RESEARCH ARTICLE

Obesity and Screening Compliance for Breast and Cervical Cancer in Korean Women

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Abstract

Purpose : This study was performed to assess whether the weight status is associated with screening rates of breast and cervical cancer in Korean women. Methods: Study participants included women aged between 30 and 80 years from the 4th Korea National Health and Nutrition Examination Survey from 2007 to 2009. Body mass index was classified into ~18.4 kg/m^2 (underweight), 18.5~22.9 kg/m^2 (normal), 23~24.9 kg/m^2 (overweight), 25.0~29.9 kg/m^2 (moderate obesity) and 30.0 kg/m^2~ (severe obesity) according to the Asia Pacific Standards of WHO recommended definition of obesity. Screening rates of breast and cervical cancer were estimated by the recommendation of the National Cancer Screening Program of the National Cancer Center, Korea. Results : The overall screening rates for breast and cervical cancer were 51.3% and 50.1%, respectively. After covariate adjustment, the screening rates for breast cancer (adjusted odds ratio, 0.70; 95% confidence interval, 0.51 to 0.97) and cervical cancer (adjusted odds ratio, 0.71; 95% confidence interval, 0.53 to 0.94) were significantly lower in the women with severe obesity. Conclusion: Obesity is associated with lower compliance with breast and cervical cancer screening guidelines in Korean women.

Key words: Body mass index - breast cancer - cervical cancer - cancer screening - compliance

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Introduction

Obese women are at increased risk for breast, and cervical cancer (Calle et al., 2003). However, Western studies showed that the obese women were less likely to undergo cancer screening such as mammogram and Papanicolaou (Pap) smears compared to the normal weight women (Cohen et al., 2008).

The effect of weight status on cancer screening is dependent on the ethnicity and the types of the screening tests. For example, the influence of obesity on the gynecologic cancer screening adherence is more pronounced in white than in black women (Fagan et al., 2011). Cervical cancer screening rates correlated inversely with body weight, while prostate specific antigen testing for prostate cancer screening increased with increasing weight (Fagan et al., 2011).

In order to reduce the mortality from breast and cervical cancer in Korean, it is important to elucidate whether the obesity is a barrier to screening compliance in Korean high risk women. This issue has never been investigated in a population-based study in an Asian country. This study is to assess whether the weight status is associated with the screening rates of breast and cervical cancer in Korean women by using a representative sample of Korean women.

Materials and Methods

The Korea National Health and Nutrition Examination Survey (KNHANES)

The KNHANES is a population based cross-sectional survey to assess the health related behavior, the health condition, and the nutritional state of the Koreans. It consists of the Health Interview Survey (HIS), the Nutrition Survey (NS), and the Health Examination Survey (HES). This study included all women aged between 30 and 80 years who participated in both the HIS and the HES of 4th KNHANES from 2007 to 2009. Detailed descriptions of the plan and operation of the survey have been described on the KNHANES website (http://knhanes.cdc.go.kr/).

Screening history of breast and cervical cancer

Data on the breast and cervical screening history were obtained through self-administered questionnaires. Screening rate was estimated by the recommendation of the National Cancer Screening Program (NCSP) of the National Cancer Center, Korea, which recommended breast cancer screening every 2 years with a mammogram for women aged 40 years or older and cervical cancer screening every 2 years with a Pap test for women aged 30 years or older.

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Table 1. Baseline Characteristics according to Body Mass Index Categories

Mean or proportion (SE)	Body Mass Index (kg/m^2)						
	<18.5	18.5-22.9	23.0-24.9	25.0-29.9	30.0-	total	P[a]
Analytic sample for breast cancer screening[b]							
Unweighted n, weighted %	132, 2.6 (0.3)	1906, 37.7 (0.9)	1319, 25.6 (0.8)	1629, 29.8 (0.8)	227, 4.5 (0.3)	5213	0.035
Absolute screening rate[c]	53.5 (5.8)	53.5 (1.4)	52.1 (1.6)	49.1 (1.5)	42.2 (3.6)	51.3 (0.9)	
Age	43.6 (0.9)	47.0 (0.3)	51.4 (0.4)	54.0 (0.4)	50.3 (0.9)	49.9 (0.2)	<0.001
Urban residing	69.2 (6.1)	79.2 (2.0)	79.2 (2.1)	75.5 (2.3)	79.5 (3.3)	77.9 (1.9)	0.04
Household income quartile							
Lowest	24.4 (4.9)	19.4 (1.2)	21.3 (1.3)	29.0 (1.5)	24.6 (2.9)	23.1 (0.9)	<0.001
2nd	16.4 (3.6)	23.0 (1.2)	24.5 (1.5)	25.8 (1.3)	33.4 (3.6)	24.5 (0.8)	
3rd	25.0 (4.6)	25.7 (1.2)	23.7 (1.4)	21.9 (1.2)	22.0 (3.3)	23.9 (0.8)	
Highest	27.9 (4.8)	29.2 (1.8)	27.6 (1.6)	20.6 (1.3)	17.6 (3.2)	25.7 (1.2)	
Missing	6.3 (2.9)	2.7 (0.5)	2.8 (0.6)	2.7 (0.5)	2.4 (1.3)	2.8 (0.3)	
Education level							
~9 yr	51.7 (5.4)	46.1 (1.8)	58.1 (1.8)	69.9 (1.3)	64.1 (3.8)	57.2 (1.2)	<0.001
~12 yr	25.6 (5.0)	34.6 (1.5)	28.1 (1.6)	22.5 (1.1)	24.8 (3.3)	28.7 (0.9)	
13 yr ~	22.7 (4.5)	19.2 (1.5)	13.8 (1.4)	7.5 (0.8)	11.1 (2.8)	14.1 (0.9)	
Married	71.3 (4.5)	73.7 (1.2)	75.6 (1.4)	70.8 (1.4)	68.5 (3.6)	73.0 (0.9)	0.058
Having private insurance	70.4 (4.2)	69.9 (1.3)	69.2 (1.4)	64.6 (1.5)	63.3 (3.8)	67.9 (0.9)	0.019
Perceived health							
Good	34.0 (4.7)	38.3 (1.3)	37.3 (1.6)	32.3 (1.4)	35.0 (3.7)	36.0 (0.9)	<0.001
So so	29.1 (4.4)	33.8 (1.3)	32.9 (1.6)	29.9 (1.4)	30.0 (3.2)	32.1 (0.9)	
Bad	36.9 (5.2)	27.9 (1.3)	29.8 (1.4)	37.8 (1.3)	35.1 (3.7)	31.9 (0.8)	
EQ5D index[e]	0.94 (0.008)	0.93 (0.003)	0.93 (0.003)	0.89 (0.004)	0.89 (0.011)	0.92 (0.002)	<0.001
Hospitalization frequency (/ yr)	0.12 (0.03)	0.11 (0.01)	0.11 (0.01)	0.12 (0.01)	0.10 (0.03)	0.11 (0.01)	0.851
Office visit frequency (/2 wks)	0.52 (0.07)	0.61 (0.03)	0.63 (0.04)	0.70 (0.05)	0.46 (0.06)	0.63 (0.02)	0.806
Analytic sample for cervical cancer screening[d]							
Unweighted n, weighted %[e]	262, 4.1 (0.3)	2802, 42.5 (0.8)	1592, 23.4 (0.6)	1878, 25.7 (0.7)	291, 4.3 (0.3)	6825	
Absolute screening rate[c]	45.6 (3.7)	52.5 (1.2)	52.5 (1.5)	46.3 (1.3)	40.0 (3.2)	50.1 (0.8)	<0.001
Age	54.9 (1.2)	53.8 (0.3)	55.6 (0.4)	57.6 (0.3)	55.1 (0.9)	55.5 (0.2)	<0.001
Urban residing	80.8 (3.5)	82.5 (1.7)	81.4 (1.9)	78.0 (2.1)	81.7 (2.7)	81.0 (1.7)	0.038
Household income quartile							
Lowest	16.9 (2.8)	14.3 (0.9)	17.7 (1.1)	25.2 (1.3)	23.1 (2.5)	18.3 (0.7)	<0.001
2nd	19.2 (2.8)	22.1 (1.0)	25.5 (1.4)	27.3 (1.2)	34.5 (3.2)	24.7 (0.8)	
3rd	26.4 (3.3)	30.0 (1.1)	26.6 (1.3)	24.0 (1.2)	24.2 (3.0)	27.3 (0.7)	
Highest	33.7 (3.4)	31.5 (1.5)	27.6 (1.4)	21.1 (1.2)	16.4 (2.7)	27.3 (1.1)	
Missing	3.8 (1.5)	2.2 (0.4)	2.6 (0.5)	2.2 (0.5)	1.9 (1.0)	2.4 (0.3)	
Education level							
~9 yr	25.4 (3.1)	30.6 (1.3)	46.9 (1.6)	60.1 (1.4)	51.5 (3.4)	42.7 (1.0)	<0.001
~12 yr	30.6 (3.5)	38.9 (1.2)	33.3 (1.5)	27.7 (1.2)	34.4 (3.3)	34.2 (0.8)	
13 yr ~	44.0 (3.6)	30.5 (1.3)	19.8 (1.3)	12.3 (0.9)	14.1 (2.5)	23.2 (0.9)	
Married	73.9 (3.2)	77.5 (1.0)	78.4 (1.2)	74.0 (1.3)	70.8 (3.1)	76.4 (0.7)	0.011
Having private insurance	76.6 (2.8)	76.2 (1.1)	73.2 (1.3)	68.5 (1.3)	66.8 (3.3)	73.2 (0.8)	<0.001
Perceived health							
Good	40.0 (3.4)	39.1 (1.1)	38.4 (1.5)	32.2 (1.3)	31.5 (3.2)	37.2 (0.8)	<0.001
So so	32.5 (3.2)	36.8 (1.2)	35.1 (1.4)	31.7 (1.3)	35.2 (3.1)	34.8 (0.9)	
Bad	27.0 (3.2)	24.1 (1.0)	26.5 (1.2)	35.1 (1.2)	33.3 (3.2)	28.0 (0.7)	
EQ5D index[e]	0.90 (0.015)	0.92(0.004)	0.91 (0.004)	0.88 (0.004)	0.87 (0.014)	0.90 (0.003)	<0.001
Hospitalization frequency (/ yr)	0.13 (0.053)	0.11(0.009)	0.11 (0.011)	0.12 (0.010)	0.01(0.027)	0.11 (0.006)	0.85
Office visit frequency (/2 wks)	0.66 (0.121)	0.63 (0.035)	0.67 (0.045)	0.68 (0.045)	0.51 (0.071)	0.65 (0.023)	0.81

SE, standard error. [a]P-values were calculated by Chi-square test for categorical variables and general linear modeling for continuous variables. [b]Only Korean women aged between 40 and 80 years old who had not been diagnosed with breast cancer were included. [c]The screening acceptance rate was defined by the recommendation of the National Cancer Screening Program of the National Cancer Center, Korea, which recommended breast cancer screening every 2 years with a mammogram for women aged 40 years or older and cervical cancer screening every 2 years with a Pap test for women aged 30 years or older. [d]Only Korean women aged between 30 and 80 years old who had not been diagnosed with cervical cancer were included. [e]EQ5D index ; Euro QOL index (www.euroqol.org/)

Weight status classification

Height (SECA 225, Hamburg, Germany) and weight (GL-6000-20, Cas, Yangju, Korea) were measured with the subject wearing a lightweight gown or underwear. Body mass index (BMI) was classified into ~18.4 kg/m^2 (underweight), 18.5~22.9 kg/m^2 (normal), 23.0~24.9 kg/m^2 (overweight), 25.0~29.9 kg/m^2 (moderate obesity) and 30.0 kg/m^2~ (severe obesity) according to the Asia Pacific Standards of WHO recommended definition of Obesity (World Health Organization et al., 2000).

Covariates measurement

We collected data on the socioeconomic and demographic characteristics, perceived health status and Euro QOL index (www.euroqol.org/), data on medical care utilization from the HIS (Table 1). These are factors which are reported to be associated with cancer screening compliance in Korean adults (Jeong et al., 2004). The household income level was classified into quartiles. The residing region was divided into urban and rural areas. Marital status and the private insurance coverage were

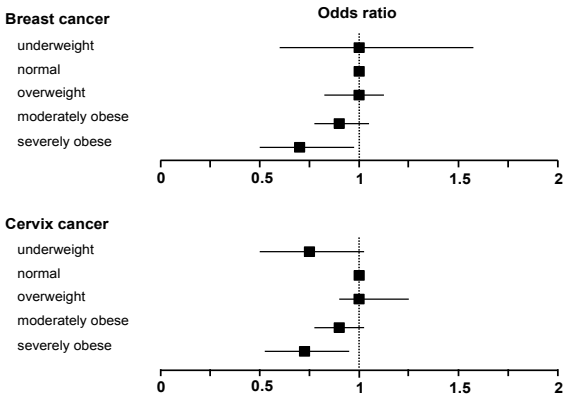

Figure 1. Adjusted Odds Ratios of Undergoing Breast and Cervical Cancer Screening according to Body Mass Index Categories. Body mass index (BMI) was classified into underweight (~18.4 kg/m^2), normal (18.5~22.9 kg/m^2), overweight (23.0~24.9 kg/m^2), moderately obese (25.0~29.9 kg/m^2) and severely obese (30.0 kg/m^2~) according to the Asia Pacific Standards of WHO recommended definition of Obesity (World Health Organization et al., 2000). Adjusted odds ratios were estimated by the multivariate logistic regression modeling controlling for the variables shown in the Table 1.

asked. The self-reported health status was classified as 'good', 'moderate', or 'bad'. Medical care utilization was assessed by the admission frequency during the previous 1 year and outpatient department visit during the previous 2 weeks.

Statistical analysis

Analytic sample for breast cancer screening included 5213 women aged between 40 and 80 years old who had not been diagnosed with breast cancer. As for cervical cancer screening, 6825 women aged between 30 and 80 years old without history of cervical cancer were included.

Descriptive analyses and bivariate analyses were performed with PASW statistics 18 (SPSS Inc., Chicago, IL, USA) to incorporate sampling weight considering the multistage probability sampling design of KNHANES and nonresponse. Multivariate logistic regression analyses were performed to examine the relationship between BMI categories and breast and cervical cancer screening after adjustment for covariates shown in Table 1.

The study protocol was approved by the Institutional Review Board (IRB) of the Seoul Paik Hospital (IRB No. IIT-2012-323). The informed consent was waived by the IRB.

Results

Table 1 showed the characteristics of study participants for breast cancer screening according to the BMI categories. The proportion of underweight, normal weight, overweight, moderate obese, and severely obese women were 2.6 (0.3)%, 37.7 (0.9)%, 25.6 (0.8)%, 29.8 (0.8)%, and 4.5 (0.3)%, respectively. Age (P<0.001), household income (P<0.001), level of education (P<0.001), having private insurance (P=0.019), perceived health status (P<0.001), and EQ5D index (P<0.001) differed significantly among the obesity categories. The absolute mammogram screening rate for underweight, normal weight, overweight, moderately obese, and severely obese women were 53.5 (5.8)%, 53.5 (1.4)%, 52.1 (1.6)%, 49.1 (1.5)%, and 42.2 (3.6)%, while the overall screening rate was 51.3 (0.9)%. The severely obese women had significantly lower screening rate compared to the normal weight women (adjusted odds ratio, 0.70; 95% confidence interval, 0.51 to 0.97). (Figure 1)

Table 1 showed the characteristics of study participants for the cervical cancer screening according to the BMI categories. The sample characteristics according to the BMI categories were similar to those of breast cancer screening. The absolute screening rates for Pap smear were 45.6 (3.7)%, 52.5 (1.2)%, 52.5 (1.5)%, 46.3 (1.3)%, and 40.0 (3.2)%, while the overall screening rate was 50.1 (0.8)%. After adjustment for covariates, the screening rate for cervical cancer was marginally decreased in underweight women (odds ratio, 0.75; 95% confidence interval, 0.55 to 1.03), and significantly decreased in the severely obese women (odds ratio, 0.71; 95% confidence interval, 0.53 to 0.94) (Figure 1).

Discussion

To the best of our knowledge, this is the first study to investigate cancer screening rate according to body weight status in a general population setting in an Asian country. The severely obese Korean women are less likely to undergo breast and cervical cancer screening than the normal weight women by approximately 30%, regardless of socioeconomic characteristics, perceived health status, or medical care utilization. Our results are similar to those reported in white women (Cohen et al., 2008).

There appears to be a threshold effect on the association between weight status and gynecologic cancer screening rate. In this study only the severely obese Korean women (BMI≥30 kg/m^2) were less likely to adhere to recommendations for mammograms and Pap smear, while in US-white women the BMI cut-off value for Pap smear was 40 kg/m^2 (Maruthur et al., 2009). However, as for the black women, there was no association between obesity and Pap testing rate (Maruthur et al., 2009). Women of different races perceive their weight differently. White women consider themselves overweight at a lower BMI, compared to black women (Fitzgibbon et al., 2000), whereas Korean women do this at much lower BMI (Kim et al., 2004). Therefore, the racial and cultural differences in weight perception might partially explain the different threshold of weight status.

Until now, there has been no effort to systematically identify the factors associated with the screening

compliance among obese women and health care providers. Possible barriers might be the personal embarrassment due to weight stigma in the clinical setting, the lack of appropriately sized examination equipment, and poor patient-provider communication (Aldrich and Hackley, 2010). The higher illness-burden of obese women might be another potential reason to hinder preventive services (Park et al., 2006), whereas the lack of physician recommendations (Ferrante et al., 2007) or the lack of awareness of cancer risk in obese women (Messina et al.) are less likely to be the main reasons.

The overall screening rates of breast and cervical cancer were around 50% in Korean women, which are suboptimal when considering the fact that the Korean NCSP provides these screening tests almost for free. The screening rates for breast and cervical cancer in the US were 66.8%, and 77.7%, respectively (National Center for Health Statistics, 2010), and in the UK, they were 75.0%, and 80.0%, respectively (Dowling et al., 2010). Fortunately, the screening rate for breast (4.5 % per a year) and cervical cancer (1.2% per a year) has been increasing in Korea (Lee et al., 2011). Still, there should be more attempts to increase the relatively low screening compliance in Korean obese women.

There are several limitations in this study. First, the data on screening history were self-reported. Therefore, screening rate may be inflated above their actual rates (Howard et al., 2009). Second, KNHANES is not designed to elucidate the reasons why obese women appear to delay screening. We have no information on what impedes obese women from obtaining screening examinations. Third, there could be residual or unmeasured confounders which may influence the screening compliance.

However, we used the measured height and weight while most population-based studies relied on self-report. We also kept the underweight women as a separate category while most studies merged them with the normal weight group, so that our study might reflect the real world situation more closely.

Obesity increases cancer risk (Jee et al., 2008), but decreases compliance to breast and cervical cancer screening in Korean women. The higher mortality rate of breast and cervical cancer in obese Korean women might be partially explained by the lower cancer screening rate. However, it is unknown whether our results can be directly extrapolated to other Asian women. Further studies are warranted to elucidate the mediating factors between obesity and low screening rate to develop a strategy to improve the cancer screening compliance among obese Korean women.

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The authors declare that they have no conflict of interest.

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