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ORIGINAL ARTICLE

DIETARY PRACTICES AND NUTRITIONAL STATUS IN SURVIVORS OF BREAST CANCER

Emilia Kałędkiewicz, Dorota Szostak-Węgierek

Medical University of Warsaw, Faculty of Health Science, Department of Clinical Dietetics, Warsaw, Poland

ABSTRACT

Background. Wrong dietary practices and excessive body mass may not only influence the risk of primary breast cancer but also the risk of its recurrence.

Objective. Evaluation of dietary practices and identification of nutritional factors which may influence the risk of tumor recurrence in women with prior breast cancer.

Materials and methods. The case-control study involved 108 women aged 50 years and older with history of breast cancer who were divided into two categories: women after completed cancer treatment with no recurrence for minimum 5 years (group I, n=82) and women with diagnosed breast cancer recurrence (group II, n=26). A control group (n=74) constituted of subjects with no breast cancer diagnosis. In every subject anthropometric measurements were taken and dietary practices were evaluated by means of an original questionnaire.

Results. Average BMI and hip circumference values were higher in the group II than in the group I. In both study groups the percentage of high WHR values was significantly higher than in the control group. Women with history of cancer consumed significantly fewer vegetable and fruit and more refined cereals, dairy products, meat and cold cuts than women in the control group. Group I responders more often declared implementation and maintenance of changes in their diet after diagnosis of cancer than women from group II. Subjects with cancer history consumed more alcohol and more often used supplements than females in the control group.

Conclusion. Avoiding overweight and obesity along with following the principles of a healthy diet seems to reduce the risk of both breast cancer incidence and its recurrence.

Key words: *breast cancer, nutrition, nutritional status*

STRESZCZENIE

Wprowadzenie. Sposób żywienia i nadmierna masa ciała mogą wpływać nie tylko na powstawanie raka piersi lecz również na ryzyko wystąpienia nawrotów choroby.

Cel. Ocena sposobu żywienia oraz identyfikacja czynników żywieniowych mogących mieć wpływ na ryzyko nowotworu u kobiet po przebytym raku piersi.

Materiał i metody. Badanie kliniczno-kontrolne objęło 108 kobiet po 50. roku życia z rakiem piersi na podstawie wywiadu. Kobiety zostały podzielone na dwie grupy: grupa I, (n=82) - kobiety po zakończonym leczeniu, u których przez minimum 5 lat nie wystąpiło wznowienie choroby i grupa II, (n=26) - kobiety z wtórnie zdiagnozowanym rakiem piersi. Grupę kontrolną (n=74) stanowiły kobiety bez raka piersi w wywiadzie. Wykonano badania antropometryczne oraz przeanalizowano sposób żywienia kobiet przy użyciu autorskiego kwestionariusza.

Wyniki. W grupie II kobiet zaobserwowano wyższe średnie wartości BMI oraz obwodu bioder niż w grupie I. W obu grupach badanych odsetek wysokich wartości WHR był istotnie wyższy niż w grupie kontrolnej. Kobiety z historią nowotworową spożywały istotnie mniej warzyw i owoców oraz więcej nabiału, mięs i wędlin niż kobiety z grupy kontrolnej. Respondentki z grupy I istotnie częściej deklarowały wprowadzenie i utrzymanie zmian w sposobie żywienia po rozpoznaniu choroby niż kobiety z grupy II. Kobiety z historią nowotworową wypijały większe ilości alkoholu i częściej stosowały suplementy diety niż kobiety onkologicznie zdrowe.

Wnioski. Unikanie nadwagi i otyłości oraz przestrzeganie zasad zdrowej diety wydaje się zmniejszać ryzyko zarówno zachorowania na raka piersi jak i wystąpienia jego nawrotów.

Słowa kluczowe: *rak piersi, sposób żywienia, stan odżywienia*

Corresponding author: Emilia Kałędkiewicz, Medical University of Warsaw, Faculty of Health Science, Department of Clinical Dietetics, Erazma Ciołka 27 street, 01-445 Warsaw, Poland, tel. +48 606 202 953, e-mail: emilia.kaledkiewicz@wum.edu.pl

INTRODUCTION

Each year the number of women diagnosed with breast cancer rises worldwide. In Poland, this type of tumor is the second most common cause of death among cancer deaths in women (13,9% of all cancer deaths). Since the beginning of the last decade the number of subjects affected by breast cancer increased substantially. In 2014, the number of new cases was 17379, and breast cancer took the first place in the structure of cancer incidence (21,7% of all tumors in women) [29].

Studies on the association between dietary practices and breast cancer risk and/ or recurrence have been performed for many years. Although the findings are not always coherent, we can currently identify several factors that increase or decrease cancer risk. Among factors classified as probably protective there are lactation and physical activity. Among the key factors, which have been proved to increase breast cancer risk in postmenopausal women there are alcohol intake and excess of body weight [18, 19, 30]. Besides, it is suggested that the intake of various foods, as well as nutrients, may influence breast cancer risk. Although the results of research are not unambiguous [30], it seems that intake of vegetable and fruit [11], soya and soya products [2, 25], and fish [15, 36] is protective. Among potentially protective nutrients there are dietary fiber [10], folate [5], vitamin D [33], and calcium [14].

The purpose of the study was the evaluation of dietary practices and nutritional status in breast cancer survivors.

MATERIAL AND METHODS

A case-control study was conducted between 2013 and 2016. It involved 182 women over fifty-year-old living in Warsaw and surroundings.

The study group consisted of 108 women with history of breast cancer who were divided into two groups. The first one included women who completed the breast cancer treatment, without recurrence for minimum 5 years (group I, n=82). Women diagnosed with recurrent breast cancer were classified as the second group (Group II, n=26). The participants of the study were the patients of two hospitals (Szpital Specjalistyczny im. Świętej Rodziny SPZOZ and Szpital Onkologiczno – Kardiologiczny MAGODENT), and members of five divisions of the association of breast cancer patients "Stowarzysze Amazonki" (Warszawa – Centrum, Warszawa – Targówek, Warszawa – Bemowo, Warszawa – Praga, and Warszawa - Ochota). The control group (n=74) consisted of women with no breast cancer history, chosen from amongst members of Centrum Kultury in Piaseczno, patients of two medical centers, Centrum Rehabilitacji FizjoSystem, and Centrum Rehabilitacji Estetica – med., as well as friends and families of the above-mentioned groups. The participants were informed about possibility to take part in the study through banners, fliers, and also information provided by their physicians. On the day of enrollment, all participants of the study were postmenopausal, due to physiological cessation of menstrual cycles or prior oncological treatment.

For collection of data about clinical problems and dietary practices an original questionnaire was used. It consisted of three parts. The first one included questions about demographic data. The second part concerned problems related to the disease and its treatment. The third one was related to current dietary habits and consisted of 30 questions concerning frequency (per day, per week or per month) and amounts of 60 foods consumed during the last year. The sizes of portions were estimated on the basis of the Photo Album of Products and Dishes [28]. When asked about specific food items, the participants were presented with examples of different food portions of appropriate food stuffs. They defined the amount of food consumed by indicating the proper picture. The questionnaire included also questions about use of dietary supplements. The collected information was recalculated into average daily intake expressed in grams, and in the case of beverages in milliliters or glasses. Consumption of alcoholic beverages was expressed in grams of total ethanol intake. Additionally, women with the breast cancer history were asked about changes of their dietary habits implemented after cancer treatment.

Waist and hip circumferences were measured with a tape measure with an accuracy of 0.1 cm. Body mass was measured with an electronic weighing scale with an accuracy of 0.1 kg, without garments. Height was measured with a wall-mounted stadiometer with an accuracy of 1 cm. On the basis of the obtained results BMI and WHR values were calculated using the formulas: body weight (kg)/ height (m) ^2 for BMI, and waist (cm)/hip circumference (cm) for WHR. BMI values were classified according to WHO: the rage of 18.5-24.9 kg/m^2 was classified as normal, <18.5 kg/m^2 was the basis to identify underweight, 25-29.9 kg/m^2 overweight, and ≥30 kg/m^2 – obesity [31]. Abdominal overweight and obesity were recognized using criteria: waist circumference above 80 or 88 cm. WHR value ≥0.85 was identified as high [32].

Continuous variables were evaluated using the *Shapiro-Wilk* test to assess compliance with the normal distribution. In addition, the degree of asymmetry in the distribution of these variables was also estimated by calculating the skewness parameter. Since large deviations from compliance with the normal distribution were found, it was decided to use nonparametric statistics in the analyzes of these variables. For the statistical assessment of differences between groups the U *Mann-Whitney* test was used for continuous variables, and Chi^2 *Pearson* test for categorical variables. A p-value <0.05 was considered statistically significant.

Table 1. Characteristics of the control and study groups

Parameter	Groups				P (I vs II)
	Control n=74	I n=82	II n=26	I+II n=108	
Age (years) x ± SD median	 65.7 ± 6.54 66.0	 67.0 ± 7.08 66.0	 71.1 ± 8.05*** 72.5	 68.0 ± 7.50* 67.0	<0.01
Menopause prior to diagnosis of the first cancer No (%) Yes (%)	----------	 59.76 40.24	 34.62 65.38	 53.70 46.30	<0.05
Years after diagnosis of the first cancer x ± SD median	----------	 14.6 ± 6.92 13.5	 16.8 ± 7.18 17.0	 15.2 ± 7.02 15.0	ns
Years after diagnosis of the second cancer x ± SD median	----------	----------	 10.5 ± 8.22 10.5	----------	----------
Age at the time of diagnosis of the first cancer (years) x ± SD median	----------	 52.3 ± 8.19 51.0	 54.2 ± 10.55 56.0	 52.8 ± 8.80 52.0	ns
Age at the time of diagnosis of the second cancer (years) x ± SD median	----------	----------	 60.5 ± 11.82 60.0	----------	----------
Residence Big town (%) Small town (%) Village (%)	 95.95 2.70 1.35	 90.24 8.54 1.22	 88.46 11.54 0.00	 89.81 9.26 0.93	ns

Statistical significance for comparisons with control group: *p<0.05, ** p<0.01, ***p<0.001, ****p<0.0001

Table 2. Anthropometric data of the control and study groups.

Parameter	Groups				p (I vs II)
	Control n=74	I n=82	II n=26	I+II n=108	
BMI (kg/m^2) x ± SD median	 26.3 ± 4.23 26.3	 26.8 ± 2.67 26.9	 29.2 ± 6.31* 28.5	 27.8 ± 4.73 27.3	<0.05
BMI <18.5 kg/m^2 (%) 18.5-24.9 kg/m^2 (%) 25-29.9 kg/m^2 (%) ≥30 kg/m^2 (%)	 2.70 32.43 43.24 21.62	 1.27 34.18 40.51 24.05	 3.85 15.38 34.62 46.15	 1.90 29.52 39.05 29.52	ns
Waist circumference (cm) x ± SD median	 82.7 ± 12.95 85.0	 88.9 ± 9.22 90.0	 91.0 ± 11.77** 92.0	 89.8 ± 10.33* 90.0	ns
Waist circumference ≤80 cm >80 - ≤88 cm >88 cm	 31.08% 22.97% 45.95%	 23.17% 29.27% 47.56%	 11.54% 23.08% 65.38%	 20.37% 27.78% 51.85%	ns
Hip circumference (cm) x ± SD median	 102.3 ± 10.94 102.0	 105.0 ± 6.81 103.5	 109.7 ± 10.49** 111.0	 107.1 ± 8.82* 105.5	<0.01
WHR x ± SD median	 0.81 ± 0.065 0.81	 0.83 ± 0.066 0.83	 0.84 ± 0.051 0.83	 0.83 ± 0.063 0.83	ns
WHR (%) WHR < 0.85 WHR ≥ 0.85	 74.32 25.68	 58.54* 41.46	 57.69* 42.31	 58.33* 41.67	ns

Statistical significance for comparisons with control group: *p<0.05, ** p<0.01, ***p<0.001, ****p<0.0001

Table 3. Plant foods consumption in the control and study groups

Products	Groups				p (I vs II)
	Control n=74	I n=82	II n=26	I+II n=108	
Vegetable (g) x ± SD median	318.24 ± 186.537 400.00	185.71 ± 90.183**** 200.00	124.86 ± 82.316**** 100.00	171.06 ± 91.778**** 200.00	<0.01
Fruit (g) x ± SD median	236.00 ± 139.943 300.00	171.86 ± 92.829** 100.00	166.21 ± 118.727* 125.00	170.50 ± 99.110** 100.00	ns
White bread (g) x ± SD median	6.57 ± 8.765 2.08	16.49 ± 25.075 3.33	29.59 ± 44.453** 9.36	19.65 ± 31.134** 4.00	ns
Wholemeal bread, mixed (g) x ± SD median	35.85 ± 24.109 35.00	44.22 ± 41.812 35.00	41.04 ± 35.060 35.00	43.45 ± 40.156 35.00	ns
White rice (g) x ± SD median	8.86 ± 12.750 6.67	15.07 ± 17.989** 8.33	17.04 ± 15.275*** 8.33	15.55 ± 17.326*** 8.33	ns
White pasta (g) x ± SD median	10.5 ± 15.55 6.7	15.1 ± 17.24* 6.7	17.1 ± 17.84* 6.7	15.6 ± 17.33* 6.7	ns
Whole-grain pasta (g) x ± SD median	5.19 ± 11.223 0.00	3.73 ± 8.870 0.00	1.74 ± 5.788* 0.00	3.25 ± 8.253 0.00	ns
Potatoes (g) x ± SD median	33.64 ± 31.407 36.43	57.33 ± 55.456** 48.57	86.05 ± 73.430*** 72.86	64.25 ± 61.156*** 48.57	ns
Dry pulses (g) x ± SD median	11.24 ± 16.477 6.67	17.65 ± 20.125* 6.67	17.70 ± 19.240* 8.33	17.67 ± 19.832** 6.67	ns
Nuts, almonds and seeds (g) x ± SD median	15.57 ± 16.940 9.29	11.91 ± 13.729 4.43	6.43 ± 9.478** 1.43	10.59 ± 13.008 3.00	<0.05
Nuts (g) x ± SD median	5.41 ± 5.919 2.18	4.70 ± 5.988 1.00	2.05 ± 3.433** 0.52	4.06 ± 5.586 1.00	<0.01
Almonds (g) x ± SD median	5.02 ± 5.790 1.50	3.16 ± 4.239* 1.00	1.98 ± 3.529*** 0.00	2.87 ± 4.095** 1.00	<0.05

Statistical significance for comparisons with control group: *p<0.05, ** p<0.01, ***p<0.001, ****p<0.0001

The study was accepted by the Bioethical Committee of Warsaw Medical University. All subjects were asked for their approval before starting the interview and a consent form was explained and then signed by all subjects.

RESULTS

Characteristics of the participants are shown in Table 1. Women from group II were significantly older than both women from the control group and group I, and also significantly more often postmenopausal before primary cancer diagnosis than women from group I.

Results of anthropometric measurements are shown in Table 2. Mean BMI, waist and hip circumference values were significantly higher in group II than in the control group. In both study groups the percentage of high WHR values was significantly higher than in the control group.

Data on the consumption of food products of various groups is shown in Tables 3, 4 and 5. Women from the study groups consumed significantly less vegetable and fruit than women from the control group. It applied to almost all categories of these products. Women with history of breast cancer consumed greater amounts of highly refined cereals and potatoes, as well as dairy products, pulses, meats and cold cuts, while smaller amounts of nuts and almonds in comparison with the control group. Women from the study groups significantly more often used supplements of calcium and vitamin D, as well as of n-3 fatty acids than participants from the control group (Table 6).

Table 4. Animal foods consumption in the control and study groups

Products	Groups				p (I vs II)
	Control n=74	I n=82	II n=26	I+II n=108	
Milk overall (ml) x ± SD median	73.70 ± 107.799 16.67	106.37 ± 109.998 50.00	1 02.84 ± 126.281 35.71	105.52 ± 113.524 50.00	ns
Fermented milk beverages (ml) x ± SD median	63.71 ± 65.961 42.86	101.78 ± 84.096*** 85.71	93.45 ± 120.388 64.29	99.77 ± 93.556** 85.71	ns
Cottage cheese overall (g) x ± SD median	24.29 ± 23.199 17.14	32.75 ± 20.511** 34.29	32.25 ± 30.725 34.29	32.63 ± 23.136** 34.29	ns
Hard cheese overall (g) x ± SD median	6.78 ± 8.265 2.50	16.32 ± 18.691*** 10.71	16.30 ± 18.030** 8.57	16.31 ± 18.450**** 10.36	ns
Other cheese (g) x ± SD median	2.66 ± 5.445 0.00	7.18 ± 11.935*** 1.67	13.62 ± 26.002* 1.67	8.73 ± 16.537*** 1.67	ns
Fish and seafood (g) x ± SD median	35.52 ± 38.077 20.00	41.82 ± 36.612 26.67	38.96 ± 33.481 28.57	41.13 ± 35.751 26.67	ns
White meat (g) x ± SD median	27.36 ± 28.536 10.00	49.67 ± 38.276**** 42.86	126.15 ± 272.961** 57.14	68.09 ± 139.987**** 50.00	ns
Red meat (g) x ± SD median	6.77 ± 9.396 5.00	15.08 ± 16.618**** 10.00	28.69 ± 36.617**** 14.17	18.36 ± 23.591**** 10.00	ns
Low-quality cold cuts (g) x ± SD median	0.69 ± 1.128 0.00	3.72 ± 6.758**** 0.58	6.51 ± 12.587* 0.00	4.37 ± 8.496**** 0.00	ns
High-quality cold cuts (g) x ± SD median	3.87 ± 4.799 2.06	8.22 ± 7.061**** 6.86	14.49 ± 15.014*** 9.71	9.73 ± 9.882**** 6.86	ns

Statistical significance for comparisons with control group: *p<0.05, ** p<0.01, ***p<0.001, ****p<0.0001

A substantial percentage of respondents, 76.8% of group I, and 42.3% of group II, declared implementation and maintenance of changes in diet after breast cancer diagnosis, and this difference was statistically significant (p <0.001). These changes included increase in consumption of vegetable and fruit (71.6% of women under study), whole grains (36.5%), fish (31%), green tea (4%), and also decrease in meat consumption (37.8%), dairy products (1.4%), high fat foods (8.1%), fried foods (6.8%), sugar and sweets (9.5%), and also reduction of portion size (1.4%). Some participants included red wine, linseed oil and legumes in their diet.

DISCUSSION

Participants with breast cancer recurrence had higher average BMI and higher incidence of abdominal fat distribution than those from the control group. It may be assumed that excess of body fat mass, especially of the abdominal deposition, could result in greater tumor malignancy. Results of other studies suggest this relationship. Meta-analyses of case-control and cohort studies, which have been published in recent years [19, 30], showed that excess of body mass increases the risk of cancer in postmenopausal women. Moreover, obesity in females with diagnosed breast cancer increases the risk of its recurrence [34]. On the other hand, we cannot rule out that large gain of abdominal fat in study participants took place after the diagnosis of breast cancer. Some studies demonstrated that many patients with breast cancer gain weight during and/or after cancer treatment [19].

It is worth noting that women with breast cancer history, when compared with participants from the control group, consumed smaller amounts of vegetable and fruit, nuts, and almonds, and bigger amounts of refined cereals, dairy products, meat and cold cuts. Other studies also

Table 5. Consumption of sugar, sweets and alcohol in the control and study groups

Products	Group				p (I vs II)
	Control n=74	I n=82	II n=26	I+II n=108	
Sugar (g) x ± SD median	5.17 ± 7.844 0.00	2.70 ± 5.950 0.00	2.36 ± 4.832 0.00	2.62 ± 5.681* 0.00	ns
Honey (g) x ± SD median	2.73 ± 3.702 0.80	5.00 ± 4.934*** 3.43	4.01 ± 4.689 0.80	4.76 ± 4.873** 3.43	ns
Sugar + Honey (g) x ± SD median	7.90 ± 8.713 5.17	7.70 ± 6.874 6.86	6.37 ± 7.712 5.07	7.38 ± 7.070 6.86	ns
Beer (ml) x ± SD median	4.78 ± 15.685 0.00	6.10 ± 55.216** 0.00	0.42 ± 2.157 0.00	4.73 ± 48.114** 0.00	ns
Wine (ml) x ± SD median	12.96 ± 43.212 0.00	15.47 ± 31.413*** 5.00	22.34 ± 46.842 0.00	17.12 ± 35.614** 5.00	ns
Vodka (ml) x ± SD median	0.14 ± 0.602 0.00	0.30 ± 1.706 0.00	0.32 ± 0.945 0.00	0.30 ± 1.553 0.00	ns
Ethanol, total (g) x ± SD median	1.73 ± 5.011 0.00	2.64 ± 5.124* 0.56	2.62 ± 5.286 0.00	2.64 ± 5.138* 0.56	ns

Statistical significance for comparisons with control group: *p<0.05, ** p<0.01, ***p<0.001, ****p<0.0001

Table 6. Use of dietary supplements in the control and study groups.

Supplement	Group				p (I vs II)
	Control n=74	I n=82	II n=26	I+II n=108	
Supplements overall					
No (%) Yes (%)	70.27 29.73	57.32 42.68	34.62 65.38**	51.85 48.15**	<0.05
Calcium No (%) Yes (%)	100.00 0.00	87.80*** 12.20	73.08**** 26.92	84.26*** 15.74	ns
Vitamin D3 No (%) Yes (%)	97.30 2.70	89.02* 10.98	76.92** 23.08	86.11** 13.89	ns
N-3 fatty acids No (%) Yes (%)	98.65 1.35	81.71*** 18.29	84.62** 15.38	82.41** 17.59	ns

Statistical significance for comparisons with control group: *p<0.05, ** p<0.01, ***p<0.001, ****p<0.0001

confirmed an inverse relationship between the intake of vegetable and fruit and the risk of breast cancer [1, 3, 13, 17]. Adverse effect of consumption of red and processed meat on breast cancer risk was observed by some authors [7, 9, 12], while other investigators demonstrated this relationship only for processed meat [23, 35]. The impact of intake of dairy products is not fully clear. However, some studies suggest a positive relationship between intake of high fat dairy products and increased risk of breast cancer [16]. Similarly, the link between pulses consumption and breast cancer incidence is not clear and requires further investigation [6].

Because of the case-control design of our study, we cannot rule out that the discussed negative features of dietary practices appeared after the diagnosis of breast cancer. In fact, a large percentage of the participants declared substantial changes in their diet. However, the introduced modifications involved increased consumption of foods considered as healthy and reduced of those that are potentially harmful. Thus, it seems that

the respondents diet before cancer diagnosis might be even worse than that observed after cancer treatment.

Compared with women who have never had breast cancer, women with breast cancer history consumed more honey and less sugar. This phenomenon is probably related to commonly available information on the harmfulness of sugar consumption. It seems that the women with cancer history, in order to eat healthier, replaced sugar with honey, which is perceived as a pro-health product. However, it should be noted that the results of studies focused on the link between sugar intake and the risk of breast cancer are not consistent. Some of them do not show any relationship whereas other show that such a relationship exists [26, 27].

In our study, participants with history of breast cancer consumed larger amounts of alcohol than the women from the control group. It suggests adverse effect of alcohol consumption. The results of studies on the relationship between consumption of alcohol beverages on breast cancer risk are consistent with ours. Alcohol consumption, based on a number of both case-control and cohort studies, has been identified as an established risk factor for breast cancer in women [30].

Participants of our study who had no recurrence of breast cancer significantly more often introduced beneficial changes in their diet than those in whom cancer recurrence was diagnosed. We speculate that these changes could to some extent facilitate the avoidance of breast cancer recurrence. It is worth mentioning that the results of the analysis performed in the British population, which suggested that lifestyle changes, including diet, can prevent 25-30% of breast cancer cases [24].

The participants of the study with the history of breast cancer more often used dietary supplements of calcium, vitamin D and n-3 fatty acids than women who had never been diagnosed with this type of cancer. This is probably related to the fact that cancer, including breast cancer, favors the development of osteoporosis [21, 22]. Therefore, it may be assumed that the observed common use of calcium and vitamin D supplements in subjects with history of breast cancer was justified more often than in other participants. It is worth mentioning that the results of array of studies suggest that supplementation with vitamin D and n-3 fatty acids may reduce the risk of breast cancer and its recurrence [4, 8]. It appears that women who have had breast cancer, knowing about the potentially beneficial effects of n-3 fatty acids, consciously took them more often than healthy women.

CONCLUSIONS

1. It seems that excess of body mass and abdominal fat distribution are associated with the risk of breast cancer.
2. The results of the study suggest the potential beneficial effects of high consumption of vegetable and fruit on the risk of breast cancer.
3. It may be speculated high intake of meats and cold cuts, as well as refined cereals and alcohol products have adverse impact on the risk of breast cancer.
4. It may be assumed that avoiding overweight and obesity, as well as adhering to the principles of a healthy diet may reduce the risk of breast cancer.
5. Counseling women with breast cancer concerning change in their adverse dietary habits would be beneficial.

Conflict of interest

The authors declare no conflict of interest.

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