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Diet in women with breast cancer compared to healthy controls – What is the difference?

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ABSTRACT

Purpose: After a cancer diagnosis, patients often change their lifestyle in order to improve health. The aim of this study was to examine whether women with breast cancer had changed their diet two years after the diagnosis, and to compare their diet with that of healthy female blood donors.

Methods: Patients (n = 180), median age 58 years (*range* 37–78), and 101 controls, median age 57 years (*age* 43–75) answered questions about consumption of alcohol, 36 different food items, and information like age, body mass index (BMI), marital status, and years of education.

Results: Forty patients (22%) had changed their diet. Comparing all patients with controls, significantly more patients avoided alcohol, p = 0.0005, and 3 of 36 food items; smoked food, p = 0.04, and milk and other dairy products, p = 0.02 and p = < 0.0001, respectively. Based on BMI, 50% of all the patients reported overweight or obesity. Breast cancer treatment explained 5.7% of the total variance in scores for changing diet, where chemotherapy was the sole significant predictor, p = 0.04.

Conclusion: Two years after a breast cancer diagnosis, most women (78%) maintained their diet, which was largely similar to the controls. Fifty percent of the patients reported overweight or obesity.

1. Introduction

Breast cancer is the most frequent cancer among women, with the highest reported incidence in Western Europe (Ferlay et al., 2015). Risk factors include age, estrogen levels/use, and family history of breast cancer (Buckland et al., 2013; Collaborative Group on Hormonal Factors in Breast Cancer, 2012). In addition, individual lifestyle factors especially such as alcohol consumption, diet and being overweight or obese are associated with higher risk of the disease (Michels et al., 2007). The relationship between alcohol and breast cancer have been thoroughly investigated over the past decades (Dam et al., 2016), and regular intake of alcohol has been consistently linked to a modest increase in incidence of breast cancer (Michels et al., 2007). A body mass index (BMI) 25.0–29.9 kg/m^2, or obesity (BMI ≥ 30 kg/m^2) have been found to increase risk of contralateral disease and recurrence thus reducing survival (Druesne-Pecollo et al., 2012; Majed et al., 2011). Maintaining a normal weight is associated with better prognosis (Vagenas et al., 2015).

Recent studies are now establishing links between obesity and breast cancer (Giles et al., 2012; Wellberg et al., 2017). An animal model has shown that weight gain following surgical ovariectomy, which models menopause, helped to stimulate breast tumor development in obese rats (Giles et al., 2012). After operation, the healthy tissues in obese rats failed to increase uptake of glucose and dietary fat, but the breast tumors dramatically increased uptake of glucose (Giles et al., 2012). Furthermore, tumors from obese rats had different molecular profiles compared to lean rats; obese rats had higher levels of progesterone receptors (PR), which was related to higher expression of genes involved in energy use and proliferation. A similar pattern has been seen in human PR-positive breast cancer tumors from postmenopausal women (Giles et al., 2012). Similar to the way in which many breast cancers drive their growth with estrogen receptors, the

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tumors in obese rats drive their growth with androgen receptors (AR) (Wellberg et al., 2017). Obesity leads to inflammation, which is associated with higher levels of interleukin 6 (IL-6). Administering IL-6 to breast cancer cells sensitized ARs, which amplified growth signals that drove breast cancer even in an environment of low estrogen availability. The researchers conclude that their results may have implications in defining the population of women with ER-positive breast cancer most likely to benefit from anti-AR therapy (Wellberg et al., 2017). Also, a more recent study showed that depression is more prevalent in women with breast cancer compared to the general female population, and is a high risk for development of obesity and cardiovascular disease (Serra et al., 2016).

Vance et al. (2014), investigating 28 women with breast cancer in their first year of treatment, reported that increased intake of fruit and vegetables, a reduced alcohol consumption, and lower intake of red meat were the most common diet changes. Templeton et al. (2013) reported that 87% of 342 consecutive women with breast cancer focused on nutrition, in most cases they ate more fruits, and kept a "balanced diet" low in fat. Ethnicity, higher education and physical activity were positively correlated to change of diet (Templeton et al., 2013). Several studies suggest that models of dietetic practice and tailored dietary information should be made available to all breast cancer women due to health benefits and an increased quality of life (McKenzie et al., 2015; Slavin and Lloyd, 2012).

Time between diagnosis and the early stage of chemotherapy treatment has been reported to be challenging because of the diagnosis of breast cancer itself, competing attention from different health professionals, and an abundance of written information (Gadea et al., 2012). Therefore, this study was performed two years after the breast cancer diagnosis. The objectives of the present study were to (i) explore the number of female survivors of breast cancer who had changed their diet two years after diagnosis, (ii) identify added and avoided food items, and (iii) compare diet in patients with that of healthy controls.

2. Methods

2.1. Participants

Patients above 18 years of age and diagnosed with breast cancer (n = 281) were recruited from two university hospitals between January 2012 and June 2013, and for a further 4 year-follow up (Hagen et al., 2016). All the patients had to be in curative treatment for breast cancer (surgery, chemotherapy, radiation, and endocrine treatment), and be able to speak, read, and write Norwegian. Basically all agreed to participate and were mailed a letter explaining the study, a packet of questionnaires, a consent form, and a stamped envelope for return mail. In addition, they were asked to give information about their age, BMI, marital status, and years of education. Medical records were used to confirm cancer-related data. The patients were not given any information about diet when diagnosed with breast cancer. Two hundred and twenty-nine patients returned the completed questionnaires, whereof 20 patients dropped out due to travel distance (n = 7), fatigue (n = 5), metastasis (n = 5), and unknown reasons (n = 3). Thus the remaining 209 patients (74%) were included in the previous study by Hagen et al. (2016).

Within two years after the breast cancer diagnosis, these 209 patients were sent a packet of questionnaires of which one form referred to their diet. The patients were asked whether they had made any changes in their diet due to their breast cancer diagnosis. If the answer was "yes", they were asked about the major changes they had made of food items excluded or included in their diet. The questionnaires were self-administered and returned during a nurse-led consultation as previously described (Hagen et al., 2016). Twenty-nine patients dropped out due to incompletely filled in diet questionnaire (n = 13), long travel distance (n = 8) and unknown reasons (n = 8). As a result, 180 (86%) patients were included in the present study. Analysis shows that there were no significant differences, according to clinical and demographic variables, among those who dropped out compared to those who continued in the study. After curative treatment, none of the patients self-reported regained menstruation. Consequently, all the patients were considered to be in a postmenopausal state.

The controls comprised 315 female blood donors continuously included for 3 months during the spring of 2014. Blood donors were selected as healthy controls because they are screened for health problems in order to be eligible to donate. Therefore, they are considered to be the healthiest part of the general population (Ullum et al., 2015). The controls were given information about the study and asked to participate by filling in 4 questionnaires, whereof one about their diet. In accordance, they were asked to give the same demographic information as the patients. All the controls accepted the participation. The blood donors are not given any dietary advice except for iron-rich foods if necessary. Those who self-reported a postmenopausal state (n = 101) were included in this study.

The study was approved by the Regional Committee for Medical Research Ethics (REK–Nord No. 2011/2161) and The Norwegian Social Science Data Services. All participants signed a consent form.

2.2. Instrument

The diet questionnaire consisted of three groups of questions; the first was given only to the patients, who were asked whether they had made any changes in their diet two years after they were diagnosed with breast cancer. If the answer was "yes", they were asked about the major changes they had made in relation to food items excluded or included in their diet. Dietary data, the second group of questions, was collected using a 36 food-item frequency questionnaire. The food items were distributed in 6 clusters; cereals (wheat, rye, oats, brown bread); fish and shellfish (cod, all kinds of fish, shrimp, crab, lobster, crayfish); fruit and vegetables (cauliflower, broccoli, cabbage, kohlrabi, onion, carrot, paprika, tomato, apple, orange, banana, kiwi, pear, strawberries); dairy products (milk, cheese, yogurt, ice cream); processed food (salty, fatty, smoked, spicy or acidic food), and other food products like sugar, cacao, coffee, yeast, spices, additives, soy, peanuts, other nuts, and eggs. All the participants were asked if they avoided any of the food items with the response options "yes", "no" or "partially". Finally, the participants were asked to report their daily and weekly use of milk and other dairy products, and whether they consumed alcohol or not. The respondents who replied positively to consuming alcohol, reported their consumption (daily, every second day, once or twice per week, once per month, or more rarely), and the number of glasses during one week. The questionnaire is made by a registered dietitian and based on the 'Nordic Nutrition Recommendations 2012 – Integrating nutrition and physical activity. Nord 2014:002, Nordic Council of Ministers, Copenhagen 2014' (http://dx.doi.org/10.6027/Nord2014-002). The questionnaire is not formally validated but cited in a thesis in clinical nutrition (Kahrs, 2005).

2.3. Statistical analysis

Descriptive statistics were presented as mean and range for continuous data, numbers (n) and percentages (%) for categorical data. Calculation of the needed sample size indicates that n = 180 have the 80% power to detect differences between the two groups of patients on a 5% significant level. Tests for differences between groups were performed using unpaired Student's t-tests for continuous data, and Chi-square tests for categorical data. Influence on scores on self-reported diet changes (dependent variable), and breast cancer treatment, BMI and age (independent variables), were studied by multiple regression analysis. All tests were two-tailed, and $p < 0.05$ was considered to be statistically significant. Data were analyzed using SPSS 22.0 for Windows (Armonk, NY: IBM Corp).