Available online at www.sciencedirect.com

ScienceDirect

www.nrjournal.com

Low dietary energy intake is associated with sarcopenia in cancer survivors: An analysis based on the Korean National Health and Nutrition Examination Survey 2008–2011

Hyoeun Kim[a], *Sunmi Yoo*[a,*], *Yong Soon Park*[b], *Seung Guk Park*[a]

[a] *Department of Family Medicine, Inje University Haeundae Paik Hospital, Busan, Republic of Korea 48108*

[b] *Department of Family Medicine, Chuncheon Sacred Heart Hospital, Hallym University College of Medicine, Chuncheon, Republic of Korea 24253*

ARTICLE INFO

Article history:
Received 23 June 2017
Revised 7 November 2017
Accepted 19 January 2018

Keywords:
Neoplasm
Survivor
Skeletal muscle mass
Sarcopenia
Dietary intake

ABSTRACT

As cancer survivors increase, management of their long-term health consequences becomes important. Sarcopenia could negatively affect on their clinical outcome and quality of life. We hypothesized that sarcopenia would be more prevalent in cancer survivors and that are associated with dietary intake. This study was conducted to compare nutritional intake and body composition, considering sarcopenia, between cancer survivors and healthy individuals using Korean National Health and Nutrition Examination Surveys conducted from 2008 to 2011. The participants were 259 adult cancer survivors and 1,295 healthy counterparts who underwent body composition tests and had no chronic diseases. Sarcopenia was defined as a condition with a skeletal muscle mass below the cut-off value (men < 6.58 kg/m^2 and women < 4.59 kg/m^2) adjusted for height. The prevalence of sarcopenia was higher in non-obese male cancer survivors (32.6% vs 16.0%, P=0.034) compared with healthy individuals. On the contrary, sarcopenia was more common in obese female survivors (35.1% vs 15.0%, P=0.005) than their healthy counterparts. Multivariable logistic analyses revealed that age increase by 1 year (aOR=1.025; 95% CI: 1.001–1.049), male gender (aOR=3.688; 95% CI: 6.061–90.910), and a lower BMI (aOR=33.201; 95% CI: 13.639–80.823) were significantly associated with the increased risk of sarcopenia. Increased energy intake by 100 kcal/day (aOR=0.930; 95% CI: 0.869–0.995) had a protective effect against sarcopenia. Our results suggest that male cancer survivors are high risk group of sarcopenia, especially when they are non-obese. More dietary energy intake may be needed to prevent sarcopenia.

Abbreviations: DXA, dual-energy X-ray absorptiometry; OR, odds ratio; CI, confidence interval; BMI, body mass index; KNHANES, Korea National Health and Nutrition Examination Survey; KCDC, Korea Centers for Disease Control and Prevention; KDRIs, Dietary Reference Intakes for Koreans; ASM, appendicular skeletal muscle mass; SD, standard deviation; SE, standard error; NA, not applicable; RAE, retinol activity equivalent; NE, niacin equivalent.

* *Corresponding author at:* Department of Family Medicine, Inje University Haeundae Paik Hospital, 875 Haeun-daero, Haeundae-gu, Busan, Republic of Korea 48108. Tel.: +82 51 797 3220; fax: +82 51 797 3229.

E-mail addresses: domodachi8@gmail.com (H. Kim), syoo@paik.ac.kr (S. Yoo), pyongs@hanmail.net (Y.S. Park), sgpark@paik.ac.kr (S.G. Park).

https://doi.org/10.1016/j.nutres.2018.01.004
0271-5317/

1. Introduction

Cancer is one of the leading causes of death in Korea and worldwide. Recent advances in diagnosis and treatment have increased the survival rate of several cancer patients. The cancer statistics in Korea in 2013 showed that about 1.3 million people have a history of cancer, and about 70% of these people survived for over five years after cancer diagnosis [1]. With an increasing number of cancer survivors, the management of health care after cancer treatment should be personalized based on the individual needs of cancer survivors.

Cancer survivors have an increased risk of cancer-related and other chronic health problems after cancer diagnosis and treatment [2,3]. Decline in muscle strength in non-cancer populations is associated with increased mortality of all-cause and quality of life [4]. Undernutrition and reduced muscle mass are common in cancer survivors and can affect clinical course [5-7]. Traditional research on muscle wasting and malnutrition has been limited to cancer cachexia in patients with advanced cancer [8,9]. Now new evidences are emerging on sarcopenia related to cancer progression in both advanced and early-stage patients [9,10].

Cancer survivors are particularly interested in dietary intakes that can improve long-term outcomes after cancer diagnosis and treatment [11]. After being diagnosed with cancer, survivors ask health care providers about healthier food choices and nutritional supplements that can improve their health and quality of life, treatment outcomes, and overall survival. However, research on the nutrition of cancer survivors is limited, and some nutritional advices are not appropriate or evidence based. The current dietary guidelines recommend cancer survivors to maintain an ideal weight and achieve a dietary pattern, such as eating more fresh vegetables, fruits, and whole grains, and to conform to the general guidelines of cancer prevention [11,12].

Nutritional assessment based on body composition would be more useful for health promotion of cancer patients. It is also important to define modifiable risk factors including dietary intake that contribute to sarcopenia. Previous studies on the nutrition status of Korean cancers survivors were only about the specific cancer type and might lack in representativeness [13,14]. Few studies have focused on the dietary intakes of survivors, considering body composition [15,16]. We hypothesized that cancer survivors are more vulnerable to sarcopenia compared with healthy individuals and it is related to different nutritional intake. To test this hypothesis, we compared body composition and dietary intakes of cancer survivors with their healthy counterparts using a nationally representative sample of Korean population.

2. Methods and materials

2.1. Data source and study participants

The participants of this study were men and women aged 19 years and over who participated in the Korea National Health and Nutrition Examination Survey (KNHANES) conducted in 2008–2011. The KNHANES is a nationally representative cross-sectional survey that evaluates the health and nutritional status of the Korean population of all ages [17]. The survey was performed by the Korea Centers for Disease Control and Prevention (KCDC). Further information can be found in the KNHANES website [18]. The data from KNHANES is available on request by email if the applicant logs onto the "Korea National Health and Nutrition Examination Survey" website and specifies with annual reports he or she needs. The KNHANES is based on a complex, multi-staged, stratified, clustered sample of the Korean population that represents them.

Among 28,377 adult participants of the KNHANES conducted from 2008 to 2011, 802 people reported that he or she had cancer before the investigation. We categorized them as the cancer survivor group if he or she answered "yes" to the question "Have you ever been diagnosed with cancer (stomach, liver, colorectal, breast, cervical, lung, thyroid, prostate, or other sites) by your doctor?" Participants who answered that they had benign neoplasm, skin neoplasm, carcinoma in situ, or ill-defined site cancer were not included as cancer survivors. Those who had two or more cancers were analyzed based on primary cancer. The cancer types and age of diagnosis of the cancer survivor group were further investigated. We also calculated the elapsed time since cancer diagnosis using the age at the time of the survey and age at the first primary cancer diagnosis. We excluded participants from the cancer survivor group when he/she has been diagnosed with one or more chronic diseases (arthritis, hypertension, diabetes mellitus, coronary heart disease [angina or myocardial infarction], stroke, asthma, or chronic obstructive pulmonary disease) by a physician.

Dual-energy X-ray absorptiometry (DXA; Hologic Discovery, Hologic Inc., Bedford, MA, USA) was performed from July 2008 to May 2011. A total of 575 cancer survivors completed the DXA according to the instructions. Finally, we analyzed the data of 259 cancer survivors (99 men and 160 women) who underwent body composition test and had no chronic disease.

To compare the body composition and dietary intake, we selected participants who are of similar age and sex and had no history of cancer and chronic disease. Considerable differences in age and sex distribution between cancer survivors and general population were observed. To balance these differences, we sampled the comparison group with 1:5 ratio allocations on sex and age group (ages 19–29, 30–39, 40–49, 50–59, 60–69, and over 70 years) at random. Finally, 1,295 healthy comparison participants who underwent body composition test and had no chronic disease were included in the analysis. Figure showed a flow of subjects selected for the study.

2.2. Study measurements

The residence area of the participants was classified into urban or rural areas. The urban areas included Seoul, Gyeonggi, and six major metropolitan cities in Korea. The rural areas included the eight remaining areas. Education level was classified according to grade that was achieved for less than nine years of schooling or otherwise. We categorized income based on individual income by quartiles, and lower quartile