

The association of physical activity and colorectal and breast cancer: The Fifth Korea National Health and Nutrition Examination Survey (2008-2011)

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Therapeutic importance of physical activity during and after cancer treatment has been supported. To examine the patterns of physical activity according to the stages of breast and colorectal cancer survivorship in Korean, Korean National Health and Nutrition Examination Survey data from 2008 to 2011 were used. International Physical Activity Questionnaire (IPAQ) was utilized to estimate weekly time spent in vigorous- and moderate-intensity physical activity, and walking, and to calculate MET-minute/week. Depending on the survivorship, the subjects were categorized into "never diagnosed with cancer" (group 1), "0-4 yr since cancer diagnosis" (group 2), and "5 or more years since cancer diagnosis" (group 3), separately for colorectal and breast cancer. The associations between physical activity and the cancer survivorship were studied. Following results were obtained: (1) Breast can-

cer ($n = 10,167$, mean age = 48.55 ± 16.27): The mean physical activity levels expressed in MET-minutes/week were 2,064.83, 1748.82, and 1998.36 in groups 1, 2, and 3, respectively. Even though cancer survivors tended to be less active compared to people without cancer, there were no statistically significant difference among the three groups. (2) Colorectal cancer ($n = 17,270$, mean age = 48.62): MET-minutes/week was 2064.30, 1084.83, and 709.04 36 in groups 1, 2, and 3, respectively. The differences were significant between group 1 and 2 ($F = 5.87$, $P = 0.016$) and group 1 and 3 ($F = 28.99$, $P < 0.001$). Despite potential therapeutic benefits of physical activity, colorectal cancer survivors were less active than people without cancer in Korea.

Keywords: Physical activity, Colorectal cancer, Breast cancer

INTRODUCTION

Lifestyle diseases, formerly known as adult diseases, are the result of a lack of exercise, hyper-nutrition, and an unhealthy lifestyle, and they cause cerebrovascular disease, cardiovascular disease, hypertension, and diabetes (Murray and Lopez, 1997). An unhealthy lifestyle leads to an increase in visceral fat and insulin resistance, both of which facilitate the development of various types of cardiovascular diseases (Völzke et al., 2015). The Korean National Statistical Office (2012) reported that the four leading causes of death from disease are cancer, cerebrovascular disease, cardiovascular disease, and diabetes.

The most common types of cancer in Korea, according to statistics from the National Cancer Information Center (2012), are stomach (18.5%), colorectal (15.5%) and lung (13.7%) cancer in

men, and thyroid (32.2%), breast (14.8%) and colorectal (10.3%) cancer in women. Colorectal cancer is also the third most common cancer in men and the second most common cancer in women over 65 yr of age (Boyle et al., 2013). The incidence of colorectal cancer in the last 10 yr has increased 5.9% per year. The survival rate of colorectal cancer was 73%, and it increased 17.8% from 2006 to 2008 (Jung et al., 2015). The incidence rates for colorectal and breast cancer are similar (National Cancer Information Center, 2012). These statistics indicate that colorectal and breast cancers are common in Korea.

On the other hand, 207,000 new cases of non-invasive breast cancer occurred in the United States in 2010, and 40,000 people are reported to have died from this disease (American Cancer Society, 2010). In Korea, an elevated incidence of thyroid cancer following breast cancer is observed in patients with an age of onset

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in the late 40s. The number of breast cancer cases increased 2.5 times over the last 10 yr, and the survival rate has gradually improved (National Cancer Information Center, 2012). The causes of cancer include genetic and environmental factors, unhealthy eating, over alcohol drinking, smoking, exercise, and lifestyle (American Cancer Society, 2010). The World Health Organization reported that lifestyle improvements, such as an increase in physical activity, reduce cancer risk. The Harvard Alumni Health Study (Paffenbarger et al., 1987) showed that a third of the total deaths were caused by cancer; after adjusting these results for age, smoking, and body mass index, the cancer risk was 50% higher in those who burnt less than 500 kcal per week performing physical activity. The Aerobics Center Longitudinal Study (Blair et al., 1989) analyzed fitness test results from 10,000 men and 3,000 women over eight years. The risk of developing cancer was 4.3 and 16.3 times higher in men and women, with low fitness levels compared to those with moderate fitness levels. Also, the risk of developing cancer was 2.8 times (men) and 1.7 times (women) higher in those with low fitness levels than that in those with high fitness level. These previous studies have emphasized the importance of exercise in the prevention of cancer. However, exercise that will further increase the cancer survival rate is also important. Korea is an aging society, and cancer survival rates are expected to continue to increase due to improvements in early diagnosis, cancer treatments, and modern testing technologies. In the United States, the number of colorectal and breast cancer survivors totaled 13.7 million in 2012, and this number is expected to reach 18 million in 2022 (Siegel et al., 2012).

With respect to cancer, both cancer patients and diagnosed survivors are interested in treatment and survival. Cancer patients have decreased physical strength and malnutrition during the treatment process. Patients diagnosed with cancer are more concerned with their quality of life, which can change after treatments (Kim et al., 2014). In particular, physical activity can be a major factor that determines the health status of cancer survivors (Fong et al., 2012). According to a meta-analysis that evaluated the ability of colorectal and breast cancer patients to participate in physical activities before and after their cancer diagnoses, there is an association between physical activity and reduced mortality risk; at least 150 min of moderate exercise per week lowered cancer survival rates by 24% and 28% for breast and colorectal cancer, respectively (Schmid and Leitzmann, 2015).

Therefore, the purpose of this study was to examine the patterns of physical activity of Korean breast and colorectal cancer survivors according to their disease stage. The results from this study

can be utilized as an important basic resource recognizing the importance of physical activity and as a strategic tool for exercise intervention programs in order to improve and extend the quality of life and reduce the death rate of cancer patients after diagnosis.

MATERIALS AND METHODS

This study was performed using data from the fifth Korea National Health and Nutrition Examination Survey (KNHANES V-2, 2011) with data collected from 2008 to 2011.

Participants

Depending on the cancer survivorship stage, the subjects were categorized as “never diagnosed with cancer” (Group 1), “0–4 years since cancer diagnosis” (Group 2), or “five or more years since cancer diagnosis” (Group 3), for colorectal and breast cancer. The characteristics of the subjects are shown in Table 1.

Physical activity

The International Physical Activity Questionnaire (IPAQ) was utilized to estimate physical activity levels. The subjects were instructed to answer written questions recalling their physical activity levels over the previous seven days. There were a total of seven survey questions regarding the level of indoor and outdoor activities, leisure time and all work-related physical activity. Their weekly physical activity was classified as walking (low intensity), moderate intensity, and vigorous activity. For each activity level, the number of sessions performed per week and their daily duration were evaluated. Using this information, exercise frequency (days per week) and exercise time (minutes per day) were calculated using the formulas below, which were then converted to total MET values representing total physical activity.

$$\text{Walking MET (min/week)} = 3.3 \times \text{Walking minutes} \times \text{days}$$

$$\text{Moderate MET (min/week)} = 4.0 \times \text{Moderate intensity activity minutes} \times \text{days}$$

$$\text{Vigorous MET (min/week)} = 8.0 \times \text{Vigorous intensity activity minutes} \times \text{days}$$

$$\text{Weekly Physical Activity (METs/week)} = \text{Walking MET} + \text{Moderate MET} + \text{Vigorous MET}$$

Data analysis

The Wald-test was used to examine the statistical significance of the association between physical activity and cancer survivorship stage. Sampling weights and a complex sampling design

were incorporated into all population-based estimations in this study. Stata 12.0 software was used, and all of the results were expressed as the means and the standard errors of the means. The significance level was set at $P < 0.05$.

RESULTS

Physical activity levels in colorectal cancer survivors

Physical activity levels and their association with colorectal can-

Table 1. Characteristics of subjects

		Age (yr)	
		M	SD
Colorectal cancer	Men (n=7,079)	48.64	15.19
	Women (n=10,191)	48.59	16.28
Breast cancer	Women (n=10,167)	48.55	16.27

Table 2. The association between physical activity level and colorectal cancer survivor stage

	Group	Mean	SD	Adjusted Wald-test		
				G1 vs G2	G2 vs G3	G1 vs G3
Vigorous (min/week)	G 1	105.4	3.14	F(1,808) = 1.58 P=0.209	F(1,808)=0.61 P=0.4359	F(1,808)=41.59 P<0.001*
	G 2	52.16	42.26			
	G 3	17.78	13.38			
Moderate (min/week)	G 1	143.51	4.08	F(1,808) = 13.39 P<0.001*	F(1,808)=0.63 P=0.4269	F(1,808)=44.18 P<0.001
	G 2	53.78	24.1			
	G 3	31.01	16.21			
Walking (min/week)	G 1	196.1	3.56	F(1,808)=2.15 P=0.143	F(1,808)=0.00 P=0.9585	F(1,808)=2.44 P=0.119
	G 2	137.1	40.06			
	G 3	134.17	39.37			
Weekly PA (MET)	G 1	2064.3	38.16	F(1,808)=5.87 P=0.016*	F(1,808)=0.64 P=0.4239	F(1,808)=28.99 P<0.001*
	G 2	1084.83	403.11			
	G 3	709.04	247.84			

*means statistically significant.

Table 3. The association between physical activity level and breast cancer survivor stage

	Group	Mean	SD	Adjusted Wald-test		
				G1 vs G2	G2 vs G3	G1 vs G3
Vigorous (min/week)	G 1	105.37	3.14	F(1,783)=0.65 P=0.422	F(1,783)=0.00 P=0.946	F(1,783)=0.45 P=0.501
	G 2	108.41	40.45			
	G 3	113.08	55.03			
Moderate (min/week)	G 1	143.54	4.09	F(1,783)=1.32 P=0.250	F(1,783)=0.50 P=0.481	F(1,783)=0.07 P=0.787
	G 2	95.41	33.42			
	G 3	154.25	77.01			
Walking (min/week)	G 1	196.26	3.58	F(1,783)=0.59 P=0.442	F(1,783)=0.02 P=0.885	F(1,783)=0.90 P=0.342
	G 2	151.49	36.18			
	G 3	144.45	36.45			
Weekly PA (MET)	G 1	2064.83	38.23	F(1,783)=0.00 P=0.969	F(1,783)=0.08 P=0.772	F(1,783)=0.13 P=0.724
	G 2	1748.82	413.53			
	G 3	1998.35	750.44			

cer survivor stage are shown in Table 2. There were significant differences in the amount of vigorous intensity activity between groups 1 and 3. Also, significant differences were observed between groups 1 and 2 for the moderate activity level. Weekly physical activity showed significant differences between groups 1 and 2 and between groups 1 and 3.

Physical activity level in breast cancer survivors

Physical activity levels and their association with breast cancer survivor stage are shown Table 3. No significant relationships were found. However, group 2 showed a trend toward reduced vigorous and moderate intensity activity and weekly physical activity levels compared to group 3. In other words, the physical activity level reduces for the first four years after breast cancer diagnosis, but it increases five years after breast cancer diagnosis; this implies that breast cancer treatment has less physical and I impact

on daily life patterns than colorectal cancer.

DISCUSSION

The survival period for colorectal and breast cancer is increasing due to the aging population and improvements to screening and cancer treatment methods. Participating in physical activity after cancer diagnosis improves physical function and reduces the mortality risk in colorectal and breast cancer survivors (Schmid and Leitzmann, 2015). However, in reality, physical activity is reduced during the cancer treatment period (Meyerhardt et al, 2009), but physical function and quality of life are similar to those of non-cancer patients one year after cancer surgery (Arndt et al, 2004). Cancer patients show a strong desire to change to a healthy lifestyle (Kim et al., 2014). These results imply that lifestyle patterns both before and after cancer diagnosis are important.

Physical activity is a particularly important health-related factor before and after cancer diagnosis, and it is beneficial for improving health condition and total cancer mortality (Baade et al., 2011; Meyerhardt et al., 2009). According to a meta-analysis (Schmid and Leitzmann, 2015), a 28% reduction in total mortality was associated with performing 150 min of at least moderate physical activity per week after colorectal cancer diagnosis, and this physical activity was also associated with a 14% reduction in the total mortality risk among colorectal cancer survivors. These results were not changed even after adjusting for tumor stage, cancer treatment, smoking, and adiposity. However, only 25.2% of colorectal cancer patients met American College for Sports Medicine (ACSM) guidelines for cancer survivors (Chung et al, 2013).

In this study, physical activity levels were significantly lower in colorectal cancer survivors than in non-diagnosed patients, and moderate and high intensity exercise was significantly lower in this patient population. These results indicate that colorectal cancer survivors were less active than people without cancer. Psychological satisfaction (Cadmus et al., 2009) and reduced lengths of hospitalization and time to flatus after colorectal cancer surgery (Ahn et al., 2013) are related to physical activity after cancer diagnosis. Performing at least 30 min of exercise on a regular basis resulted in a higher survival rate in lung cancer patients (Clark et al., 2008), but there are very limited exercise guidelines for colorectal patients. Kang et al. (2014) conducted a study on Korean colorectal cancer patients and identified fatigue, lack of exercise skill and confidence as exercise barriers. In the current study, physical activity levels were significantly lower in colorectal can-

cer survivors. Therefore, understanding patients' exercise barriers and motivations for physical activity as well as determining an effective exercise program are important for proper cancer treatment.

Although the positive effects of physical activity before and after breast cancer diagnosis were generally observed, there were no significant differences in the physical activity levels between the non-diagnosed breast cancer group and cancer survivors in this study, and even the level of high-intensity physical activity was somewhat similar between cancer survivors and non-cancer patients. Moderate exercise intensity has been well known for its importance in health management, and our results showed that moderate and high intensity physical activity was higher in Group 3 (5 yr breast cancer survivors) than in Group 1 (non-cancer diagnosis). Also, weekly physical activity was similar between cancer and non-cancer patients. These results imply that exercise intervention program have very little effect on breast cancer patients. Although previous research found no association between physical activity and breast cancer (Lee et al., 2001; Luoto et al., 2000; Moradi et al., 2000; 2002), exercise or physical activity should still be recommended to reduce abdominal fat and weight (Hulver et al., 2003). According to previous studies, breast cancer risk has been significantly related to body weight (Suzuki et al., 2006), adiposity (Macinnis et al., 2004), impaired glucose metabolism (Lin et al., 2006), serum adiponectin levels (Tian et al., 2007), and IL-6 levels (Hussein et al., 2004), which are all related to physical activity. Also, physical activity is still promoted to cancer survivors since it reduces the risk of other chronic diseases (US Department of Health and Human Services, 1996).

The lack of a significant relationship between the physical activity levels in breast cancer patients may be explained by the assessment method for physical activity. In this study, the data were obtained from the KNHANES survey of physical activity levels, and data were collected using a questionnaire assessed based on the participants' recollection (recall survey). Therefore, there was a chance of over- or underestimating the level of physical activity, potentially resulting in unreliable data. In the cancer risk and mortality studies, the results were depended on the age of the participant. Lee et al. (2001) stratified patients' entire life into four stages to analyze the relationship between breast cancer risk and physical activity, and they showed that physical activity was not clearly predictive of a lower risk of breast cancer. In another study, physical activity during the youth and adult period was associated with a lower breast cancer rate (Coogan et al., 1997; Moradi et al., 2002). These findings imply that the assessment method is im-

portant; a longitudinal study may compensate for this limitation.

In future studies analyzing breast cancer risk and physical activity, an intervention study with risk factors that are known to affect breast cancer, such as fat intake, dietary information (Velie et al., 2000), and family history should be performed. In addition, a larger sample size may provide sufficient statistical power to detect more subtle differences.

In summary, a significantly different physical activity level was observed in colorectal cancer survivors compared to non-cancer patients, but no significant differences were observed in breast cancer survivors. Breast cancer survivors seem to have fewer fitness barriers for physical activity, but physiological improvement with exercise should also be emphasized after breast cancer diagnosis. Individual health, medical history, and fitness level are important to achieve proper exercise in this population. These results provide evidence of the direct and indirect beneficial effects of exercise on colorectal cancer survivors.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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