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ORIGINAL PAPER

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The Impact of the Characteristics of Exercise on The Risk of Breast Cancer Instructions

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ABSTRACT

Background: Exercise seems to protect from breast cancer (BC) and this protection is likely mediated through weight control during menopause. Considering that night work is associated with higher risk for BC. **Objective:** The aim of this study was to examine the possible relation of BC risk to daytime or nighttime hours of exercise. **Methods:** The material was taken from primary elements of a doctoral thesis at the Department of Midwifery, University of West Attica that examines the impact of the characteristics of exercising on BC. The data were obtained from relevant questionnaires filled in at a big private hospital, following a relevant permit of the scientific committee, and adjusted Google Forms, ensuring anonymity. **Results:** Almost 3 times more women without a history of BC were exclusively exercising during the daytime compared to the ones with a history of BC who were exclusively exercising during the nighttime (40 vs 15). On the contrary, a smaller number of women without a history of BC were exclusively exercising during the nighttime compared to the ones with a history of BC who were exclusively exercising during the nighttime (17 vs 20) (odds ratio >3 with a confidence interval >1 to >7.5 and p<0.05). **Conclusion:** It seems that the protective impact of exercising on BC is mitigated when the exercise is performed exclusively during night hours. **Keywords:** breast cancer; exercise; risk factor; exercising during the nighttime; exercising during the daytime.

cancer from both European (1) and US (2) data. On the other hand, exercise seems to protect from breast cancer. This protection is likely mediated through weight control and hormonal influences such as impairing serum insulin levels (3) and estrogens. When exercising, metabolism increases (4), the cardiovascular function accelerates (5), and blood parameters (6) seem to be affected. The endocrine system seems to play an important role in those changes (7). It would be logical, thus, for someone to assume that exercise plays an important role in hormone-dependent conditions, such as breast cancer (BC).

Indeed, exercising is included in the factors that can lower the risk for BC (8-10). However, the causal pathway underlying the association between exercise and cancer risk reduction is less clear (11). Furthermore, increased estrogen levels and increased bone density seem to raise the risk of BC (9). Actually, exercise is effective in improving estradiol levels of postmenopausal osteoporotic females and the efficacy of anaerobic exercise was found to be more potent on estradiol level than that related to aerobic exercise (12). Still, besides the above mentioned impacts, exercising has a possible primary protective impact on certain cancers or precancer lesions, such as BC, endometrial hyperplasia, endometrial cancer, colon cancer and prostate cancer (13-16) and it seems also to protect from a possible recurrence and mortality (16, 17). Essentially, in experimental studies, exercise training prevented endometrial hyperplasia and biomarkers for endometrial cancer (18), an hormonally depended cancer in humans, such as BC. It is noted that even the mildest type of exercise seems to be protective for BC (19). Gi-

1. BACKGROUND

Obesity in postmenopausal women is included in the major factors that have been consistently associated with a higher risk of breast

ven that few women have included a systematic exercising regimen in their daily activities, the last observation, i.e. that even light exercise is enough to protect from BC, is very encouraging. Furthermore, a broad spectrum of studies described the relations of cancer treatment (as surgery and adjuvant therapy) and complications (as lymphedema) with exercise in breast cancer survivors (20-22).

Finally, it was hypothesized that exercise has protective effects against other hormonally dependent diseases characterized by inflammatory processes, such as endometriosis, since it increases cytokines with anti-inflammatory properties (23), hypothesis confirmed in experimental data (24).

2. OBJECTIVE

The aim of the study was to demonstrate the possible impact of the characteristics of the exercise on the risk for BC. The initial idea derived from the fact that night work is associated with higher risk for BC for workingwomen (25) due to the suppressive impact on melatonin levels in conditions of night work (26), although there is no agreement in all studies. Given this fact, possible suppression, of the above levels during night exercise (or any other mechanism) could possibly affect the more general benefit of exercising on BC.

3. MATERIAL AND METHODS

Please MS Word, following the instructions about preparing figures, tables and references presented herein. The material was taken from primary elements of a doctoral thesis at the Department of Midwifery, University of West Attica, and, inter alia, examines the impact of the characteristics of exercising (during the day or the night) on BC. Apart from the hours of exercise during the day or the night, the type of the exercise was also recorded, but these data have not been analyzed yet. The data were taken from a relevant questionnaire filled in at a big private hospital, following a relevant permit of the competent scientific committee, and adjusted Google Forms (total number: 300) for a predetermined time period, ensuring anonymity. The questionnaire included classic risk factors for breast cancer and factors related to exercise (Table 1). Initially, limited data were analyzed using the chi-square test to see if there was association between night exercise and the risk for BC. The odds-ratio calculation was used to estimate the strength of this relation. The second calculation was performed after introducing the data to the SPSS 20 (without

Factors related to breast cancer risk		
Classic factors	Factors possibly related to exercise	Exercise characteristics
Family history of breast cancer	Current Weight	Time of day
History of breast biopsy	Weight in younger ages	Kind of exercise
Age	Weight gain during pregnancies	Duration of exercise

Table 1. Indicative factors included in the questionnaire related to the risk of breast cancer and under investigation (3rd column) for the risk of breast cancer.

the need for VPN activation) and then to the SPSS 26 (after activating the VPN with Tunnelblick and connecting with the University of the West Attica), when problems were detected in the reading of Greek fonts in the first edition. The results were confirmed with relevant software in a Mac environment where only the total number of the people belonging to each group was required and not the analytical recording of the data (per woman). Indicatively, the (subscription) MEDCALC software was used. Our research does not include laboratory measurements for the time being.

4. RESULTS

Headings should be capitalized (i.e. nouns, verbs, and all other words except articles, prepositions, and conjunctions should be set with an initial capital) and should be aligned to the left. Words joined by a hyphen are subject to a special rule. If the first word can stand alone, the second word should be capitalized. Despite the relevantly satisfactory number of women participating in the study, there was some difficulty in achieving the initial aim of the study, because quite a big percentage of the women did not exercise at all during the day or the night. However, skewness and kurtosis of available figures were shown a normal univariate distribution increasing the data strength (Table 2). Almost three times more women without a history of BC exclusively exercised during the day compared to the ones with a history of BC exclusively exercising during the day (40 vs 15) (Figure 1). On the contrary, a slightly smaller number of women without a history of BC exclusively exercised during the night compared to the ones with a history of BC who exclusively exercised during the night (17 vs 20) (Figure 2).

The statistical analysis of the sample showed that the odds ratio was almost three times higher (odds ratio >3

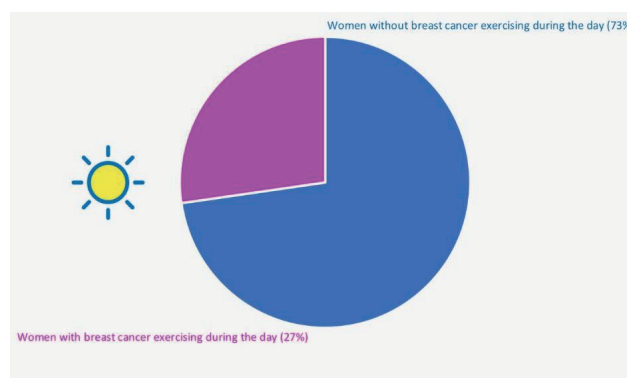


Figure 1. Almost three times more women without breast cancer exclusively exercised during the day.

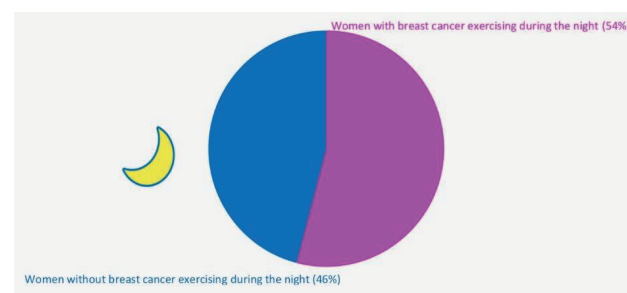


Figure 2. Slightly higher number of women with breast cancer exclusively exercised during the night

	Range	Minimum	Maximum	Mean	Standard deviation	Skewness	Kurtosis
Age (years)	57	25	82	52.9	12.7	0.3	-0.5
Weigth (kg)	47	48	95	68.9	10.9	0.1	-0.5
Height (cm)	28	150	178	164.3	6.2	0.2	-0.9

Table 2. Indicative information for factors influencing the risk of breast cancer.

with a confidence interval >1 to >7.5 and $p < 0.05$) although this seemed to mainly derive from the higher number of the healthy women without a history of BC exercising during non-night hours compared to the ones with a history of BC exercising during non-night hours. The coincidence of the SPSS results with the ones of MEDCALC was reflected up to the third decimal digit. Indicatively, the higher limit of the above confidence interval was 7.545 and 7.5456 in the SPSS and MEDCALC, respectively. The data estimation continues to a multifactorial analysis.

5. DISCUSSION

Exercising is included in a big group of factors that can affect the risk for BC (10) and other cancers. Although the exact mechanisms are not fully understood, some causal Women with breast cancer exercising during the night (54%) 5 relations are obvious. As an example, obesity during menopause belongs to the major risk factors for both breast and endometrial cancer. Thus, exercise defending obesity (27) could protect from those malignancies. Furthermore, night-shift workers are predisposed to obesity and dysregulated metabolism (28), factors that could affect their risk for breast and other cancers. Finally, the increased body mass index, visceral fat area, waist circumference, and waist-height ratio were correlated with an increased risk of other hormonally dependent tumors such as uterine fibroids (29). In this study, given that the number of the women with a history of BC exercising during the night and the ones that did not exercise was almost the same (with a slight superiority of the women with a history of BC exercising during the night), the statistical impact (odds ratio >3) seemed to mainly come from the high number of healthy women without a history of BC exercising during non-night hours compared to the ones with a history of BC exercising during non-night hours. With the previous limitation, the protective impact, perhaps, of exercising on BC is mitigated (regarding its primary occurrence) when the exercise is performed exclusively during night hours. However, given the wide confidence interval (lower limit near 1), exclusively exercising during night hours may not act as a risk factor for BC increase (as it is true with night work). It is noted that the wide confidence interval of the results differs from the narrower corresponding intervals in relevant studies on night work (25, 30) and our findings must be interpreted carefully. Furthermore, in the procedure of further analyzing our data (and recruiting more patients), some other factors related to exercise may strongly impact the influence of the exercise to BC risk, such as the kind of exercise. It is known that weightbearing and resistance exercises (including lifting weights, walking, jogging, playing tennis, etc.) are included in the factors increasing (more or less) bone mineral density in different 6 ages and clinical situations in both sexes (31-34). Furthermore, female ath-

letes have a greater bone mineral density compared with non-active females (35). On the other hand, considering that bone contains estrogen-receptors and is highly sensitive to circulating estrogen levels, long-term exposure to endogenous and exogenous estrogen can be concluded from bone mineral density (9). Actually, increased bone mineral density increases BC risk (36) and it was found that each unit increase in the total hip bone mineral density T-score was associated with an increased risk of breast cancer, a risk factor (bone mineral density) that is not included in the Gail model (37). Thus, it seems that several endocrinological factors, through exercise, could influence BC risk including melatonin, estrogen levels and perhaps specific estrogens (12). To further emphasize the importance of melatonin, melatonin alone or in combination with established treatments was proposed for the management of early stages of breast cancer (38). Lastly, it should be emphasized that a sedentary lifestyle without the appropriate amounts of exercise seems that strongly predicts the risk of cancer recurrence and death (39).

6. CONCLUSIONS

The protective impact of exercising on BC is possibly mitigated, when exclusively exercising during the night.

Exclusively exercising during night hours may not act as a risk factor for BC increase.

In the procedure of further analyzing and expanding our data, some other factors related to exercise may impact the influence of the exercise to BC risk, such as the kind of exercise.

The endocrinology laboratory association and documentation of the epidemiological findings in similar trials of a bigger scale would be interesting in the future.

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