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Diet, Obesity, and Sedentary Lifestyle as Risk Factor of Breast Cancer among Women at Yogyakarta Province in Indonesia

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Abstract

BACKGROUND: Breast cancer prevalence remains high worldwide, including in Indonesia. Studies examining relationship between obesity, dietary habit, sedentary lifestyle, and breast cancer development are largely inconclusive.

AIM: This study aimed to determine relationship between obesity, dietary habit, sedentary lifestyle, and breast cancer risk among women at Yogyakarta Province in Indonesia.

METHODS: This was a cross-sectional study on 135 women selected purposively during March–May 2019. Binary logistic regression models were employed in the analysis with 0.05 considered significant.

RESULTS: Among study subjects, 54.07% and 40% were, respectively, ≥40 years old and smokers. About 53.33% consumed preserved food 3–6 times/week, and 49% and 50.37% consumed sweet food and beverage >1 time/ day, respectively. High body mass index (BMI) and physical inactivity were associated with 93% and 85% breast cancer risk reductions (adjusted odds ratio [AOR]: 0.07, 95% confidence interval [CI]: 0.01–0.45, $p < 0.01$ and AOR: 0.15, 95% CI: 0.05–0.47, $p < 0.001$). Smoking showed no significant relationship. A waist circumference (WC) of ≤80 was linked to 78% breast cancer risk reduction. Sweet food, sweet beverage, and energy drink consumption of >1 time/day led to 96%, 36%, and 84% reductions of invasive breast cancer risks. Meanwhile, consumption of preserved food 3–6 times/weeks and soft drinks >1 time/day correlated with an increased risk of breast cancer.

CONCLUSION: High BMI, physical inactivity, and lower WC were associated with the lower breast cancer risk, while preserved food and soft drink consumption significantly increase the risk. Although sedentary lifestyle seems to have a small protective effect, healthy lifestyle should be encouraged and effective strategies are required to encourage women to adopt healthy lifestyle.

Introduction

Breast cancer is known as the deadliest form of cancer with increasing incidence around the world. Almost half of the breast cancer cases and more than half of deaths due to cancer occur in Asian countries where almost 60% of the world population lives [1]. In women, breast cancer is the most frequently diagnosed cancer and the leading cause of death globally, including in Indonesia. Data from the Ministry of Health of the Republic of Indonesia (2019) demonstrated that the majority of breast cancer patients in Indonesia are diagnosed at an advanced stage. Therefore, it is not surprising that breast cancer ranks first among all cancers in women with 13.9 deaths per 100,000 population. The Indonesian government through the Ministry of Health of the Republic of Indonesia has propagated *Germas* (*Gerakan Masyarakat Hidup Sehat,* Healthy Living Community Movement) to instill active and healthy lifestyle by doing physical activities, eating more vegetables and fruit, avoiding smoking, not drinking alcohol, and having regular health checks to reduce non-communicable disease incidence, including for breast cancer. However, the incidence of breast cancer still increases from 1.4/1000 population in 2013 to 1.79/1000 population in 2018, with a mortality rate of 17 per 100.000 population.

This high incidence and mortality rate of breast cancer are not solely related to genetic profiling tendencies as 90–95% of the cases are linked to a number of modifiable risk factors related to lifestyle, such as physical inactivity, smoking habit, alcohol consumption, unhealthy eating patterns, and obesity [2], [3], [4]. A large body of evidence has mentioned the role of body mass index (BMI) in cancer and that weight gain in breast cancer patients may complicate the detection of breast cancer and influence patient's response to breast cancer treatment. The previous studies reported that obesity does not only cause endocrine system disorders, but also causes insulin resistance [5], [6] and significantly increases inflammatory breast cancer [7].

Obesity has also been associated with reduced breast cancer survival [8]. A physically active lifestyle, in comparison with inactive lifestyle, has been shown to positively reduce the risk of breast cancer in several studies [9], [10]. In contrast, unhealthy eating habit such as consuming high-sugar drinks, foods containing saturated fat, and red/processed meat have been shown to increase the risk of breast cancer [11]. However, the relationship between physical activity and the incidence of breast cancer is still debatable [10]. Furthermore, whether the habit of consuming fatty food will affect the development of tumor cells in the breast or not still remains a controversy [12], [13]. Moreover, several previous studies revealed that, in women, BMI is inversely associated with an increase in breast cancer [14], [15], [16]. Hence, this study sought to examine the associations between obesity, diet, sedentary lifestyle, and breast cancer at Yogyakarta, Indonesia.

Methods

Study design and participants

This cross-sectional study was conducted after obtaining approval from the Ethics committee on Human Research of Ahmad Dahlan University (011903016). Written informed consent was obtained from all subjects before interview. This study involved 135 subjects who were diagnosed to have breast cancer treated at the PKU Muhammadiyah Yogyakarta hospital which specializes in oncology and cancer treatment. We have selected the province of Yogyakarta based on cancer data by the Indonesian Ministry of health in 2020, which had the highest cancer incidence rate compared to any other province in Indonesia. The inclusion criteria for participation were ≥18 years old, Indonesian, and able to communicate verbally. The exclusion criteria were designed to avoid those with diabetes mellitus, liver and renal diseases, and rheumatoid arthritis because this disease condition may require adherence to “special diet,” which may interfere with the apparent effects of the dietary pattern studied and result in unwillingness to be interviewed.

Data measurement process

Lifestyle was measured based on previous research, in which regular exercise, absence of smoking habit, BMI, waist circumference (WC), and a healthy diet were used as indicators of healthy lifestyles. Poor lifestyle is said to trigger high morbidity and mortality of diseases, including breast cancer [17], [18]. In this study, physical activity was measured using the Global Physical Activity Questionnaire (GPAQ) through interviews that collected information on the participants’ physical activity during the past week. Rigorous physical activity was defined as doing physical activities at least 3 days in the past week with a total activity duration of at least 1500 metabolic equivalent of task (MET) minutes. MET minutes of rigorous activity are the duration (minutes) of activity in a week times eight calories. Moderate activity was defined as activities such as sweeping, mopping, and gardening for at least 5 days with a total duration of 150 min in the previous week. Subsequently, the participants who performed rigorous activities and/or moderate activities were categorized into adequately active. Participants who did physical activities but did not fall into rigorous activity and moderate activity categories were classified as physically inactive.

The anthropometric measurements were used to assess BMI and WC. BMI was measured by a trained research assistant with the participants in a standing position without shoes and outer clothing. A digital scale (Camry brand) is used and its calibration was monitored regularly before use in this study. BMI was calculated as weight (kg) divided by the square of height (m2), and categorized into four groups according to the standard for ASEAN people in the World Health Organization (WHO) guideline: Underweight (<18.5 kg/m^2), normal weight (18.5–24.99 kg/m^2), overweight (25.0–29.9 kg/ m^2), and obesity (30 kg/m^2 or greater) [19].

WC measurement was conducted by referring to the WHO steps protocol where the measurement is made at the approximate midpoint between the lower margin of the last palpable rib and the top of the iliac crest using a stretch-resistant tape that provides a constant 100 g tension. The participants were asked to be relaxed and breathe out gently during the measurement. Furthermore, they were asked to stand with feet close together, arms at the side, body weight evenly distributed, and wear fewer clothing. The tape was held firmly in the horizontal position and the measurement was repeated twice. If the measurements were within 1 cm of one another, the average should be calculated. If the difference between the two measurements exceeded 1 cm, the two measurements should be repeated based on the WHO cutoff points and risk of breast cancer incidence. WC are categorized into (1) high risk of breast cancer (>80 cm) and (2) less risk of breast cancer (≤80 cm). Measurement of dietary habit of the participants was conducted using the Food Frequency Questionnaire. Participants were asked about the average frequency of consuming one standard serving of specific food in three categories during the past month (1/day, 3–6/week, and <3/month). The responses on a frequency of consumption of a specific serving size for each item were converted into average daily intake. Subsequently, the consumption of daily foods was classified into sweet meals, sweet drinks, salty foods, fatty meals, roasted food, preserved food, seasoning, soft drinks, energy drinks, and instant

noodle. Other variables were also asked to the participants, such as smoking (Yes/No), age, marital status, and occupation.

Statistical analysis

All statistical analyzes were performed using STATA version 13. Means and standard deviations were used to interpret continuous variables, while count and percentage were used to represent variables of categories. Multiple logistics regression was used to calculate adjusted odds ratio (AOR) and confidence intervals (95% CI) for evaluating associations between independent and dependent variables. Age, marital status, occupation, BMI, smoking, physical activity, and WCs were assessed as potential confounders variables. Chi-square was used to estimate the differences among categorical variables. The significance level was set at $p < 0.05$.

Results

The variable of participants' age in this research was divided into two: Aged <40 (45.93%) and aged 40 years (54.07%). Of the total 135 participants, the majority of participants were married (76.30%) and 48.89% of them did not do physical activities. In details, the socio-demographic characteristics of the respondents are described in Table 1.

Table 1: Selected characteristics of participants study

Participant characteristics	n	%
Age (years)		
<40	62	45.93
≥40	73	54.07
Marital status		
Single	27	20.00
Married	103	76.30
Widowed/separate/discovered	5	3.79
Occupation		
Unemployment	28	20.74
Labor	77	57.04
Government/official/business	30	22.22
BMI		
<18.5	7	5.19
18.5–22.99	80	59.26
23–24.99	21	15.56
≥25	27	20.00
Smoking		
Yes	54	40.00
No	81	60.00
Physical activity		
Inactivity	66	48.89
Enough active	69	51.11
Waist circumference (cm)		
>80	84	62.22
≤80	51	37.78

More than half of the respondents (53.33%) consumed preserved food 3–6 times a week and 49% of the respondents consumed sweet food more than once per day. Sweet drinks were consumed more than once a day by 50.37% of the respondents. A more detailed description of the respondents' daily food consumption is listed in Table 2.

Table 2: The daily food consumption risk from study participants

The daily foods	n	%
Sweet meals		
>1 time/day	67	49.63
3–6 times/week	61	45.19
<3 times/month	7	5.19
Sweet drinks		
>1 time/day	68	50.37
3–6 times/week	61	45.19
<3 times/month	6	4.44
Salty foods		
>1 time/day	48	35.56
3–6 times/week	81	60.00
<3 times/month	6	4.44
Fatty meals		
>1 time/day	45	33.33
3–6 times/week	83	61.48
<3 times/month	7	5.19
Roasted food		
>1 time/day	9	6.67
3–6 times/week	85	62.96
<3 times/month	41	30.37
Preserved food		
>1 time/day	26	19.26
3–6 times/week	72	53.33
<3 times/month	37	27.41
Seasoning		
>1 time/day	101	74.81
3–6 times/week	16	11.85
<3 times/month	18	13.33
Soft drink		
>1 time/day	4	2.96
3–6 times/week	41	30.37
<3 times/month	90	66.67
Energy drink		
>1 time/day	5	3.70
3–6 times/week	28	20.74
<3 times/month	102	75.56
Instant noodle		
>1 time/day	4	2.96
3–6 times/week	51	37.78
<3 times/month	80	59.26

The unadjusted and adjusted odd ratios representing the relationship between sedentary lifestyle and the breast cancer occurrence are shown in Table 3. After adjusting for other covariates, a higher BMI category was demonstrated to be significantly associated with increasing breast cancer incidence, with the odds of the risk for breast cancer decreased by 93% (AOR: 0.07, 95% CI: 0.01–0.45, $p < 0.01$). It was also demonstrated in this study that patients with the lack of physical activities had lower odd of developing breast cancer (AOR: 0.15, 95% CI: 0.05–0.47, $p < 0.001$). In contrast, smoking was shown to have no significant relationship with breast cancer incidence.

With regard to WC, the odds of increasing of breast cancer risk for someone who had a WC of more than 80 was 78% less than someone who had a waist circumstance of ≤80 (AOR: 0.22, 95% CI: 0.75–0.65, $p < 0.01$). In terms of age, respondents aged 40 years old or above presented 3.24 higher odds to have increased breast cancer compared to those who were ≤40 years old as illustrated in Table 4 (AOR: 3.24, 95% CI: 1.91–11.36, $p < 0.05$).

Table 4 presents the AOR and 95% CI for daily food consumption. Intake of sweet food seemed to increase the risk of developing breast cancer, with the odds of patients who consumed sweet meals once a day and 3–6 days a week had an increased breast cancer risk of 96% and 99%, respectively (AOR: 0.04, 95% CI: 0.01–0.05, $p < 0.001$; AOR: 0.01, 95% CI: 0.03–0.05, $p < 0.01$). The odds of breast cancer risk

Table 3: Crude odds ratio (OR) and adjusted odds ratio (AOR) for socio-demographic related to breast cancer incidence

Variables	Breast cancer		Crude OR	95% CI	AOR	95% CI
	Yes (%)	No (%)				
Age (years)						
<40	8 (21.05)	54 (55.67)	1		1	
≥40	30 (78.95)	40 (44.33)	1.90***	1.19–2.62	3.24*	1.91–11.36
Marital status						
Single	2 (5.26)	25 (25.77)	1			
Married	33 (86.84)	70 (72.16)	1.77	0.53–3.01	1.98	0.31–12.52
Widowed/separate/discovered	3 (7.89)	2 (2.06)	2.93	0.94–4.91	8.03	0.39–167.22
Occupation						
Unemployment	11 (28.95)	17 (17.53)	1		1	
Labor	11 (28.95)	66 (68.04)	0.26**	0.09–0.69	0.35	0.10–1.25
Government/official/business	16 942.11)	14 (14.43)	1.77	0.62–5.02	2.55	0.61–10.63
BMI						
<18.5	2 (5.26)	5 (5.15)	1		1	
18.5–22.99	27 (71.05)	53 (54.64)	1.27	0.23–6.19	3.40	0.31–41.75
>23–24.99	8 (21.05)	13 (13.40)	1.53	0.23–9.89	2.49	0.17–34.85
≥25	1 (2.63)	26 (26.80)	0.10	0.01–1.27	0.07**	0.01–0.45
Smoking						
No	20 (52.63)	61 (62.89)	1		1	
Yes	18 (47.37)	36 (37.11)		0.71–3.26	2.01	0.70–5.78
Physical activity						
Enough active	28 (73.68)	41 (42.27)	1		1	
Inactivity	10 (26.32)	56 (57.73)	0.26***	0.12–0.60	0.15***	0.05–0.47
Waist circumference (cm)						
≤80	23 (60.53)	28 (28.87)	1		1	
>80	15 (39.47)	69 (71.13)	0.27***	0.12–0.58	0.22**	0.75–0.65

CI: Confidence interval; cm:Centimeter; *** p<0.001; ** p<0.01; * p<0.05.

were 34% and 86% less for participants who consumed sweet drinks >1 time/day and 3–6 times/ week compared those who consumed sweet drinks <3 times/ month (AOR: 0.66, 95% CI: 0.03–0.07, p < 0.01; AOR: 0.14, 95% CI: 0.04–0.05, p < 0.001). Participants who consumed preserved food 3–6 times/weeks had 1.01 times higher risk of breast cancer compared to those who consumed preserved food more than 1-day time/day (AOR: 1.01, 95% CI: 1.28–8.09, p < 0.01). In addition, consuming >1 time/day of soft drink presented a 1.60 higher odd for increasing breast cancer risk (AOR: 1.60, 95% CI: 2.01–1.39, p < 0.05), while the daily consuming of energy drink reduced the risk for developing breast cancer (AOR: 0.16, 95% CI: 0.08–0.32, p < 0.05). Instant noodle was found to decrease breast cancer risk with an AOR of 0.17 (95% CI: 0.04–0.82) when consumed 3–6 times/week.

Table 4: Adjusted odds ratio[1] for the daily consumption of food of participants

Items	Crude OR	95% CI	Adjusted OR	95% CI
Sweet meals (ref.<3 times/month)				
>1 time/day	0.04****	0.01–0.25	0.04***	0.01–0.05
3–6 times/week	0.32	0.06–1.77	0.01**	0.03–0.05
Sweet drinks (ref.<3 times/month)				
>1 time/day	0.23**	0.04–1.48	0.66**	0.03–0.07
3–6 times/week	1.81***	0.30–10.64	0.14***	0.04–0.05
Salty foods (ref.<3 times/month)				
>1 time/day	0.01**	0.01–0.14	0.03	0.01–9.07
3–6 times/week	0.34	0.06–1.99	0.21	0.01–38.95
Fatty meals (ref.<3 times/month)				
>1 time/day	3.00	0.34–27.23	2.07	0.01–3.03
3–6 times/week	2.16	0.25–18.99	1.68	0.01–3.01
Roasted food (ref.<3 times/month)				
>1 time/day	2.19	0.58–3.81	0.35	0.01–16.01
3–6 times/week	1.26	0.22–2.30	4.01	0.54–29.50
Preserved foods (ref.<3 times/month)				
>1 time/day	3.39	0.98–11.72	1.52	0.53–4.37
3–6 times/week	3.20*	1.11–9.26	1.01**	1.28–8.09
Seasoning (ref.<3 times/month)				
>1 time/day	1.62	0.49–5.32	0.32	0.02–6.14
3–6 times/week	0.50	0.08–3.19	0.06	0.01–1.747
Soft drink (ref.<3 times/month)				
>1 time/day	0.52	0.05–5.23	1.60*	2.01–1.39
3–6 times/week	0.08*	0.02–0.36	0.06	0.01–3.72
Energy drinks (ref.<3 times/month)				
>1 time/day	0.50	0.05–4.64	0.16*	0.08–0.32
3–6 times/week	0.24*	0.07–0.85	2.32	0.31–17.47
Instant noodle (ref.<3 times/month)				
>1 time/day	0.48*	0.04–4.77	2.33	0.01–1.32
3–6 times/week	0.12*	0.03–0.37	0.17*	0.04–0.82

[1]Estimates from binary logistic model adjusted for age, marital status, and occupation. Ref.: Reference; CI: Confidence interval; cm: Centimeter; *** p<0.001; ** p<0.01; * p<0.05.

Discussion

This study is the first attempt to evaluate the impact of obesity, poor food consumption patterns, and unfavorable lifestyles in relation to breast cancer risk in Indonesia. After taking into account, the characteristics of the respondents, obesity, certain food groups (sweet foods and drinks, preserved foods, and instant noodles), and physical inactivity are identified as factors that may be positively associated with the risk of breast cancer. Usually, BMI is used to evaluate obesity in general, while WC is used to evaluate central obesity. Several previous studies reported that obesity is significantly associated with an increased risk of breast cancer especially in premenopausal women [20], [21]. However, studies on premenopausal women who are survivors of breast cancer, the BMI is inversely associated with breast cancer risk [22], [23].

The results of this study support this finding as among 38 participants with breast cancer in our study, most have a BMI of 18.5–22.99 kg/m2 (71.05%) and >23–24.99 kg/m2 (21.05%). In line with a study conducted by Lyengar *et al*. (2019), this study also shows that breast cancer is more associated with the body fat level than with BMI [24]. The fact that obesity is a risk factor for some types of cancer is largely based on the use of anthropometric indexes such as BMI as an indirect measure of adiposity. This anthropometric measurement is a crude measure of body size that does not differentiate adiposity and muscle. People who have a normal BMI may actually have cardiometabolic disorders, which are collectively

referred to as metabolic obesity in normal weight [25]. Another study using a meta-analysis shows that there is a linear relationship between BMI and breast cancer risk ($p < 0.001$), where an increase in BMI of 5 kg/m2 is associated with a 2% increase in breast cancer risk with the summary relative risk (SRR) of 1.02 (95% CI: 1.01–1.04) thus showing that increased BMI can increase the risk of breast cancer [20]. Association between central obesity and breast cancer was identified in the findings of this study. This is in line with a case-control study among pre-menopause of Brazilian women that shows the association between WC and breast cancer risk (OR = 3.31, 95% CI 1.45–7.55) [23]. Based on a previous study, WC is more widely used to measure central obesity than other anthropometric measurement indicators. This consideration is based on the fact that WC is used to measure the risk of mortality risk caused by normal-weight central obesity and has the ability to identify pragmatic clinical measures to assist in identifying those at risk [26]. The central obesity can amplify the risk of estrogen receptor-negative breast cancers [27].

When assessing unfavorable lifestyle, the findings of this study indicate that physical inactivity is significantly associated with breast cancer. On the other hand, smoking is not shown to have any relation with breast cancer. In line with the Physical Activity Guidelines Committee for American scientific report in 2018, physical activities reduces the risk of breast cancer [28]. In addition, many studies have shown that physically active women have a lower risk of breast cancer than inactive women. Working women tend to have a low physical activity status that increases the risk of developing breast cancer [29], [30]. Low physical activity is also associated with malnutrition that can lead to an increased risk of breast cancer. Both underweight women and obese women tend to have lower activity than women with normal nutritional status, so they are more at risk of developing breast cancer [31]. Physical activity is associated with reduced risk of breast cancer through several mechanisms, including reducing the production of hormones such as estrogen. High levels of estrogen can stimulate the growth and division of breast epithelial cells, which may increase the risk of cancer by allowing the spread of genetic errors. Therefore, it is necessary to have adopt adequate physical activities to prevent breast cancer [32], [33].

In addition, the previous studies have proven for decades that nutrition plays an important influence on the risk of developing cancer [34], [35]. This study found that consuming sweet foods is associated with decreasing breast cancer risk. Furthermore, it was identified that that a high consumption of soft drink is significantly associated with increasing breast cancer risk (AOR: 1.60, 95%CI: 2.01 to 1.39, $p < 0.05$) while daily consumption of energy drink reduced the risk for developing breast cancer. Sugary drinks, also categorized as sugar-sweetened beverages or “soft” drinks, refer to any beverage added with sugar or other sweeteners (high fructose corn syrup, sucrose, fruit juice concentrates, and more). This includes soda, pop, cola, tonic, fruit punch, lemonade, sweetened powdered drinks, sports drinks, and energy drinks [36]. As a category, these beverages comprise the single largest source of calories and added sugar. Sugary drink consumption is rising dramatically due to the widespread urbanization and beverage marketing, particularly in developing countries, including Indonesia [37], [38]. Many studies showed that the consumption of sugary drinks and artificially sweetened beverages is significantly associated with the risk of overall cancer, including breast cancer [34], [39]. Cancer cells require glucose to produce energy to support their rapid growth and spread. They also need a lot of other nutrients such as amino acids and fats. Furthermore, sugary food and sugary drink consumption are associated with glucose metabolism which requires insulin that can increase tumorigenesis either through a direct effect on epithelial tissue or indirectly by influencing the levels of other modulators such as the insulin-like growth factor (IGF) receptor group, sex hormones, and adipokines. Hyperinsulinemia and higher IGF-1 levels are also well-known to be associated with breast cancer risk [40].

Findings in this study also show that processed food consumption is also associated with the incidence of breast cancer. This supports the finding of a previous cohort study stating that a 10% increase in the proportion of ultra-processed foods in the diet is significantly associated with a more than 10% increase in the overall risk of cancer, including breast cancer [41]. Preserved food often contains higher total fat, saturated fat, sugar, and salt, but lower in fiber and vitamins. In addition, it also has potential carcinogenic properties from food additives used, such as sodium nitrite in processed meat [42]. Although preservatives such as nitrate are generally considered safe, there are several concerns regarding their actual safety that raise from, among others, the formation of carcinogenic nitrosamines from nitrites [43]. Other food preservatives such as sodium benzoate and potassium sorbate are also associated with the risk of various health problems. Sodium benzoate is thought to be linked to the possibility of allergies and has immunosuppressive effects. Interactions between sorbate and nitrites in the digestive tract is also regarded to produce a series of genotoxic compounds [43]. Based on the recommendation from the WHO (2016) through the Joint FAO/WHO Expert Committee on Food Additives (JECFA), the acceptable daily intakes (ADIs) of benzoate and sorbate are 0–5 mg/kg body weight/day for benzoic acid (and benzoate salts) and 0–25 mg/kg body weight/day for sorbic acid (and sorbate salts).

A major strengths in this study are high response rate of the participants (100%), use of standardized protocol for data collections, and include the measurements of BMI and WC that are well known

to be factors that may predict the development of breast cancer. The biological mechanisms that may work for most of these lifestyle factors seem to be mediated by adipose tissue, with chronic low-grade inflammation creating an environment that encourages breast cancer to develop and grow. Sedentary lifestyle has also been linked to increased risk for estrogen receptor (ER)-positive breast cancer [44]. However, some limitations should be acknowledged. First, reporting of repeated diet history may be biased due to short memory of the respondents. Second, several factors related to lifestyle such as measurement of physical activity and smoking are in the form of self-reported questionnaires. As a result, they may have been misclassified. Third, this study is an observational study with a cross-sectional approach where the cofounding variables are difficult to separate so that the causality relationship of the observed variables is difficult to determine. In addition, it is necessary to consider eating patterns and lifestyles that can be influenced by local culture or customs.

Conclusion

This study indicates that obesity, WC, smoking habit, and physical activity are associated with lower breast cancer risk. Unsurprisingly, smoking shows no significant relationship with increased breast cancer risk. Poor dietary habits characterized by the consumption of preserved food and soft drinks appear to be linked to increased risk for breast cancer, while sweet meals and sweet drinks are inversely associated with the increase in breast cancer. Although a small protective effect of sedentary lifestyle against breast cancer incidence is identified, the role of healthy lifestyle should still be emphasized using an integrated approach and an effective strategy is required to encourage women to adopt a healthy lifestyle.

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