Available online at www.sciencedirect.com

Public Health

journal homepage: www.elsevier.com/puhe

Original Research

The preventive effects of lifestyle intervention on the occurrence of diabetes mellitus and acute myocardial infarction in metabolic syndrome

D. Kim [a], S.-J. Yoon [a,*], D.-S. Lim [b], Y.-H. Gong [a], S. Ko [a], Y.-H. Lee [a], H.S. Lee [c], M.-S. Park [c], K.-H. Kim [d], Y.A. Kim [e]

[a] Department of Preventive Medicine, Korea University College of Medicine, Seoul, Republic of Korea
[b] Department of Cardiology, Korea University Anam Hospital, Seoul, Republic of Korea
[c] Metabolic Syndrome Management Center of Seoul Metropolitan Government, Seoul, Republic of Korea
[d] Health Insurance Review & Assessment Service, Seoul, Republic of Korea
[e] Cancer Policy Branch, National Cancer Control Institute, National Cancer Center, Goyang, Republic of Korea

ARTICLE INFO

Article history:
Received 28 October 2015
Received in revised form
13 April 2016
Accepted 10 June 2016
Available online 9 July 2016

Keywords:
Metabolic syndrome
Lifestyle intervention
Diabetes mellitus
Acute myocardial infarction

ABSTRACT

Objectives: Metabolic syndrome (MS), as a precursor of diabetes mellitus (DM) and cardiovascular disease, is increasing steadily worldwide. We examined the preventive effects of lifestyle intervention on the occurrence of DM and acute myocardial infarction (AMI) in MS.
Study design: Observational study on disease occurrence after lifestyle intervention.
Methods: The lifestyle intervention was administered to subjects with MS participating in a metropolitan lifestyle intervention program for 1 year. The same numbers of non-participating age- and sex-matched subjects with MS were randomly extracted from national health examination data. After intervention or examination, new occurrences of hypertension, DM, and AMI were identified through the national health insurance claims data during 1 year. For DM and AMI, multivariate logistic regression analysis for the factors affecting each disease was performed.
Results: In the intervention group and the control group (14,918 in each group), the occurrence of hypertension was 555 (6.07%) and 751 (8.33%), the occurrence of DM was 324 (2.55%) and 488 (3.89%), the occurrence of dyslipidemia was 321 (2.59%) and 373 (2.72%), and the occurrence of AMI was 13 (0.09%) and 26 (0.17%), respectively. In multivariate logistic regression analysis, adjusted odds ratios for intervention were 0.752 (95% confidence interval [CI]: 0.644–0.879) and 0.499 (95% CI: 0.251–0.992) for DM and AMI, respectively, indicating that lifestyle intervention has a preventive effect.
Conclusions: Lifestyle intervention in MS has preventive effects on the occurrence of DM and AMI, and long-term follow-up is needed to evaluate these preventive effects in more detail.

* *Corresponding author.*
E-mail address: yoonsj02@korea.ac.kr (S.-J. Yoon).
http://dx.doi.org/10.1016/j.puhe.2016.06.012

Introduction

Metabolic syndrome (MS) is a comprehensive term encompassing diabetes mellitus (DM), hypertension, obesity, and dyslipidemia. The prevalence of MS is increasing steadily worldwide, and Korea is not an exception.[1] MS is a precursor of DM[2] and cardiovascular disease (CVD) and increases the risk of incident cardiovascular events and death.[3] As the burden of disease due to acute myocardial infarction (AMI) and the resulting economic burden have increased,[4,5] comprehensive management of MS is necessary.

Lifestyle intervention aims to improve the metabolic parameters through diet, exercise, and education, and many studies regarding the effects of lifestyle intervention on MS have been reported. A recent meta-analysis further strengthens the evidence that long-term regular lifestyle intervention reduces the prevalence of MS and abnormalities associated with MS and may be a useful tool in reducing the future occurrence of MS.[6]

Of course, these positive results mean that the intervention improve the metabolic parameters but more important than that is whether these interventions are effective in the prevention of complications of MS such as DM, hypertension, and ischaemic heart disease.

In subjects with impaired glucose tolerance (IGT), several studies have reported the prevention of MS[7,8] or DM[9,10] as well as improvement in the risk factors of CVD[11] through lifestyle intervention, but there is little research on the prevention of DM or AMI in MS.

In South Korea, the MS management projects are underway in many local health centres under the awareness of the importance of MS, and the design and preliminary results have been announced previously.[12]

Therefore, we evaluated the preventive effects of lifestyle intervention on the occurrence of DM and AMI in MS by a metropolitan lifestyle intervention program.

Methods

Study population

Korean adults aged 30 years and older with MS were enrolled among the subjects participating in a metropolitan lifestyle intervention program for city residents aimed at decreasing the risk of MS from January 2009 to December 2012.

MS was defined with the widely used National Cholesterol Education Program – Adult Treatment Panel III guidelines.[13] However, for the waist circumference in consideration of the characteristics of the Korean, it was applied with the recommendations of the Korean Society for the Study of Obesity.[14,15] Therefore, the subjects who have three or more of the following five criteria were classified in MS in this study: (1) abdominal obesity (waist circumference > 90 cm for men or > 85 cm for women); (2) triglycerides (TG) ≥ 150 mg/dl or receiving drug treatment; (3) high-density lipoprotein cholesterol (HDL-C) < 40 mg/dl for men or < 50 mg/dl for women or receiving drug treatment; (4) systolic blood pressure (SBP)/diastolic blood pressure (DBP) ≥ 130/85 mmHg or receiving drug treatment; and (5) fasting plasma glucose ≥ 100 mg/dl or receiving drug treatment.

The intervention program has been described previously.[12] In brief, face-to-face lifestyle counselling on diet, physical activity, smoking, and alcohol consumption was provided monthly to the subjects with MS in the Public Health Centre for 12 months. For diet, dietary counselling was provided by dietitians and consisted of an inquiry into dietary history, a nutrition regimen, and regular monitoring. Dietary history was collected through a 24-h recall method and a weekly meal diary. Diet regimen was developed according to each subject's major health and dietary problems. For physical activity, exercise specialists conducted physical activity counselling sessions. A subject's physical activity was determined every session using a standardized physical activity questionnaire, which takes into account and sums up all physical activities from the three areas of exercise, domestic chores, and vocational activity, on a weekly basis by intensity and duration. To monitor the five risk factors of MS and changes in lifestyle, the intervention group was reassessed every 3 months. Most South Korean adults possess their own mobile phones; so, one health tip text message was sent out once per week, a message encouraging further efforts was sent out once a month, and a message notifying the subject of upcoming visits was also sent out once a month.

For the control group, the national health examination data were utilized. In South Korea, health examinations are implemented for white-collar workers every 2 years and for non-white-collar workers annually. The examination includes medical history, smoking and drinking habits, and metabolic factors that can determine MS, such as waist circumference (WC), SBP, DBP, and fasting blood glucose (FBG), HDL-C, and TG levels. After collecting the national health examination data of Seoul citizens aged 30 years and older from January 2009 to December 2009, we excluded the participants by using the Resident Registration Number. Then, we randomly extracted the same number of subjects matched for age and sex with the intervention group.

All subjects fasted for 10 h before being tested for the five metabolic factors of MS: waist circumference; blood pressure; plasma glucose; TG; and HDL-C. Serum TG and HDL-C levels were determined by enzymatic methods with a chemistry analyser. Plasma glucose was measured with the glucose oxidase method.

Measuring the occurrence of disease

To identify the occurrence of MS-related diseases, we requested the claims data with the International Classification of Disease tenth revision codes from the National Health Insurance Service between 2009 and 2014. For the intervention group, the claims with hypertension (I10-15), DM (E10-14), dyslipidemia (E78), and AMI (I21) were extracted during a period of 1 year before and after the intervention. For the control group, the same claims were extracted during a period of 1 year before and after the health examination.

The occurrence of hypertension, DM, and dyslipidemia was defined as a subject with one inpatient admission or more than three outpatient visits within 1 year after the intervention or the health examination among the subjects with no claim within 1 year before the intervention or the health examination. Meanwhile, the occurrence of AMI was defined as