity management prototype" is commercialized, it will be available for convenient treatment of individuals with obesity and metabolic syndrome.

Key words: Cognitive behavioral therapy, Digital technology, Obesity, Telecommunication, Weight loss

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INTRODUCTION

Obesity is a significant health problem that is associated with numerous health issues, including cardiovascular disease (heart disease, stroke), type 2 diabetes, musculoskeletal problems, psychosocial disorders, and cancer.[1] In 2016, the World Health Organization estimated that more than 650 million adults were obese, which is 13% of the population.[2] According to the 2020 Obesity Fact Sheet created by the Korean Society for the Study of Obesity (KSSO), the prevalence of obesity in Korea continuously increased between 2009 (32.6%) and 2018 (38.5%) among the overall population and in both sexes.[3] Such a rapid increase in the obese population is a social burden, so measures to prevent and treat obesity are essential.

To prevent obesity from overwhelming clinical practice, patients with obesity should be included in multidisciplinary programs with combined treatment options (diet, physical activity, cognitive-behavioral, pharmacological, and surgical).[4,5] However, combined treatment options have often led to suboptimal outcomes due to difficulties in access, cost, lack of personnel and resources, patient treatment adherence, and long-term efficacy of these options. Moreover, about one-third of patients regain the lost weight after the first year of starting these lifestyle interventions.[6] Therefore, the challenge of treating obesity is not only to achieve weight loss, but

also to maintain it.[7]

Recently, there has been commitment to developing and implementing digital health technologies for assessment, prevention, and treatment of disease and to promote health and well-being worldwide.[8] Digital health is defined broadly as a form in which the use of information and communication technology (ICT) is combined with improving or enabling health and healthcare.[9] Since 2020 during the global coronavirus disease 2019 (COVID-19) pandemic, ICT-based interventions have experienced growth in many countries, such as the United States, Europe, China, and Japan. In line with this, ICT-based interventions for obesity have been suggested to be more suitable treatment options.[10] The Committee of IT-convergence Treatment of Obesity and Metabolic Syndrome in KSSO (Director Sang Youl Rhee) was established in February 2021. The goals of this committee are as follows: (1) presenting academic rationale for IT-convergence technology for effective treatment of obesity and metabolic syndrome, (2) standardization of digital treatment (DTx) and presenting a general-purpose DTx algorithm, (3) proposal of policy direction for digital dissemination, and (4) establishing a multi-institutional/-disciplinary industry-academic collaboration network for dissemination and supply of treatment techniques for IT-convergence obesity and metabolic syndrome.

EFFECTS OF ICT-BASED INTERVENTIONS IN MANAGEMENT OF OBESITY

ICT-based interventions include web-based platforms (e.g., websites), mobile devices (e.g., cell phones), or wearable devices (e.g., pedometers, accelerometers, Fitbits, and Apple/Galaxy watches).[11] Web-based platforms provide education on nutrition and physical activity, self-monitoring of targeted behaviors, goal setting, and more. Mobile devices allow people to use text messages and smartphone applications to monitor their food intake and weight. In the past, wearable technology has been used to set and evaluate the target amount of physical activity as measured by tools such as a pedometer or accelerometer; recently, wearables (e.g., Fitbit, Apple Watch, and Galaxy Watch) have also been used to monitor sleep patterns and other health-related activities.[12]

The most significant advantages of ICT-based interventions are that they can effectively provide feedback via direct communication and build alliances[13] while improving patient convenience and reducing cost and time input.[14,15] ICT-based interventions can be used at any time of day to help communicate with healthcare experts to support effective and efficient interventions. Web-based or smartphone application-based management of obesity can improve compliance with interventions. In addition, it can provide opportunities for solving problems related to weight loss and maintenance, including long-term efficacy.[16] In particular, ICT-based interventions can compensate for the lack of psychological and behavioral counseling provided by healthcare experts, which can help to achieve and maintain the goal of lifestyle modification for overweight and obesity treatment.[17,18] ICT-based interventions that use these advantages effectively enable weight loss and maintenance, and previous studies have shown the benefits of ICT-based interventions.[14,19,20] Such effects have been confirmed through studies conducted in Korea.[21,22]

In the past, ICT-based interventions for obesity treatment have been considered a supplementary means of obesity management through lifestyle modification. Recently, ICT-based obesity treatment has emerged as a parallel or central means of obesity intervention as a part of DTx. Further, randomized controlled clinical trials (RCTs), long-term observational studies, and cost-effectiveness studies to ensure sufficient evidence are warranted.

RESULTS OF PREVIOUS STUDIES FOR ICT-BASED INTERVENTIONS IN OBESITY TREATMENT

ICT-based interventions using telephone, internet, smartphone applications, and wearable devices for obesity management effectively support weight loss and weight loss maintenance.[23] In a meta-analysis from 2019, the weight loss was significantly higher when a web-based intervention was implemented than when not used (–2.14 kg; 95% confidence interval [CI], –2.65 to –1.64).[24] However, this result does not provide conclusive evidence that an ICT-based intervention can be used as an alternative to existing face-to-face programs. Few studies have compared the effects of weight loss and weight maintenance using therapy based on ICT through phones, the internet, and smartphone apps versus conventional behavioral therapy through face-to-face methods.[11,20]

As a result of a meta-analysis of 23 RCTs that compared the effects of ICT-based interventions and existing management on weight loss, a significant effect (–0.68 kg, $P=0.03$) of ICT-based interventions was confirmed.[17] In addition, when ICT-based weight loss and conventional (face-to-face) interventions were combined, superior weight loss (–1.93 kg; 95% CI, –2.71 to –1.15; $P<0.001$) was obtained compared to that of ICT-based intervention alone.[17] However, a meta-analysis published in 2019, showed that the weight loss effect was inferior when using only ICT-based interventions compared to conventional (face-to-face) behavioral therapy (0.82 kg; 95% CI, 0.06–1.59).[24] In addition, in a meta-analysis from 2021, ICT-based interventions had an effect on weight loss but it was not statistically significant compared to that of general treatment (–0.56 kg; 95% CI, –3.74 to 4.59; $P=0.786$).[25]

Table 1 summarizes the results of existing studies comparing the effects of obesity treatment on information and communication-based interventions with those of face-to-face treatment.[26] To confirm the effect size, comparative advantage, and other factors related to ICT-based interventions compared to conventional (face-to-face) behavioral therapy for weight loss and maintenance, additional studies are needed.

In Korea, when patients were treated for obesity using a mobile app, the average weight loss was –2.73 kg,[27] and a combined approach using both an ICT-based intervention and conventional cognitive behavioral therapy showed a more effective weight loss effect than the existing face-to-face treatment (–3.4% vs. –0.7%).[28] Overseas, an intensive contact web-based program showed a remarkable effect on weight loss (mean, –4.31 kg; 95% CI, –5.22 to –3.41).[29] These results suggest that ICT-based interventions can be most effective when provided multi-dimensionally and accompanied by therapist feedback and support.

FUTURE PERSPECTIVES

The KSSO established the Committee of IT-convergence Treatment of Metabolic Syndrome in 2021, and is working to secure theoretical and academic evidence in related fields by developing new obesity and metabolic syndrome management methods. In particular, the committee is making efforts to improve the completeness of digital health solutions for obesity and metabolic syn-

Table 1. Studies on the effectiveness of online obesity behavioral therapy[26,29]

Study	Duration (mo)	Intervention	Control	Men	Age (yr)	BMI (kg/m^2)	Weight change	Effect
Shuger et al.[30]	9	PA monitoring device	SC	197 (19)	46.8±10.8	33.3±5.2	SWA: –3.55 kg vs. SC: –0.9 kg (no significance)	No difference
van Wier et al.[31]	6	Web-based intervention	Control group	1,386 (67)	43±8.6	29.6±3.5	Internet: –1.9 kg vs. control: –1.0 kg ($P=0.112$)	No difference
Allen et al.[32]	6	SP application	IC	68 (22)	44.9±11.1	34.3±3.9	SP: –1.8±3.7 kg vs. IC: –2.5±4.1 kg ($P=0.89$)	No difference
Steinberg et al.[33]	6	Smart scale on SP	Text message	91 (25)	44±11	32.15±3.8	Intervention: –6.55% vs. control: –0.35% ($P<0.001$)	Superior
Harvey-Berino et al.[34]	6	Web-based intervention	Teleconsultation	481 (80)	46.6±9.9	35.7±5.6	Internet: –5.5 kg vs. in person: –8.0 kg ($P<0.01$)	Inferior
Sullivan et al.[35]	3/6	Web-based class (VR)	Face to face	20 (15)	31.1±3.6	32.8±5.1	Weight loss: VR: –7.6 % vs. FTF: –10.8% ($P<0.05$), weight maintenance: VR: 14.0% vs. FTF: 9.5% ($P<0.05$)	Inferior/small
Blomfield et al.[36]	6	Website CalorieKing	Program materials	159 (100)	47.5±11.0	32.7±3.5	Online: –5.8±5.3 kg vs. resource: –4.4±4.7 kg ($P>0.05$)	No difference
O'Brien et al.[37]	4	Web-based management	Personal feedback	289 (41)	41.6±10.2	32.4±3.6	Control: 0.4±2.4 kg vs. basic: –2.2±3.4 kg ($P<0.001$)	Superior
Thomas et al.[38]	12	Web-based intervention	PA monitoring	271 (22.5)	33.9±3.7	33.9±3.7	WWOAL: –1.6 kg vs. control: –1.2 kg ($P>0.26$)	No difference

Values are presented as number (%) or mean±standard deviation.
BMI, body mass index; PA, physical activity; SC, standard care; SWA, SenseWear Armband; SP, smartphone; IC, intensive counseling; VR, clinical delivered via virtual reality; FTF, face to face weight management clinic; WWOAL, Weight Watchers Online plus ActiveLink.

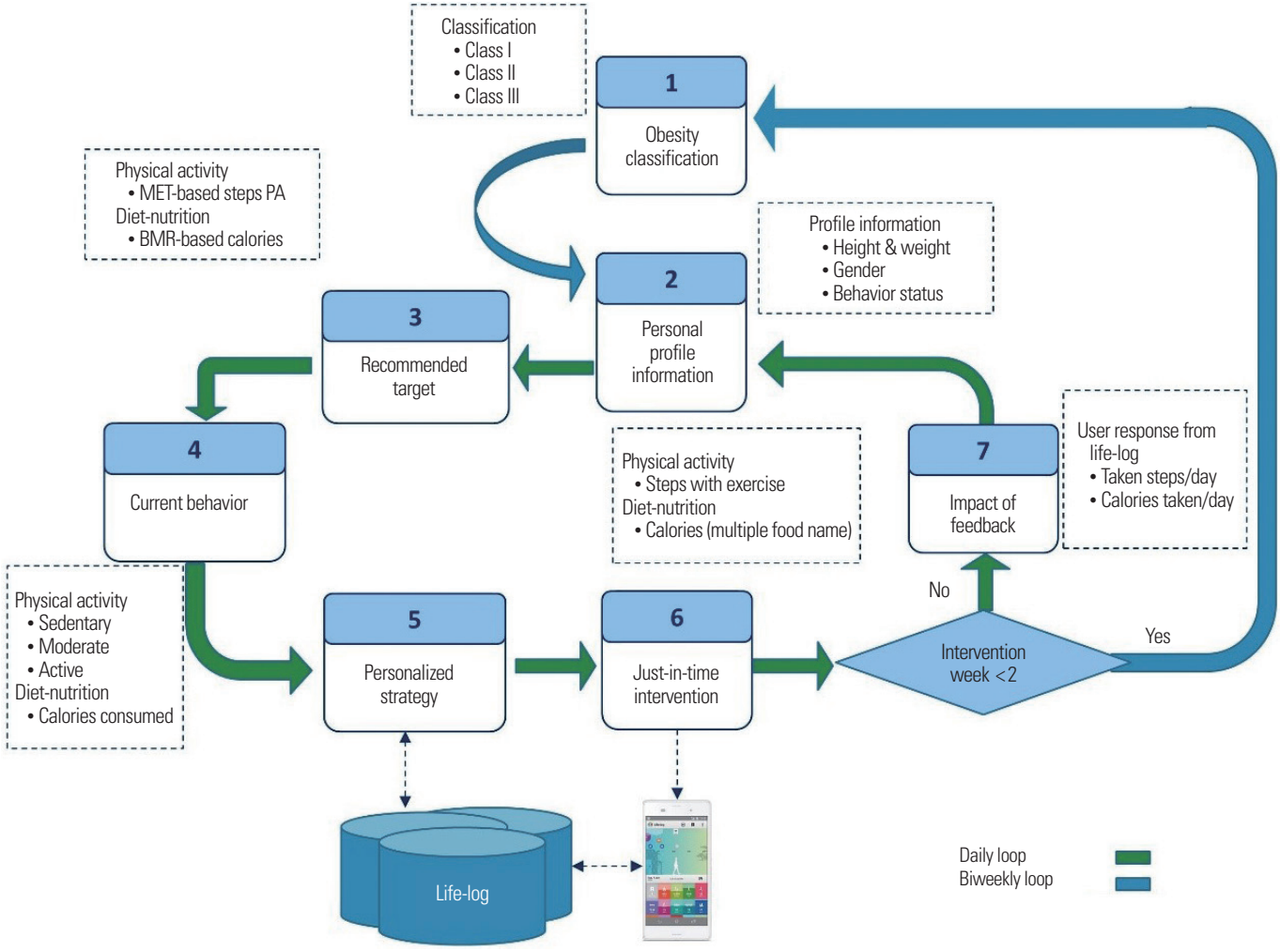

Figure 1. The feedback system of intervention evolution for obesity management. MET, metabolic equivalent of task; PA, physical activity; BMR, basal metabolic rate.

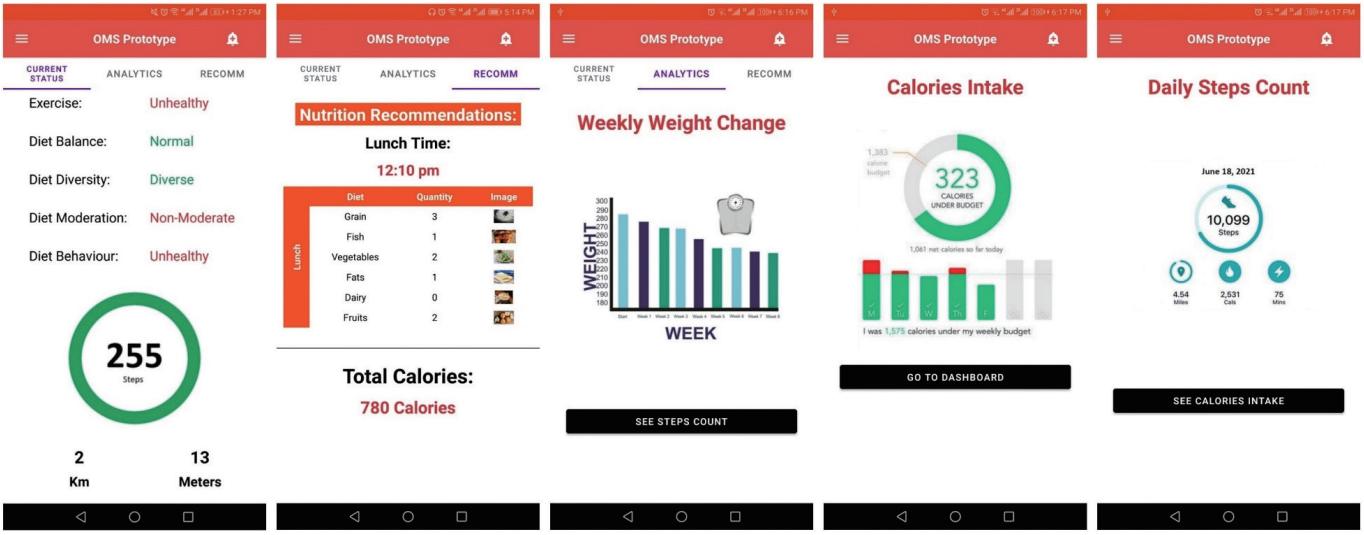

Figure 2. The basic user interface of a smartphone application. OMS, obesity management system.

drome management, including detailed individual weight goals, individualized interventions, continuous motivation, and maximized possibility of weight loss. The committee has developed a patent-pending prototype that collects and analyzes information for each algorithm and provides appropriate intervention information or methods customized by subject (Fig. 1).

In the future, the KSSO aims to identify and improve additional problems through peer evaluation in conjunction with various expert groups and distribute the findings through an easily accessed open platform (Fig. 2). Furthermore, the committee plans to link this health promotion program to an institutional medical system through multicenter RCTs and real-world studies.

CONCLUSION

ICT-based interventions have several advantages in weight loss and maintenance in obese/metabolic syndrome patients and can be recommended as part of a comprehensive strategy. The obesity prototype is an ICT-based intervention for obesity and metabolic syndromes that is being developed and supplemented by the Committee of IT-convergence Treatment of Metabolic Syndrome for easy and convenient use in obesity and metabolic syndrome treatment.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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AUTHOR CONTRIBUTIONS

Study concept and design: SK and SYR; drafting of the manuscript: SK; critical revision of the manuscript: SK, SYR, and Korean Society for the Study of Obesity; administrative, technical, or material support: all authors; and study supervision: RSY.

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