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HOW NUTRITION AFFECTS THE QUALITY OF LIFE IN BREAST CANCER PATIENTS, A LONGITUDINAL COHORT STUDY

Anastasios Katsourakis*[1], Nikolaos Arkadopoulos[2], Nikolaos Michalopoulos[3], Georgios Zografos[3], Ioannis Vrabas[4], Iosif Chatzis[1]

[1]Department of General Surgery, General Hospital of Thessaloniki "Agios Dimitrios", Thessaloniki, Greece.
[2]Fourth Department of Surgery, Attikon University Hospital, School of Medicine, Faculty of Health Sciences, National and Kapodistrian University of Athens, Athens, Greece.
[3]First Propaedeutic Department of Surgery, Hippocration General Hospital, National and Kapodistrian University of Athens, School of Medicine, Athens, Greece.
[4]School of Physical Education and Sport Science at Serres, Aristotle University of Thessaloniki, Serres, Greece.

***Corresponding Author: Anastasios Katsourakis**

Department of General Surgery, General Hospital of Thessaloniki "Agios Dimitrios", Thessaloniki, Greece.

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ABSTRACT

Breast cancer is the most common malignancy in women, with 2.3 million new cases worldwide in 2022. Research indicates that healthy diet can significantly benefit women with breast cancer, offering advantages in prevention, treatment, and recovery. Adopting a healthy lifestyle is associated with enhanced well-being, improved outcomes, and reduced mortality rates related to breast cancer. Our study aimed to explore the impact of nutrition on the quality of life for individuals with breast cancer. The European Organization for Research and Treatment of Cancer (EORTC) QLQ-C30 questionnaire and the Malnutrition universal screening tool as well as the Subjective global assessment form, were used to assess quality of life and nutrition respectively. We employed descriptive statistics to describe the participant sample and inferential statistics to analyze relationships between nutrition and quality of life. Our findings suggest that red meat consumption may affect the quality of life in breast cancer patients. Nevertheless, larger, multi-center studies are required to strengthen this conclusion.

KEYWORDS: breast cancer, nutrition, quality of life.

INTRODUCTION

The Global Cancer Observatory's (GLOBOCAN) 2020 data revealed a figure exceeding two million cases of breast cancer globally. Worldwide, breast cancer (BC) accounts for a quarter of all cancer diagnoses in women, representing a significant burden. Further estimates suggest that breast cancer diagnoses are expected to make up a third of all new cancer cases. The high mortality rates associated with BC have reached a level of concern, making it a major health issue, leading to more than 685,000 fatalities globally.

Several risk factors for BC that can be changed have been identified, including radiation exposure, alcohol consumption, obesity, hormonal imbalances, and a lack of physical exercise. Of these contributors, a key factor with significant influence is lifestyle. Growing evidence indicates that diet is a crucial element of a healthy lifestyle; it presents a modifiable risk factor that significantly influences about 35 percent of cancer diagnoses.

Healthy living practices have been linked to an improved quality of life leading to a more positive prognosis and reduce death rates. Therefore, our study examined how nutrition affects the quality of life for individuals with BC.

MATERIALS AND METHODS

Study design

A prospective cohort study took place at Agios Dimitrios General Hospital in Thessaloniki, Greece, focusing on

women who had breast cancer surgery. These women were enrolled if they received radiotherapy, chemotherapy, or hormone therapy within a year following their surgery, with follow-up assessments conducted one month post-operatively. However, individuals meeting any of the following criteria were excluded from the study: being over 75 years old, having an American Society of Anaesthesiologists (ASA) score higher than 3, having distant metastases, being pregnant at the time of enrollment and Stage III and over disease. This research assessed the impact of incorporating physical activity into patients' daily lives on their perceived quality of life (QoL). The study received approval from the Bioethics and Deontology Committee at the Medical School of Aristotle University, Thessaloniki, on March 11, 2022 (reference number ERC-003/2022). The study aimed to gather a sufficient number of patient responses to ensure statistical significance. All participants provided informed consent and were treated in accordance with the ethical principles outlined in the Declaration of Helsinki. Our research was not funded or sponsored by any organizations.

Quantitative data examination

To assess QoL, the EORTC Questionnaire for Quality of Life Assessment in patients with cancer, Greek version 3.0 (QLQ-C30) was used. To evaluate the nutrition status, the Malnutrition universal screening tool (MUST) and Subjective global assessment (SGA) form were used. Data collection, encompassing patients' initial attributes, surgical procedures, treatment types, and MUST/SGA outcomes, was conducted using the Google form. To gain insights into the sample and data, we employed descriptive statistics. These statistics provided a foundation for our hypothesis that nutrition impacts quality of life (QoL). To further validate our findings, we utilized inferential statistics, including a two-way analysis of variance (ANOVA) with parametric assumptions and the Kruskal–Wallis test, which is non-parametric. The Mann–Whitney test was also incorporated to strengthen the analytical approach. Statistical analysis and visualization were performed using IBM SPSS Statistics version 29 and JASP version 19.0.0.

RESULTS

Demographics

This study examined data from 47 women diagnosed with breast cancer. Their initial physical attributes revealed an average height of 1.65 meters (± 0.07m), an average weight of 74.3 kilograms (± 8.9 kg), and an average body mass index of 27.5 kg/m² (± 5.4). 63.8% of patients were married and 83% had completed high school or received higher education.

Clinical characteristics of participants

All patients were diagnosed with early stage disease. Regarding the type of operation, 76.6% underwent breast conserving surgery, 63.8% had sentinel lymph node biopsy and 21.3% axillary lymph node dissection. Patients in the study were undergoing or had received hormone therapy (85.1%), chemotherapy (31.9%) and immunotherapy (10.6%). At least one comorbidity was reported at baseline by 42.5% of participants; 20% had type 2 diabetes, 29.7% had hypertension and 14.9% had hypercholesterolemia.

The relationship between nutritional status and the quality of life

In order to examine the impact of nutrition to patients QoL, we examined the relationship of vegetables, legumes, red meat, fish and dairy products with the quality of life.

QoL – Vegetables

We divided our sample into two categories based on the amount of vegetables consumed. The first category includes patients who consume a significant amount of vegetables, specifically more than 18 servings per month and the other category includes those who consume 18 servings or fewer of vegetables per month.

Table 1 presents the descriptive statistics for the QoL variable for the two sample groups based on vegetable consumption.

Table 1: Descriptive statistics for the Quality of Life (QoL) variable values in the sample regarding vegetable consumption. (N = number of patients, Mean = mean QoL score, SD = standard deviation of QoL, SE = standard error, and Coefficient of variation = SD/Mean).

Consumption of vegetables	N	Mean	SD	SE	Coefficient of variation
Less than 18 portions/month	15	4,700	1,399	0,361	0,298
More than 18 portions/ month	32	4,828	1,330	0,235	0,275

As shown in TABLE 1, the mean score for the QoL variable is slightly lower—specifically 4.700—for those who consume fewer vegetables compared to those who consume more than 18 servings per month, who have a mean QoL score of 4.828. Furthermore, the two groups have similar values for the remaining statistical measures, such as standard deviation and coefficient of variation. From the above, it appears that there is no significant difference in quality of life between the two groups. These estimates are also illustrated in Figure 1, which shows the scatter plots, box plots, and corresponding probability density functions for each of the two patient groups, which were divided based on their vegetable intake.

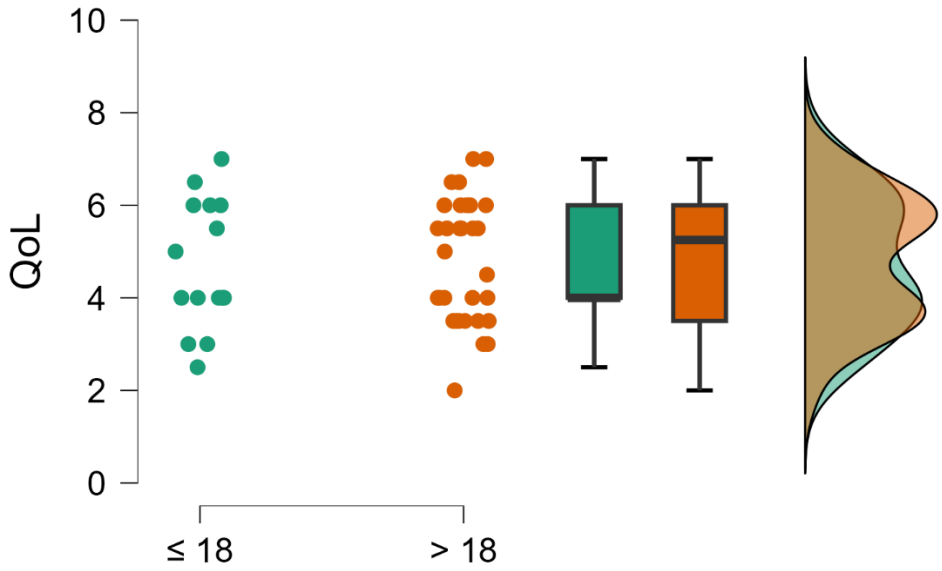

Figure 1: Rain cloud plot of the histograms and corresponding density functions for the Quality of Life (QoL) variable with respect to vegetable consumption.

The findings described above are confirmed below using inferential statistics. Specifically, we used the independent samples t-test as well as the corresponding nonparametric method, which is implemented using the Mann-Whitney hypothesis test (Table2)

Table 2: Hypothesis testing using the parametric Student's t-test and the non-parametric Mann-Whitney U test. (Vegetable consumption)

QoL	Test	Statistic	df	pvalue
	Student	-0,303	45	0,763
	Mann-Whitney	232,000		0,863

In both cases, the p-value is much greater than 1%, 5%, and 10%, which are the standard significance levels for hypothesis testing. Therefore, the hypothesis that consuming an increased amount (>18 servings per month) of vegetables does not significantly affect patients' quality of life is not rejected. We have similar findings for the other food groups, although in all cases the mean of the QoL variable is higher in the group of patients who follow a healthier diet, e.g., more legumes, vegetables, fish and dairy products, there is no statistically significant effect of any dietary habit on patients' quality of life, except for red meat consumption, which is analyzed below.

QoL-Red meat

The most notable instance where a difference is observed relates to the effect of red meat consumption on patients' quality of life. Specifically, from Table 3, which presents descriptive statistics for the QoL of patients, it is observed that the group consuming up to 4 servings of red meat per month has a significantly higher mean (5.069) on the quality of life variable compared to those who consume more red meat (4.333).

Table 3: Descriptive statistics for the Quality of Life (QoL) variable in the sample with regard to red meat consumption. (N = number of patients, Mean = Mean QoL, SD = Standard Deviation of QoL, SE = Standard Error, and Coefficient of Variation = SD/Mean).

Group	N	Mean	SD	SE	Coefficient of variation
> 4 portions/ month	18	4,333	1,465	0,345	0,338
< 4 portions/month	29	5,069	1,193	0,222	0,235

This result is also confirmed by Figure 2.

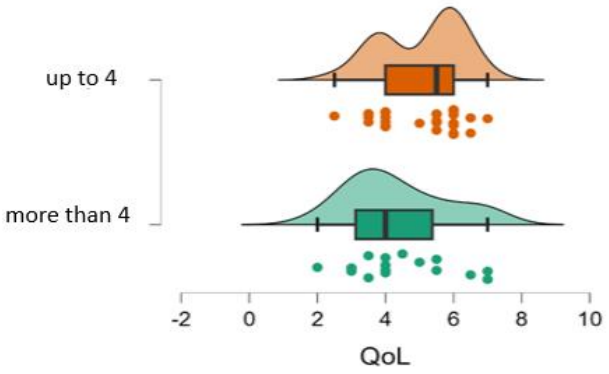

Figure 2: Rain cloud plot of the histograms and corresponding density functions for the Quality of Life (QoL) variable in relation to red meat consumption.

The above findings suggest that this case should be investigated using inferential statistics. In Table 4, the p-value for both the parametric and non-parametric tests is 0.066, which makes the effect of red meat on patients' QoL statistically significant if we choose a significance level of 10%, which, in our case, is an acceptable significance level.

Table 4: Hypothesis testing using the parametric Student's t-test and the nonparametric Mann-Whitney U test. (Red meat consumption)

QoL	Test	Statistic	df	pvalue
	Student	-1,882	45	0,066
	Mann-Whitney	177,500		0,066

DISCUSSION

Maintaining a healthy lifestyle, encompassing weight control and a nutritious diet, has a significant impact on both the likelihood of developing breast cancer and the prognosis after diagnosis. According to epidemiological and pre-clinical research, certain foods and nutrients, such as carbohydrates, saturated fats, red and processed meats are thought to potentially elevate the risk of BC due to their ability to increase the levels of naturally occurring estrogen, insulin-like growth factor (IGF)-1, and pro-inflammatory signaling molecules in the bloodstream. Conversely, fiber, omega-3 polyunsaturated fatty acids (PUFAs), vitamins C and E, along with fruits and vegetables, could potentially play a protective function by mitigating oxidative stress and decreasing chronic inflammation.[1-3]

The Mediterranean diet's high intake of vegetables and fruits delivers significant quantities of polyphenols and fiber, compounds believed to play a role in inhibiting the development of cancer. One proposed way polyphenols work is by reducing oxidative stress and inflammation. For instance, polyphenols found in blueberry powder can influence BC growth and spread by controlling the levels of interleukin (IL)-6. Polyphenols have been shown to suppress the function of enzymes like lipoxygenase and cyclooxygenase, along with the activity of the transcription factor NF-κB. These proteins are often found in elevated amounts within tumor cells and play a crucial role in controlling the production of inflammatory cytokines, including tumor necrosis factor α and IL-1, which contribute to inflammation. Certain polyphenols have been discovered to interfere with estrogen signaling. They achieve this by either blocking aromatase, the enzyme that produces estrogen, or directly interacting with the estrogen receptor. This interaction can subsequently influence the growth of tumor cells.[4-9]

The consumption of red and processed meats poses a risk for BC due to their high levels of heme iron, as well as the presence of estrogens in cattle and mutagens formed during cooking processes.[10] The cooking method, not the red meat itself, might be responsible for a rise in BC risk. This is because cooking at high temperatures leads to the creation of potentially cancer-causing substances, such as heterocyclic amines, N-nitroso compounds, and poly-aromatic hydrocarbons. While definitive proof is lacking, as per the WCRF/AICR 2018 guidelines, general advice suggests not entirely eliminating meat from your diet due to its nutritional value (providing essential nutrients such as proteins, iron, zinc, and vitamin B12). Instead, it is recommended to restrict red meat intake to approximately three servings per week, which equates to roughly 350–500 grams of cooked weight.[11]

For breast cancer stages I to III, treatment typically involves surgery and radiation therapy, frequently combined with chemotherapy or other medications

administered before or after the surgical procedure. Stage IV breast cancer and cases of distant recurrence are usually treated with systemic therapies, which include chemotherapy, hormone therapy, and antibody therapy. Chemotherapy typically lasts for 3 to 6 months and frequently causes side effects such as nausea, vomiting, decreased appetite, dry mouth, and alterations in taste or smell. Among women undergoing chemotherapy, weight gain is the most prevalent side effect, which can negatively impact both their quality of life and overall survival rates.[12-13] Weight gain following chemotherapy typically falls between 1 and 5 kilograms. This weight increase often involves a shift in body composition, characterized by an elevation in fat mass and a reduction in muscle mass, a condition referred to as sarcopenic obesity. Excess weight or obesity during chemotherapy can adversely affect breast cancer prognosis and overall survival, potentially exacerbating existing medical issues like diabetes, heart disease, hypertension, and high cholesterol.[14-16]

Based on the points described above, in this study, we aimed to determine whether there is any gain from nutrition for patients after BC surgery. The two-way ANOVA demonstrated that the consumption of vegetables, fish and dairy products cannot influence the QoL, on the contrary reduction of red meat may improve it. Despite this outcome, our study is characterised by limitations such as its low number of participants and single-centre design. For this reason, in the future, larger multicentre trials should be carried out in order to extract safer and more valid results.

CONCLUSION

Living a healthy lifestyle is linked to better overall well-being, more favorable treatment results, and a lower risk of death from breast cancer. This research investigated the influence of nutrition on the quality of life for people living with breast cancer.Our prospective cohort study demonstrated that consumption of less meat can improve QoL. However, it is important to stress that while positive lifestyle changes are advantageous, they cannot independently address malignancy. Larger multicentre studies are needed to confirm the positive effect of nutrition, and additional investigation is necessary to enhance our understanding of the molecular mechanisms that determine the impact of nutrition on BC.

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