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Research Article

Weight Gain and its Correlates among Breast Cancer Survivors

Soo Hyun Kim, RN, PhD, OCN,[1,*] Young Up Cho, MD, PhD,[2] Sei Joong Kim, MD, PhD[2]

[1] Department of Nursing at the Inha University, Incheon, South Korea
[2] Department of Surgery, Inha University Hospital, Inha University College of Medicine, Incheon, South Korea

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SUMMARY

Purpose: Weight gain after diagnosis of breast cancer is a profound issue that may negatively impact cancer prognosis. However, most existing research on weight change has been conducted in Western countries. In addition, several factors related to weight gain have been reported; however, the evidence is inconsistent. The purpose of this study was to examine weight gain and its correlates among Korean breast cancer survivors.
Methods: A total of 132 female breast cancer survivors were recruited from one university hospital in South Korea. Participants completed anthropometric measurements (i.e., body weight, height) and a self-reported questionnaire, including the International Physical Activity Questionnaire Short Form and Mini Dietary Assessment.
Results: The mean weight change was −0.09 kg ($SD = 4.28$). Only 27 women (19.7%) gained more than 5% of their weight at diagnosis, 59.1% maintained weight, and 21.2% lost weight. In multivariate logistic regression analysis, significant correlates of weight gain were younger age, obesity at diagnosis, duration of more than 36 months since diagnosis, and low diet quality.
Conclusion: Younger women, women who were obese at diagnosis, women with more than 36 months since diagnosis, or women who showed lower diet quality should be considered at high-risk for weight gain. Findings from our study suggest that optimal weight management strategies should be developed using ethnically- or culturally-appropriate approaches.

Introduction

Breast cancer is the second most commonly diagnosed cancer among Korean women (National Cancer Information Center, 2012). Although the incidence of breast cancer in Korea is lower than that in Western countries, it is rapidly increasing, with an annual growth rate of 6.3% (National Cancer Control Institute). Due to early detection and advanced medical treatment, the 5-year survival rate in Korean breast cancer patients has increased from 77.9% in 1993–1995 to 90.6% in 2005–2009 (National Cancer Control Institute), which is comparable to that in the United States and Canada. As the number of breast cancer survivors increased, cancer survivorship issues among this population have become more important.

Weight gain is a common and persistent problem for many breast cancer survivors (Vance, Mourtzakis, McCargar, & Hanning, 2011). As many as 50–96% of women diagnosed with breast cancer experience significant weight gain during treatment (Rock & Demark-Wahnefried, 2002). Weight gain usually ranges from 1.0 kg to 6.0 kg during the first year after diagnosis (Demark-Wahnefried et al., 2001; Goodwin, 2001; Irwin et al., 2005; Makari-Judson, Judson, & Mertens, 2007). Several studies have reported that weight gain after breast cancer diagnosis may have a negative impact on quality of life, increase the risk for recurrence, and shorten survival time (Chlebowski, Aiello, & McTiernan, 2002; Demark-Wahnefried, Rimer, & Winer, 1997; Kroenke, Chen, Rosner, & Holmes, 2005).

Weight gain is more common in women receiving adjuvant chemotherapy, particularly for women undergoing treatments that require a longer duration, and it appears to be especially pronounced in premenopausal women (Caan et al., 2008; McInnes & Knobf, 2001; Vance et al., 2011). Other factors suggested to influence weight gain after cancer diagnosis include age (Caan et al., 2008; Chen et al., 2011; Gu et al., 2010), advanced disease stage (Caan et al., 2008; Gu et al.; Irwin et al., 2005; Saquib et al., 2007), decreased physical activity (Demark-Wahnefried et al., 1997; Irwin et al.; Rock et al., 1999) and increased energy intake (Chen et al.; Demark-Wahnefried et al., 1997; Rock et al., 1999). However, the evidence is limited and inconsistent. For example, Goodwin et al. (1999) reported that adjuvant chemotherapy was a strong and independent clinical factor of weight gain. The Health, Eating,

* Correspondence to: Soo Hyun Kim, RN, PhD, OCN, Department of Nursing, Inha University, 253 Yonghyun-dong, Nam-gu, Incheon 410-742, South Korea.
E-mail address: soohyun@inha.ac.kr

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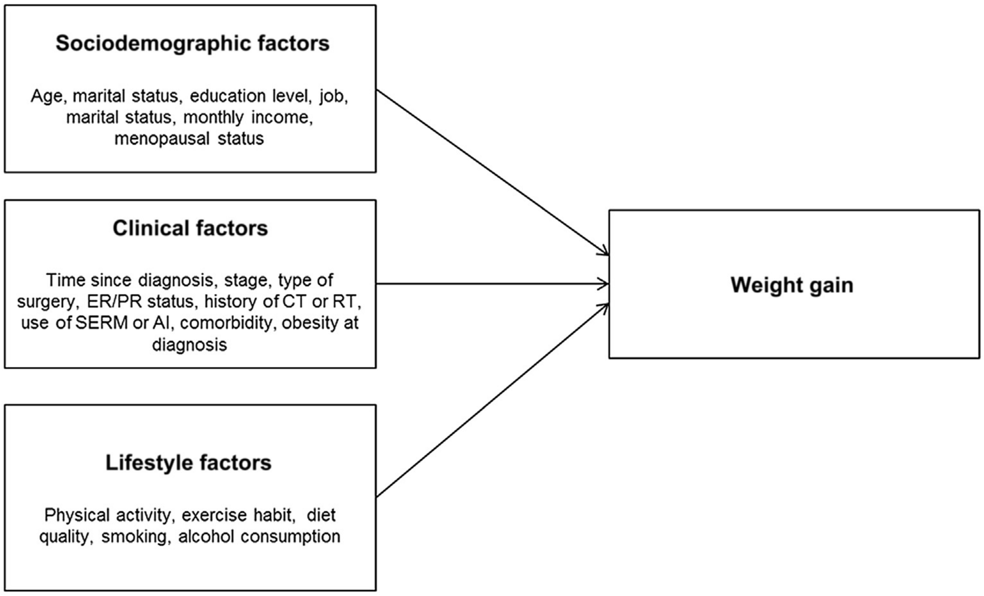

Figure 1. Conceptual framework for the study. *Note.* ER = estrogen receptor; PR = progesterone receptor; CT = chemotherapy; RT = radiation therapy; SERM = selective estrogen receptor modulator; AI = aromatase inhibitor.

Activity, and Lifestyle Study reported an association of receiving chemotherapy with greater weight gain (Irwin et al.). However, a Korean study found that women with early stage breast cancer did not gain weight after adjuvant chemotherapy (Han et al., 2009), which was similar to the results of the study by Campbell, Lane, Martin, Gelmon, and McKenzie (2007) in Canada. In addition, premenopausal status showed a significant association with weight gain (Caan et al., 2008; Chen et al.; Heideman, Russell, Gundy, Rookus, & Voskuil, 2009), contradicting findings from the Health, Eating, Activity, and Lifestyle Study (Irwin et al.) and the Korean study (Han et al.).

Most existing research on weight change has been conducted in Western countries, where the prevalence of obesity is relatively high (Demark-Wahnefried et al., 2001; Goodwin et al., 1999; Irwin et al., 2005; McInnes & Knobf, 2001; Rock et al., 1999). The prevalence of obesity [body mass index (BMI) $\geq$ 30 kg/m^2] and of overweight and obesity combined (BMI $\geq$ 25 kg/m^2) in the US were 35.7% and 68.8% (Flegal, Carroll, Ogden, & Curtin, 2010), respectively. On the other hand, those in Korea were 3.9% and 30.9%, respectively (Oh, 2011). Because there are differences in the epidemiology of obesity and breast cancer between Asian and Western regions, there may also be ethnic differences in the pattern of weight gain after initiation of breast cancer treatment (Han et al., 2009). However, few studies have investigated weight change and related factors among Asian women after breast cancer diagnosis. Han and colleagues conducted a retrospective study of weight change after breast cancer diagnosis among the Korean population. They found no weight gain after adjuvant therapy for breast cancer, which is inconsistent with previous findings from Western countries (Chlebowski et al., 2002; Demark-Wahnefried et al., 1997; Goodwin et al., 1999; McInnes & Knobf). However, in a population-based cohort study among Chinese women, Gu et al. (2010) reported that weight gain was common over the first 3 years after breast cancer diagnosis. Thus, patterns of weight change among Asian breast cancer survivors remain controversial. In addition, there were differences in the correlates of weight change. For example, in the study by Han et al., BMI at diagnosis and hormone therapy showed significant correlations with weight change, while in the study by Gu et al., age, stage and comorbidity were significant factors showing an association with weight gain. These two studies only evaluated correlates in terms of sociodemographic and clinical factors while they did not include lifestyle factors related to weight gain.

Therefore, the aims of the current study were to examine the prevalence of weight gain and its correlates among Korean breast cancer survivors. For comprehensive identification of correlates of weight gain, we developed a conceptual framework that included sociodemographic, clinical, and lifestyle factors for explaining weight gain (Figure 1). We expect that our findings will help identify women who are most at risk and will inform the development of culturally-appropriate weight management interventions aimed at promoting overall health and long-term survivorship.

Methods

Study design

This study used a retrospective and cross-sectional descriptive study design.

Setting and sample

Participants were breast cancer survivors from the outpatient department of the breast cancer center at a university hospital in South Korea. Participants were included in this study if they (a) were women who had histologically confirmed stage I–III breast cancer, (b) had received at least one treatment for breast cancer, and (c) had completed their primary treatment, except hormone therapy. Participants were excluded if they (a) had distant metastasis, (b) had a previous or concurrent history of other cancer(s), or (c) did not have a baseline body weight.

To verify the statistical power of our sample, we used the G*Power 3.1 software (Faul, Erdfelder, Buchner, & Lang, 2009). The sample size required in logistic regression method was 132 with the following parameters: odds ratio (OR) = 1.69, Cronbach's α = .05, power = 80%, rate of outcome = 44% based on previous research (Saquib et al., 2007). Of the 185 breast cancer survivors screened from July 2010 to March 2011, 160 women met the selection criteria and were invited to participate in this study. A total of 132 women participated voluntarily in the study, giving a response rate of 82.5%.

Ethical consideration

At the meeting with each participant, the researcher explained the purpose and the procedures of the study and obtained written informed consent before the data collection procedure. Participants were informed that they were not obliged to participate in the study and could withdraw any time they wished. The participating institutional review board reviewed and approved the protocol and consent form for the study.

Measurements

Anthropometric measurements

Body weight and height. A trained research nurse took anthropometric measurements twice according to a standard protocol. Weight was measured to the nearest 0.1 kg using a digital weight scale (Seca model 707; Vogel & Halke GmbH & Co., Hamburg, Germany). Participants were weighed while wearing light clothes and no shoes; participants' height was also measured without shoes. Information on body weight and height at diagnosis was extracted from medical records.

BMI. BMI was calculated by dividing weight (kg) by height (m) squared. Overweight and obesity were categorized according to the World Health Organization (WHO) criteria for Asians (WHO & International Association for the Study of Obesity, International Obesity Task Force, 2000). In 2000, the Regional Office for the Western Pacific Region of WHO, the International Association for the Study of Obesity, and the International Obesity Task Force proposed a separate classification of obesity for Asians, i.e., a BMI of $\geq$25 kg/m^2.

Weight change. Relative percent weight changes between current weight and weight at diagnosis were calculated {[current weight (kg)−weight at diagnosis (kg)]/weight at diagnosis (kg)} $\times$ 100. The participants were then categorized into three groups: weight loss group (loss $\geq$ 5%), weight stable group (within 5%), and weight gain group (gain $\geq$ 5%). These change categories were chosen because they were commonly used in previous studies (Caan et al., 2008; Gu et al., 2010; Han et al., 2009; Saquib et al., 2007).

Lifestyle variables

Physical activity. Physical activity was assessed using the International Physical Activity Questionnaire Short Form (IPAQ-SF) (Craig et al., 2003). This is a 9-item scale that assesses the number of minutes spent in vigorous and moderate intensity activity and walking during the last 7 days. Participants were required to define how many days and how many minutes they spent at a specific activity category. For all categories, the amount of metabolic equivalent task (MET)-minutes was calculated by multiplying the number of minutes by 8 (*vigorous*), 4 (*moderate*), 3.3 (*walking*), or 1.3 (*sitting*). Based on these calculations, three classification groups were arbitrarily defined: low (< 3 MET-hour/week), moderate (3–21.9 MET-hour/week), and high ($\geq$ 22 MET-hour/week). A reliability and validity study previously conducted in 14 centers in 12 countries reported acceptable measurement properties of IPAQ-SF for monitoring population-level PA among 18–65-year-old adults in diverse settings (Craig et al.).

Exercise habits. Because the IPAQ-SF provides the overall level of physical activity, we also collected information about participants' exercise habits in the past year (type of exercise, frequency, time). However, this was limited to examining specific exercise behaviors. Current public health exercise guidelines recommend exercise of moderate intensity for more than 150 minutes/week or of vigorous intensity for more than 75 minutes/week (Kushi et al., 2006; Schmitz et al., 2010). Thus, we calculated total minutes per week by combining the measures of moderate and vigorous exercise.

Diet quality. We assessed diet quality using the Mini Dietary Assessment Index for Koreans (MDA) (Kim, Cho, & Lee, 2003) This was developed for assessment of the quality of the Korean diet and for screening nutritional status. It includes a total of 10 questions on meal regularity, diet diversity, intake frequency for each food group and snacks, and preference for salty taste. Answers to most questions receive 5, 3, and 1 points for *always true*, *sometimes true*, and *not necessarily true*, respectively. However, questions on the frequency of consuming snacks and high fat food and on preference for salty taste receive 1, 3, and 5 points for answers of *always true*, *sometimes true*, and *not necessarily true*, respectively. The total possible score is 50. Higher MDA scores reflect a higher quality diet. MDA shows high reliability and validity (Kim et al.) and has been used in various settings in Korea.

Smoking and alcohol consumption. These two items were based on items in the Korean National Health and Nutrition Examination Survey. Smoking behavior was categorized as "never smoker," "past smoker," and "current smoker". Alcohol consumption was assessed in terms of type of alcohol and frequency of drinking.

Procedure

A research nurse identified potential participants, conducted in-person interviews and explained the purpose of the study. Each participant received an informed consent form and was administered a questionnaire including questions on sociodemographic (i.e., age, education level, job, monthly income, & menopausal status) and lifestyle factors (i.e., physical activity, exercise habit, diet quality, smoking behavior, & alcohol consumption). After completion of the questionnaire, the weight and height of each participant were measured. Medical charts were reviewed to collect information on clinical factors (i.e., time since diagnosis, stage, type of surgery, hormone status, history of chemotherapy or radiation therapy, use of antihormone agents, comorbidity, and obesity at diagnosis) and weight/height at diagnosis.

Data analysis

Descriptive statistics were performed for all sociodemographic, clinical, lifestyle characteristics, and anthropometric data. To test our hypotheses, we reclassified the outcome variable of weight change from three groups to two groups (i.e., weight gain group vs. weight stable/weight loss group). For multivariate analyses, the associations of individual sociodemographic, clinical, and lifestyle characteristics and weight gain were examined separately using simple logistic regression analysis. Variables that were significant or nearly significant factors showing association with weight gain in univariate tests (i.e., simple logistic regression analysis; $p < .10$) were considered for use in the final model of multivariate logistic regression analysis (Goodwin et al., 1999). Multicollinearity was examined using the variance inflation factor. A two-sided $p < .05$ indicated statistical significance. We performed data analysis using SPSS 19.0 version (SPSS Inc., Chicago, IL, USA).

Results

Sociodemographic, clinical, and lifestyle characteristics of participants

The mean age of the women was 51.48 years ($SD = 7.58$). Most were married and more than half of the participants had more than

Table 1 *Sociodemographic, Clinical, and Lifestyle Characteristics of Study Participants (N = 132)*

Characteristic	*n* (%)	*M* ± *SD*
Age (yr)		51.48 ± 7.58
<50	55 (41.7)	
≥50	77 (58.3)	
Marital status		
Married	124 (93.9)	
Divorced/widowed/single	8 (6.1)	
Education level		
<High school	47 (35.6)	
≥High school	85 (64.4)	
Job		
Yes	49 (37.1)	
No	83 (62.9)	
Monthly income (US$)		
<2,000	43 (32.6)	
≥2,000	89 (67.4)	
Menopausal status at diagnosis		
Premenopausal	91 (68.9)	
Postmenopausal	41 (31.1)	
Time since diagnosis (month)		34.11 ± 26.07
<12	21 (15.9)	
12–35	58 (43.9)	
≥36	53 (40.2)	
Stage		
0–I	56 (42.4)	
II	56 (42.4)	
III	20 (15.2)	
Estrogen receptor status		
Yes	102 (77.3)	
No	28 (21.2)	
Missing	2 (1.5)	
Progesterone receptor status		
Yes	93 (70.5)	
No	37 (28.0)	
Missing	2 (1.5)	
Type of surgery		
Mastectomy	71 (53.8)	
Breast conserving surgery	61 (46.2)	
Received chemotherapy		
Yes	106 (80.3)	
No	26 (19.7)	
Type of chemotherapy regimen (*n* = 106)		
AC	51 (48.1)	
TAC	37 (34.9)	
CMF	13 (12.3)	
Others	5 (4.7)	
Received radiation therapy		
Yes	78 (59.1)	
No	54 (40.9)	
Current or past use of SERM		
Yes	87 (65.9)	
No	45 (34.1)	
Current or past use of AI		
Yes	26 (19.7)	
No	106 (80.3)	
Comorbidity		
Yes	43 (32.6)	
No	89 (67.4)	
Physical activity		
IPAQ classification (*n* = 118)		
Low	29 (24.6)	
Moderate	59 (50.0)	
High	30 (25.4)	
Meet criteria of public recommendation[a]		
Yes	81 (61.4)	
No	51 (38.6)	
Diet quality		
MDA total score		40.82 ± 5.28
Smoking		
Never	119 (90.1)	
Past	8 (6.1)	
Current	5 (3.8)	
Alcohol consumption (frequency)		
Never	98 (74.3)	
≤1/month	13 (9.8)	
2–4/month	14 (10.6)	
2–3/week	6 (4.5)	
≥4/week	1 (0.8)	

Note. AC = doxorubicin + cyclophosphamide; TAC = docetaxel + doxorubicin + cyclophosphamide; CMF = cyclophosphamide + methotrexate + fluorouracil-1; SERM = selective estrogen receptor modulator; AI = aromatase inhibitor; IPAQ = International Physical Activity Questionnaire; MDA = Mini Dietary Assessment.

[a] Criteria for public recommendation of exercise was defined as exercise more than 150 minutes/week with moderate intensity or 75 minutes/week with vigorous intensity.

a high school education. The majority of the women (68.9%) were premenopausal at diagnosis. The mean duration of time from diagnosis to study entry was 2.84 years (*SD* = 2.17). The majority received chemotherapy (80.3%) and 59.1% of participants received radiation therapy. According to the IPAQ-SF classification, 24.6% of the participants had low physical activity, 50.0% had moderate physical activity, and 25.4% had high physical activity. Eighty-one women (61.4%) met the criteria of the public recommendation for physical activity (i.e., 150 minutes or more per week). The mean total MDA score was 40.82 (*SD* = 5.28). The majority had no experience with smoking; only 13 women (9.9%) reported being past or current smokers. Most women (74.3%) reported not drinking any alcohol (Table 1).

Weight change

The mean weight change was −0.09 kg (*SD* = 4.28). Of the 132 participants, more than half (59.1%) maintained their weight, 19.7% gained more than 5% of their weight at baseline, and 21.2% lost weight. The proportion of overweight or obese participants decreased from diagnosis to study entry. At the time of breast cancer diagnosis, 64.4% of women were overweight or obese (BMI ≥ 23 kg/m^2) and 62.2% were overweight or obese at study entry (Table 2).

Correlates of weight gain

The univariate analyses of associations between weight gain and sociodemographic, clinical, and lifestyle factors are presented in Table 3. Variables associated in the univariate analysis at a level where $p < .10$ were considered for inclusion in the multivariate model. In univariate analyses, younger age (i.e., age < 50 years;

Table 2 *Descriptive Statistics of Weight Change (N = 132)*

Characteristic	*n* (%)	*M* ± *SD*
At diagnosis		
Weight (kg)		59.69 ± 9.20
Overweight or obesity (BMI ≥ 23.0 kg/m^2)	85 (64.4)	
At study entry		
Weight (kg)		59.60 ± 9.34
Overweight or obesity (BMI ≥ 23.0 kg/m^2)	82 (62.2)	
Weight change (kg)		−0.09 ± 4.28
Weight change classification[a]		
Weight loss group	28 (21.2)	
Weight stable group	78 (59.1)	
Weight gain group	26 (19.7)	

Note. BMI = body mass index.

[a] Weight loss group = {[current weight (kg)−weight at diagnosis (kg)]/weight at diagnosis (kg)} × 100 ≤ −5%; weight stable group = −5% < {[current weight (kg)−weight at diagnosis (kg)]/weight at diagnosis (kg)} × 100 < 5%; weight gain group = {[current weight (kg)−weight at diagnosis (kg)]/weight at diagnosis (kg)} × 100 ≥ 5%.

Table 3 *Univariate and Multivariate Analyses of Correlates of Weight Gain (N = 132)*

Variables	Univariate analysis			Multivariate analysis		
	OR	95% CI	*p*	aOR	95% CI	*p*
Age < 50 years (ref. ≥ 50 years)	2.75	1.14–6.65	.025	3.75	1.28–11.02	.016
Married (ref. unmarried or widowed or divorced)	2.64	0.59–11.82	.206			
<High school graduation (ref. ≥ high school graduation)	1.17	0.48–2.83	.735			
Having a job (ref. no job)	2.89	1.20–6.95	.018	2.30	0.83–6.38	.110
Monthly income < US$2,000 (ref. ≥ US$2,000)	1.12	0.45–2.77	.804			
Premenopausal at diagnosis (ref. postmenopausal at diagnosis)	0.98	0.39–2.49	.971			
Time since diagnosis ≥ 36 months (ref. time since diagnosis < 36 months)	3.67	0.11–0.67	.005	4.71	1.58–14.06	.005
Stage ≥ IIb (ref. stage = I or IIa)	1.12	0.43–2.94	.815			
Positive ER (ref. negative ER)	3.79	0.84–17.16	.084			
Positive PR (ref. negative PR)	1.75	0.61–5.08	.301			
Mastectomy (ref. breast conserving surgery)	1.22	0.51–2.90	.656			
Received chemotherapy (ref. not received chemotherapy)	1.44	0.45–4.61	.539			
Received radiation therapy (ref. no radiation therapy)	0.93	0.39–2.22	.871			
SERM use (ref. no SERM use)	2.55	0.89–7.28	.082	2.26	0.68–7.48	.182
AI use (ref. no AI use)	0.69	0.22–2.22	.539			
Having a comorbid condition (ref. no comorbid condition)	1.11	0.44–2.80	.826			
Obesity at diagnosis (ref. BMI < 25.0 kg/m^2)	3.70	1.52–9.03	.040	3.45	1.24–9.63	.018
Low physical activity (ref. IPAQ = high or moderate group)	1.81	0.56–5.82	.318			
Unmet public guideline of exercise (ref. weekly minutes of moderate intensity exercise ≥ 150 min)	1.21	0.51–2.89	.668			
Low diet quality (ref. MDA score ≥ 40.8)[a]	2.17	0.90–5.22	.084	2.12	1.15–6.54	.042
Current or past smokers (ref. never smokers)	0.15	0.04–1.28	.231			
Drinking ≥ 2 times/week (ref. < 2 times/week)	0.31	0.07–1.48	.142			

Note. OR = odds ratio; aOR = adjusted odds ratio; ref. = reference group; ER = estrogen receptor; PR = progesterone receptor; SERM = selective estrogen receptor modulator; AI = aromatase inhibitor; BMI = body mass index; IPAQ = International Physical Activity Questionnaire; MDA = Mini Dietary Assessment.
[a] This categorization was based on the mean score of MDA in our sample.

OR = 2.75, *p* = .025), having a job (OR = 2.89, *p* = .018), duration of more than 36 months since diagnosis (OR = 3.67, *p* = .005), estrogen receptor (ER) positive (OR = 3.79, *p* = .084), use of selective estrogen receptor modulators (SERM; OR = 2.55, *p* = .082), obesity at diagnosis (OR = 3.70, *p* = .040), and low diet quality (i.e., below the mean score of MDA; OR = 2.17, *p* = .084) were associated with weight gain.

Before entering the seven factors into a multivariate model, we checked for multicollinearity. Although there was no problem of multicollinearity using the variance inflation factor (range: 1.004–1.839) among the seven potential correlates of weight gain, we detected a potential clinical multicollinearity problem between ER status and SERM use. Among women who are ER positive, most should use SERM. Therefore, we did not include a variable of ER status in the final model. Thus, six factors derived from univariate analysis were entered into the multivariate model simultaneously. The overall model exhibited a good fit with the data ($\chi^2 = 35.181$, $p < .001$, Nagelkerke $R^2 = .436$). In multivariate logistic regression analysis, four variables were found to be significant correlates of weight gain: younger age (OR = 3.75, *p* = .016), duration of more than 36 months since diagnosis (OR = 4.71, *p* = .005), obesity at diagnosis (OR = 3.45, *p* = .018), and lower diet quality (OR = 2.12, *p* = .042) (Table 3).

Discussion

Weight gain is a common phenomenon among breast cancer survivors (Chen et al., 2011; Chlebowski et al., 2002; Demark-Wahnefried et al., 1997; Goodwin et al., 1999; Gu et al., 2010; McInnes & Knobf, 2001; Vance et al., 2011). However, the findings of the current study do not support the existing evidence indicating that women tend to gain weight after breast cancer therapy. In contrast with the majority of studies conducted in the West, we observed no weight gain in our Korean breast cancer survivors. Of particular interest, factors showing an association with weight gain were somewhat different than those reported in previous studies.

In the current study, the mean weight change was −0.09 kg. Only 19.7% of the participants reported weight gain of more than 5% of their weight at diagnosis, which was much lower than in previous data from the West (range: 38.9%–47.8%; Caan et al., 2006, 2008; Saquib et al., 2007) or from Asian countries (Gu et al., 2010; Yaw et al., 2011). Han et al. (2009) observed no weight gain after adjuvant therapy among Korean breast cancer survivors. In that study (Han et al.), the mean weight changes were −0.3 kg at 1 year and −0.4 kg at 2 years after cancer treatment, and only 10% of women gained more than 5% of baseline body weight at 1 year. These results were in line with our findings. However, data on weight change in Asian populations are limited; therefore, more research in this area is needed.

Lack of weight gain after treatment among Korean breast cancer survivors may be a unique phenomenon. This discordant finding may be related to characteristics of breast cancer occurrence in Korea. Compared with their counterparts from Western countries, Korean patients characteristically develop breast cancers at a younger age. The median age of Korean breast cancer patients is in the late 40s, which is more than 10 years younger than that of patients from North America or Europe. In addition, approximately half of Korean breast cancer patients are under the age of 50 (Jung et al., 2011). Second, dietary habits of Korean people may be partially responsible for the lack of weight gain. Most Korean patients with breast cancer believe that eating meat could increase the risk of recurrence and therefore tend to avoid eating meat (Min et al., 2008). Our data on diet quality supported this speculation; the score for intake of meat, fish, and eggs was the second lowest item. This change in diet could influence the pattern of weight change in our participants. Third, hospital-based education could contribute to the lack of weight gain observed in our study. The hospital that participated in this study runs a group education class for patients who are admitted for surgery. Weight management is one of the main topics in this class. Most patients come to understand that weight gain may negatively impact their prognosis. Finally, another possible explanation may be related to chemotherapy in our study. In this study, two thirds of the participants received anthracycline-based chemotherapy, administered over a relatively short period of time. Previous research has indicated that weight gain was higher among women who underwent treatment with chemotherapy over longer periods of time (Demark-Wahnefried, Winer, & Rimer, 1993).

We examined the correlates of weight gain, including sociodemographic, clinical, and lifestyle factors. Among sociodemographic characteristics, age was a significant factor showing an association with weight gain. In our study, we found that younger women were more likely to gain weight than older women were, consistent with earlier reports (Demark-Wahnefried et al., 2001; Goodwin, 2001; Irwin et al., 2005; Rock et al., 1999). Previous studies have reported a significant correlation of premenopausal status at diagnosis with greater weight gain (Campbell et al., 2007; Demark-Wahnefried et al., 1993, 1997; Huntington, 1985; McInnes & Knobf, 2001). However, not all studies have reported such a finding (Han et al., 2009; Irwin et al.; Rock et al., 1999). In this study, we did not find this association. According to Heideman et al. (2009), weight gain was largely limited to premenopausal women, who gained an average of 3.9 kg. Thus, this relationship may not be apparent in our study, which revealed no weight gain. The association between menopausal status and weight change remains controversial and further research is needed.

Among clinical factors, two factors showed significant correlation with weight gain. In our study, time since diagnosis showed a significant association with weight gain. Women who had received their diagnosis more than 36 months ago were more likely to gain weight than women who had not; this finding was similar to that reported by Caan et al. (2006). Second, obesity status at diagnosis showed a significant association with weight gain. This result was contradictory to findings from previous studies (Gu et al., 2010; Yaw et al., 2010) In our study, women who were obese at diagnosis were more likely to gain weight than women who were not, whereas in two previous studies, women who were obese at diagnosis had lower risk of weight gain (Gu et al.; Yaw et al., 2010). Differences in study design, characteristics of the study populations, or categorization of BMI may account for the discrepancies between our study and previous studies (Gu et al.; Yaw et al., 2010).

A relationship between lifestyle factors and weight gain in breast cancer survivors has been suggested (Chen et al., 2011; Demark-Wahnefried et al., 2001; Goodwin, 2001; Irwin et al., 2005; Rock et al., 1999; Yaw et al., 2011). However, this relationship has not been fully evaluated and evidence has been inconsistent. Factors previously reported as significant correlates of weight gain included low levels of physical activity (Rock et al., 1999), higher levels of energy intake (Chen et al.; Rock et al., 1999), and smoking (Chen et al.). In our study, diet quality showed an independent association with weight gain. This is a new finding. Previous researchers have only evaluated intake of specific nutrients or energy intake. However, the findings of our study suggest that assessment of diet quality may also be important for weight management education for women with breast cancer after therapy.

This study has several limitations. Our sample was recruited from only one university hospital and the small sample size of this study may not be representative of the population of women with breast cancer in Korea. This study was a retrospective study with a cross-sectional study design, which causes difficulty in identification of cause-and-effect relationships with regard to weight gain. A longitudinal study design is most appropriate for identification of such relationships. On the other hand, our study has several strengths. First, we collected detailed information on sociodemographic, clinical, and lifestyle factors, which allowed a comprehensive evaluation of correlates of weight gain. Second, trained nurses performed anthropometric measurements during study recruitment, and medical charts were reviewed for collection of information on weight at cancer diagnosis. Third, because relatively little is known about weight gain among Asian breast cancer survivors, this study adds to our knowledge.

Conclusions

In conclusion, the results of this study indicate that weight gain is not common among Korean breast cancer survivors. In this study, younger age, obesity at diagnosis, duration of more than 36 months since diagnosis, and lower diet quality showed significant correlation with weight gain. These findings differ from those of previous studies conducted in Western countries; therefore, the results of the current study suggest that nurses should provide ethnically- or culturally-appropriate weight management intervention. Among the Korean population of women with breast cancer, women who were obese at diagnosis and women who received their diagnosis more than 36 month ago should receive special attention. Early identification of these women and close monitoring are important, so that timely and appropriate counseling may be offered.

Conflict of Interest

The authors have no conflicts of interest to disclose.

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