



ORIGINAL ARTICLE

# Improvements in the Metabolic Syndrome and Stages of Change for Lifestyle Behaviors in Korean Older Adults

Seunghyun Yoo<sup>a</sup>, Hyekyeong Kim<sup>b,\*</sup>, Han-Ik Cho<sup>b</sup>

<sup>a</sup>*Seoul National University, Graduate School of Public Health & Center for Health Promotion Research, Seoul, Korea.*

<sup>b</sup>*Korea Association of Health Promotion, Health Promotion Research Institute, Seoul, Korea.*

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**Abstract**

**Objectives:** This study aims to examine the effectiveness of a 6-month lifestyle modification program on the improvement in metabolic syndrome (MetS) status and in stages of change for lifestyle behaviors associated with MetS among Korean older adults.

**Methods:** A lifestyle modification program was developed based on the trans-theoretical model. The program consisted of health counseling, education classes, a self-management handbook, newsletters and a health diary. Older adults aged  $\geq 60$  ( $n = 480$ ) with MetS were randomly assigned to the intervention group (IG) or the comparison group (CG). The IG received a comprehensive 6-month lifestyle modification intervention, while the CG received minimal information on MetS and lifestyle modification. Health examination and self-administered survey were conducted before and after the intervention to determine the effectiveness of the program.

**Results:** After the intervention, the prevalence of MetS decreased to 38.1% in the IG and 52.4% in the CG ( $p = 0.046$ ). The IG improved abdominal obesity ( $p = 0.016$ ), blood pressure ( $p = 0.030$ ), and triglyceride ( $p = 0.005$ ) more than the CG did. The IG demonstrated significant improvements in the behavioral stages for portion control ( $p = 0.021$ ), balanced diet ( $p < 0.001$ ) and adequate intake of fruits and vegetables ( $p = 0.012$ ). The IG reduced the prevalence of abdominal obesity (OR = 2.34) and improved MetS status (OR = 1.79) better than the CG. The IG were more likely to advance from preaction stages at baseline to action stage at post-intervention for portion control (OR = 3.29) and adequate intake of fruits and vegetables (OR = 2.06).

**Conclusion:** Lifestyle modification can improve the MetS status and behavioral stages in older adults.

\*Corresponding author.

E-mail: [hkkim@kahp.or.kr](mailto:hkkim@kahp.or.kr)

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## 1. Introduction

Metabolic cardiovascular risk factors are significant predictors of cardiac events in old age [1,2], and concurrence of a number of metabolic cardiovascular risk factors is more common in older adults [3]. Metabolic syndrome (MetS) refers to a cluster of concurrent metabolic cardiovascular risk factors. According to the National Cholesterol Education Program's Adult Treatment Panel III (NCEP ATP III), MetS is defined as having three or more of the following: abdominal obesity, elevated blood pressure, impaired fasting glucose, elevated triglyceride, and decreased high-density lipoprotein (HDL) cholesterol level [4]. MetS is associated with increased risk of cardiovascular disease (CVD) and type 2 diabetes [5], particularly with an increased CVD-related morbidity and mortality even when CVD or diabetes does not exist clinically [6,7].

MetS is increasing worldwide including Asia [4,8]. Asians tend to have higher risk of type 2 diabetes and CVD even at lower body mass index (BMI) than Caucasians [9]. The age-adjusted prevalence of MetS in South Korea (Korea hereafter) among Korean adults aged  $\geq 20$  years, using the NCEP ATP III definition based on the Korean National Health and Nutrition Examination Surveys, increased consistently and significantly from 24.9% in 1998 to 31.3% in 2007 [8], compared to 34.0% in the USA, 2003-2006 [10]. The prevalence is greater in older adults [6,8].

Lifestyle modification intervention especially targeting diet and physical activity is instrumental and necessary for reducing the prevalence of MetS [4,11,12]. Healthy diet and regular physical activity are essential in the lifestyle modification for MetS management [13,14]. The transtheoretical model (TTM) has often been employed as a framework for interventions for healthy diet and physical activity [15]. However, application of TTM to improve diet and physical activity has been limited in MetS studies in Korea until recently [16,17]. The stages of change (SOC) construct in the TTM emphasizes behavioral change as a process that involves adopting the new behavior and acting on it. The SOC postulates behavior change as a dynamic process consisted of mutually exclusive stages of readiness: pre-contemplation (not considering change), contemplation (considering change), preparation (decided to take action in the next month), action (changed behavior in the past 6 months), and maintenance (maintained the changed behavior for longer than 6 months) [18]. The assessment of SOC can guide an intervention to identify behavioral readiness and intention for change and to develop effective processes for behavioral change [19]. SOC are, in fact, a predictor of actual behavior such as dietary intake [18]. This study aims to examine the changes in MetS status in Korean older adults after a 6-month health education intervention program along with

the improvement in behavioral stages from nonaction to action for lifestyle behaviors associated with MetS.

## 2. Materials and Methods

### 2.1. Intervention

A 6-month lifestyle change program was developed to control MetS through increasing physical activity, improving diet, and reducing weight. TTM is applied to our program to provide different intervention strategies to the older adults according to their SOC (pre-contemplation, contemplation or preparation, and action or maintenance [20]). Participants were encouraged to enhance MetS-related knowledge (definition, prevalence and trends, causes, and consequences of MetS) and life skills for hypocaloric, balanced diet, moderate drinking, and adequate level of physical activity [21]. Cognitive and behavioral strategies included consciousness raising, enhancing pros of lifestyle change and self efficacy, goal setting for behavior change, regular self-monitoring of progress, and providing rewards to promote the movement from stage to stage and to reinforce healthy lifestyle (Table 1).

The intervention composed of individual counseling sessions with registered dietitians, health education classes, educational newsletters and booklets, and keeping a health diary. One-on-one health counseling was provided every other week, by telephone when face-to-face counseling was not possible. A booklet and a health diary were provided to those in the intervention group as health education material and also as a self-monitoring tool. In addition to individual counseling, the intervention group members were invited to two health classes on prevention and management of hypertension, diabetes, obesity, and MetS. Monthly newsletters on healthy lifestyle were sent to the intervention group members (Figure 2). The comparison group, in contrast, was provided with their MetS status and a one-page health information sheet on MetS at baseline.

### 2.2. Participants and recruitment

The participants were 430 adults aged 60 and older who were diagnosed with MetS after completing health examinations at one of 15 regional branch medical facilities of the Korea Association of Health Promotion (KAHP) between June 1, 2008 and April 30, 2009. MetS is defined by the NCEP ATP III criteria for MetS [4] and the Asia-Pacific standard for abdominal obesity [22]. That is, older adults who meet three or more of the following five conditions are classified as having MetS: (1) waist circumference  $>90$  cm for men or  $>80$  cm for women; (2) HDL cholesterol  $<40$  mg/dL for men or  $<50$  mg/dL for women; (3) triglyceride  $\geq 150$  mg/dL; (4) systolic blood pressure  $\geq 130$  mmHg or diastolic blood pressure  $\geq 85$  mmHg; and (5) fasting glucose

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