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Method of Cooking and Risk of Breast Cancer in Serbia: A Case-Control Study †

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Abstract:A hospital-based, individually matched case-control study analyzing risk factors for breast cancer was conducted in UniversityClinical Centre in Kragujevac (Serbia). Logistic regression was used to calculate odds ratios (ORs) with 95% confidence intervals (95% CI). Compared with controls, breast cancer cases significantly more often reported use of lard for cooking (OR = 4.57, 95%CI = 1.51–13.84; $p = 0.007$). The increase of risk for breast cancer was associated with use of smoked food (OR = 1.67; 95%CI = 1.17–2.38; $p = 0.005$), especially in those who regularly used smoked food every week (OR = 3.12; 95%CI = 1.08–9.01; $p = 0.036$). The reduced risk for breast cancer was associated with hot pepper use (OR = 0.56; 95%CI = 0.37–0.86; $p = 0.008$).

Keywords: breast cancer; cooking; risk factors; case-control study

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1. Introduction

Breast cancer is the leading cause of cancer death among women in Serbia, with upward trend during the last decades [1]. Some epidemiological studies have suggested that there may be an increase in the risk of breast cancer associated with the method of food preparation [2,3].

Although ecological studies have suggested a positive correlation between intake of meat and dietary fat and the risk of breast cancer [4], results from analytic studies have been inconsistent [5,6]. Numerous case-control studies suggest that the use of an unhealthy cooking method may influence the risk of breast cancer [5,7,8], but not all [6,9]. A pooled analysis of nine cohort studies conducted among the Western societies, however, did not find a significant association between intake of meat or dairy products and risk of breast cancer [10]. Two large meta-analyses showed significant associations for dairy intake with breast cancer risk [11,12]. Contrary to previous studies, findings of a recent study in Iranian women did not support the hypothesis that higher total fruits and vegetables reduce breast cancer risk and suggested that only higher berry fruits intake may have an association with lower breast cancer risk [13].

Part of the inconsistency in some research could be attributed to the fact that the potential modifying effects of cooking methods were not evaluated in most of the previous studies [10]. Although certain studies suggested the importance of factors linked to cooking in breast cancer occurrence [5,8], it is not yet fully explained.

Nevertheless, research of the impact of dietary risk factors in less developed countries is still limited. No studies have been done to evaluate the association between the prevalence of dietary risk factors and breast cancer in Serbia. The aim of this study was to examine possible association of breast cancer occurrence in relation to method of cooking in Serbian women.

2. Materials and Methods

A hospital-based, individually matched case-control study analyzing risk factors for breast cancer was conducted in University Clinical Centre in Kragujevac (Serbia).

A total of 382 women (191 cases with histologically confirmed incident breast cancer and 191 controls) were includedin this study. At the Clinic for Oncology, patients were recruited with a newly diagnosed breast cancer, in whom the diagnosis was evaluated by the Consilium for breast cancer in the Clinical Center in Kragujevac, in accordance with the National Guidelines for Good Practice, i.e., according to the diagnostic criteria based on the European Society for Medical Oncology, which precisely proposed rules for standard diagnostics of breast cancer. To confirm the diagnosis of breast cancer, surgical biopsy of the breast and histopathologic examination of the sample were performed. The final pathological diagnosis was made according to the World Health Organization classifications. The diagnosis of breast cancer was not older than 2 months until the survey was conducted (the mean time interval between diagnosis and interview of cases was 2 weeks). No one refused to participate in the study.

For each case with breast cancer, one control was selected, mainly among patients who were at the same time hospitalized at the Clinic of Orthopedic Surgery and Traumatology due to milder conditions (such as gonarthrosis, coxarthrosis, etc.). Controls were without anamnestic or diagnostic data for breast cancer. Cases and controls were individually matched by gender, age (±2 years), and place of residence (rural/urban). All selected controls accepted to participate in the survey.

Data from patients and their controls were collected through a direct interview, which lasted 2 hours. The survey was always conducted by a medical doctor. The interviews were always conducted in the hospital.

In this paper, only data on the method of food preparation were presented (i.e., type of fat used; fresh or frozen meat, milk, vegetables, fruits; smoked food, fried food, cooked food, grilled food; spices such as salt, pepper, allspice, vegeta, hot pepper, celery, parsley, horseradish, vinegar).

Statistical evaluation was performed through logistic regression analysis (univariate and multivariate logistic regression models) to calculate the odds ratio (OR) with 95% confidence interval (95% CI) in order to estimate the association between cooking and breast cancer. Multivariate logistic regression model was made for all variables that were related to breast cancer in univariate analyses at a p value of <0.10. Statistical significance was considered when $p < 0.05$. All statistical analyses were conducted using the Statistical Package for Social Sciences software (version 20.0, SPSS Inc., Chicago, IL, USA).

3. Results

Our study comprised 382 participants: 191 newly diagnosed patients with breast cancer and 191 controls (Table 1). Cases and controls were individually matched by gender (all cases were females), age (±2 years) and place of residence (rural/urban). Over half of the patients were 65 or younger and were from urban areas.

Table 1. Characteristics of patients with breast cancer and their controls.

	Cases (n = 191) No. (%)	**Controls (n = 191) No. (%)**	
Gender (Female)	191 (100.0)	191 (100.0)	Matched
Age (≤65 years)	124 (64.9)	126 (66.0)	Matched
Place of residence (Urban)	116 (60.7)	116 (60.7)	Matched

Among participants, a higher proportion of cases (8.9%) than controls (2.1%) used lard as the only type of fat for cooking (p = 0.004) (Table 2). Also, a higher proportion of cases than controls reported use of smoked food (p = 0.004), both monthly (32.5% vs. 25.1%, respectively) and daily (6.8% vs. 2.6%, respectively).Compared with controls,

breast cancer cases significantly (p = 0.016) much more reported using cooked food weekly (9.4% vs. 3.6%), while less often reported use of cooked food daily (90.1% vs. 95.3%, respectively). Also, breast cancer cases significantly (but at p = 0.078) less frequently reported use of grilled food weekly (3.7% vs. 6.8%) and monthly (17.3% vs. 23.0%, respectively), while use of grilled food almost never was reported by 78.5% of cases and 70.2% of controls. When the use of spices in food preparation was reported, significant differences were found only for the use of hot peppers: the breast cancer cases used hot pepper less frequently than controls (28.3% vs. 41.4%, respectively; p = 0.007).

Table 2. Characteristics of cases with breast cancer and their controls, by cooking habits .

Cooking Habits	Cases (n = 191) No. (%)	Controls (n = 191) No. (%)	p
Type of fat			
- Lard only	17 (8.9)	4 (2.1)	0.004
- Vegetable only	69 (36.1)	81 (42.4)	0.249
- Vegetable/Lard	105 (55.0)	106 (55.5)	0.918
Meat			
- Frozen	182 (95.3)	185 (96.9)	0.430
- Fresh	155 (81.2)	152 (79.6)	0.700
Milk			
- Frozen	5 (2.6)	2 (1.0)	0.253
- Fresh	188 (98.4)	185 (96.9)	0.312
Vegetables			
- Frozen	89 (46.6)	96 (50.3)	0.474
- Fresh	189 (99.0)	188 (98.4)	0.653
Fruits			
- Frozen	14 (7.3)	16 (8.4)	0.704
- Fresh	189 (99.0)	188 (98.4)	0.653
Smoked food			
- Almost never	115 (60.2)	138 (72.3)	
- Monthly	62 (32.5)	48 (25.1)	
- Weekly	13 (6.8)	5 (2.6)	
- Every day	1 (0.5)	0 (0.0)	0.004
Fried food			
- Almost never	5 (2.6)	3 (1.6)	
- Monthly	9 (4.7)	14 (7.3)	
- Weekly	143 (74.9)	132 (69.1)	
- Every day	34 (17.8)	42 (22.0)	0.410
Cooked food			
- Almost never	0 (0.0)	3 (1.6)	
- Monthly	1 (0.5)	0 (0.0)	
- Weekly	18 (9.4)	6 (3.1)	
- Every day	172 (90.1)	182 (95.3)	0.016
Grilled food			
- Almost never	150 (78.5)	134 (70.2)	
- Monthly	33 (17.3)	44 (23.0)	
- Weekly	7 (3.7)	13 (6.8)	
- Every day	1 (0.5)	0 (0.0)	0.078
Spices			
- Salt (Yes)	191 (100.0)	191 (100.0)	1.000
- Pepper (Yes)	190 (99.5)	190 (99.5)	1.000
- Allspice (Yes)	186 (97.4)	181 (94.8)	0.184
- Vegeta (Yes)	188 (98.4)	186 (97.4)	0.475
- Hot pepper (Yes)	54 (28.3)	79 (41.4)	0.007
- Vinegar (Yes)	182 (95.3)	184 (96.3)	0.610
- Celery (Yes)	179 (93.7)	184 (96.3)	0.240

- Parsley (Yes)	188 (98.4)	186 (97.4)	0.475
- Horseradish (Yes)	167 (87.4)	165 (86.4)	0.762

Abbreviations: *p*—probability value (according to univariate logistic regression analysis) indicates statistical significance of the difference between cases and controls**.**

In the multivariate logistic regression model (Table 3), lard only as type of fat for cooking (OR = 4.17, 95%CI = 1.34–12.97; $p = 0.014$) and use of smoked food (OR = 2.07, 95%CI = 1.39–3.09; $p = 0.000$) were independently associated with the increase of risk for breast cancer. By contrast, the use of grilled food (OR = 0.51, 95%CI = 0.34–0.78; $p = 0.002$) and hot pepper as spice for food preparation (OR = 0.54, 95%CI = 0.34–0.84; $p = 0.006$) were independently associated with the reduced of risk for breast cancer.

Table 3. Risk of breast cancer associated with cooking habits in females.

Variable	OR (95% CI)	*p*
Type of fat (Lard only)	4.17 (1.34–12.97)	***0.014***
Smoked food	2.07 (1.39–3.09)	***0.000***
Cooked food	0.71 (0.39–1.27)	*0.248*
Grilled food	0.51 (0.34–0.78)	***0.002***
Spice-Hot pepper (Yes)	0.54 (0.34–0.84)	***0.006***

Abbreviations: OR—Odds Ratio; 95%CI—Confidence Interval; *p*—Probability value according to multivariate logistic regression analysi.

4. Discussion

The results of the present study confirm the well-known relationship between use of lard as type of fat for cooking and breast cancer. Our findings suggest that females who had breast cancer often used smoked food. On the other hand, females who had breast cancer less often used grilled food and hot pepper as spice.

Consistent with others [5,7,8], our results showed significant associations between certain characteristics of cooking pattern and breast cancer among females. Also, majority of previous studies suggested a positive association between red meat intake and cancer of the breast [14,15]. In the Nashville Breast Health Study, a 50% increase in breast cancer risk was observed among women with elevated consumption of red meat, but this excess of risk was not significantly different according to cooking methods [16]. In contrast to our study, a case-control study among women in Greece [6] showed that consumption of potatoes, red meat and its products, poultry and white meat, dairy products, use of margarine/butter in cooking or at the table, consumption of sausages, fried food as well as grilled meat or fish, was not significantly associated with breast cancer; at the same time, the consumption of whole grains, fruits, and vegetables, as well as the consumption of olive oil and fish consumption were favorably associated with the absence of having breast cancer.

The well-known shortcomings of case-control studies (such as the lack of a direct estimation of the cooking patterns, information and selection biases) is potential limitation of this analysis. Information bias, however, was minimized through the direct interview of cases and controls by the same trained interviewers, under similar conditions in a hospital setting. A further limitation of the study was the relatively small sample size, which could explain why some established risk factors, such as use of meat, were not detected to be significantly related to breast cancer. Also, there is always a question about potential confounding factors (such as socioeconomic status, family history of breast cancer), that might at least in part explain the results of this study.

5. Conclusions

Our study provides findings for the importance of cooking method for breast cancer risk, and indicates some ways of the possible role of cooking method on prevention of this disease.

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Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki. At the time when our study was conducted, the Ethics Committee of the Clinical Center in Kragujevac was giving approval for clinical studies only. After obtaining the approval of the Ethics Committee, the informed consent was written and signed for participants in clinical studies only. For our study, which included only the interview of the cases and controls, without any clinical examination, the Ethics Committee of the Clinical Center in Kragujevac did not require either approval or written and signed informed consent.

Informed Consent Statement: Informed verbal voluntary consent was obtained from both breast cancer cases and controls prior to the interview.

Data Availability Statement: Data is contained within the article.

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Conflicts of Interest: The authors declare no conflict of interest.

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