



ORIGINAL PAPER

DOI: <https://doi.org/10.20883/jms.2017.168>

Physical activity and the risk of breast cancer development in women

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ABSTRACT

Introduction. The role of physical activity in preventive healthcare constitutes a subject matter of numerous research. In fact, it was proven that physical effort has an impact on lowering the risk of some neoplasms.

Aim. The aim of the paper was to assess the influence of physical activity on the increase or a decrease of odds ratio for developing breast cancer in women.

Material and Methods. The research included healthy women and women diagnosed with breast cancer on the basis of biopsy material or surgical intervention. The research involved 850 women, aged 21–84.

Results. Increased physical effort during household duties and physical activity in patients with breast cancer presented as follows: 1102.61 MET (Metabolic Equivalent of Task) for passive rest, 3803.47 MET for household duties, and 1971.54 MET for physical activity. On the other hand, in subjects with no change in the breasts the study indicated the following results: 1024.05 MET for passive rest, 4150.97 MET for domestic activities and 1651.46 MET for sports activities.

Conclusion. Medium and high physical activity associated with household duties decreases the risk of breast cancer development. In order to lower the risk of developing breast cancer in women, active lifestyle should be promoted in terms of physical effort within medium physical activity, i.e. 600–1500 MET.

Keywords: breast cancer, physical activity, professional work.

Introduction

The role of physical activity in malignant tumour aetiology has been the topic of many research studies. In fact, the research indicates that physical effort may contribute to the decrease in the development of breast, colon, prostate and endometrial cancer. What is more, the benefits stemming from an active lifestyle involve lowering the risk of chronic diseases, such as cardiovascular diseases, diabetes, osteoporosis and hypertension [1–4].

Additionally, minimizing the risk of malignant tumours is directly proportional to the intensity of physical activity, although intensive form of exercise is not indicated for patients with cardiovascular disorders [5].

Furthermore, regular and moderate physical activity influences proper weight and BMI within 18.5–25 kg/m². In fact, it is recommended to involve in physical exercise 3 times a week for 30 minutes [5].

The advantages of a healthy lifestyle involving a balanced diet, appropriate physical activity and maintaining proper body weight may contribute to a decrease in the incidence of cancer.

Aim

The aim of the paper was to assess the influence of physical activity associated with domestic duties, pro-

fessional work, as well as with the recreational activities on an increase or a decrease in breast cancer odds ratio in women.

Material and Methods

The research was conducted among the patients of the Gynaecology and Maternity Teaching Hospital at Poznan University of Medical Sciences between 2011 and 2013. It involved healthy subjects (n = 683), not diagnosed with breast cancer, as well as patients with breast cancer (n = 167) diagnosed on the basis of the histopathological examination. The research in total included 850 women aged 21–84.

The questionnaire was based on questions assessing physical activity in professional work and leisure time. The patients were asked to choose forms of physical activity which they had been involved in prior to the breast cancer diagnosis. A given unit of physical effort was assigned to a physical activity form, whereas in order to assess the intensity of the activity, a metabolic equivalent in MET units (Metabolic Equivalent of Task) was attributed to it.

Estimated physical activity was presented in MET units, as a value of the following parameters: MET value, number of days in a week when the activity was performed, and the activity duration in minutes per day. Additionally, MET coefficient facilitated the division of patients into 3 groups in terms of physical activity: low (under 600 MET), moderate (600–1500 MET) and high (more than 1500–3000 MET) [6].

The assessment of physical activity in professional work was attempted on the basis of a modified Freidenreich's questionnaire [7].

$$\sum_{age} \left[\frac{(final\ age - initial\ age) * \left(\frac{months}{year}\right) * (4,33) * \left(\frac{number\ of\ days}{week}\right) * \left(\frac{hours}{day}\right)}{52} \right]$$

The intensity of the professional activity was defined as follows:

1. Profession involving only sedentary work with minimal walking.
2. Profession involving little physical effort, without increased breathing rate and without slightly increased heart rate.
3. Profession involving carrying light load (2.2–4.5 kg) with increased heart rate.
4. Profession involving carrying heavy load above 4.5 kg, quick pace walk, mainly in the fresh air, with increased heart and breathing rate.

Table 1. Odds ratio was calculated for each risk factor.

Risk factor	Present	Absent	Total
Research group	a	b	a + b
Controls	c	d	c + d
Total	a + c	b + d	a + b + c + d

The odds for developing breast cancer were calculated when the risk factor was present:

$$Odds\ ratio_{positive} = \frac{\frac{a}{a+c}}{1 - \frac{b}{b+d}}$$

In addition, it was also calculated when it was absent:

$$Odds\ ratio_{negative} = \frac{\frac{b}{b+d}}{1 - \frac{c}{c+d}}$$

By means of logistic regression model, odds ratio (OR) as a relative risk was calculated with its confidence intervals (CI) at 95%.

$$OR = \frac{a * d}{c * b}$$

Statistical analysis

The calculations were performed using StatSoft, Inc. STATISTICA Version 10.

Odds ratio (OR) with confidence intervals at 95% was established by means of logistic regression model. The odds ratio relevance was verified with a test where statistical hypotheses were the following $H_0: OR_i = 1$, $H_1: OR_i \neq 1$. Moreover, Wald test statistics was established which is characterized by asymptotic distribu-

tion χ^2 with first degree freedom. On the basis of p value compared with relevance level $\alpha = 0,05$ the following decision was made: if $p \leq \alpha$, H_0 was rejected, whereas H_1 was accepted. On the other hand, if $p > \alpha$ there was no ground to reject H_0 .

The research was approved by the Poznan University of Medical Sciences Ethical Board.

Results

35.4% of the subjects diagnosed with breast cancer went for a walk daily, 11.4% took a stroll once a week,

and 17.7% did not undertake it at all. The majority of the patients (81%) did not go to the swimming pool, 11.4% went to the swimming pool less frequently than once a month, whereas 3.8% went for a swim once a week. More than a half of subjects (50.6%) did not ride a bicycle at all, 16.4% rode a bike 3 times a week, and 10.1% participated in this activity every day.

Nearly half of the subjects with no change in the reproductive organs (40.6%) did not ride a bicycle, 11.2% participated in this activity once a week, and 9.3% took part in it six and more times a week. However, 15.8% of the patients went for a walk every day, 13.4% did so once a week, whereas 10.4% went for a walk less frequently than once a month. 23.8% of patients did not take part in such an activity at all.

Increased physical effort during household duties and physical activity in patients with breast cancer presented as follows: 1102.61 MET for passive rest, 3803.47 MET for household duties, and 1971.54 MET for physical activity. However, in the patients with no change in breasts the results were: 1024.05 MET for passive rest at home, 4150.97 MET for household duties, and 1651.46 MET for sports activities.

Professional work analysis in the studied groups, revealed the following results: the average number of hours per week in the breast cancer patients was estimated at 19.9 hours. On the other hand, in subjects with no change in breast it was 31.9 hours.

The average MET value during household duties was the following: the highest value of 1297.5 MET was attributed to patients with no change in breast in the course of preparing meals, whereas in subjects diagnosed with breast cancer this value was 799.4 MET. Detailed data is presented in **Figure 1**.

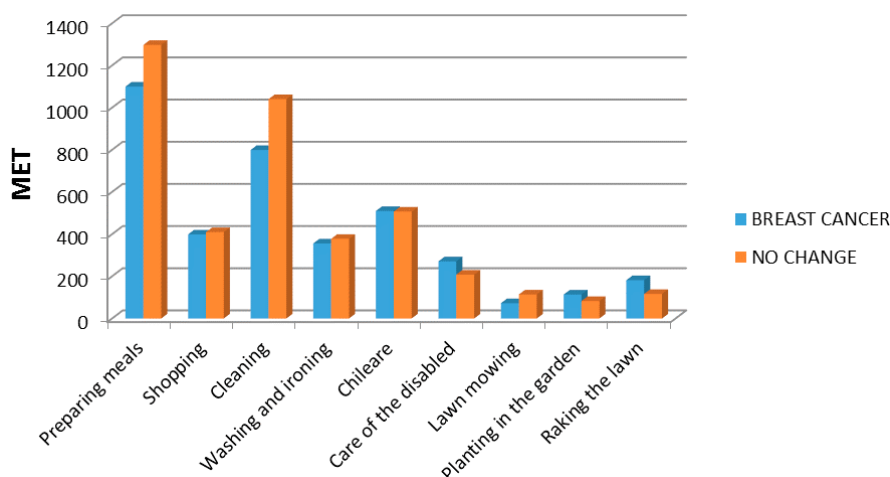


Figure 1. Average MET value during household duties in the research group

What is more, the influence of physical activity on an increase or a decrease in developing breast cancer odds ratio was also analysed.

Subjects assessing their sports activities between 600–1500 MET daily have 1.29 times higher odds ratio for developing breast cancer, where OR = 1.29; 95% CI 0.68–2.44. On the other hand, participating in sports activities above 1500 MET daily indicated a 1.72 increase in the risk of developing cancer, where OR = 1.72; 95% CI 0.99–2.98, as compared to patients undertaking little physical activity. The results are presented in **Table 2**.

Table 2. Odds ratio for breast cancer development on the basis of physical activity

Sports activities	Odds Ratio OR	Confidence Intervals 95%	Level of significiance
600–1500 MET	1.29	0.68–2.44	p = 0.4378
≥ 1500 MET	1.72	0.99–2.98	p = 0.0537

Moderate physical effort during household duties decreases the risk of breast cancer development. The odds ratio equals to OR = 0.52; 95% CI 0.06–4.53 in comparison with low physical effort.

On the other hand, in subjects participating in passive rest of 600–1500MET daily the risk is increased. Odds ratio for developing breast cancer is OR = 1.51; 95% CI 0.81–2.81, whereas in patients characterized by passive rest higher than 1500MET the odd ratio was elevated to OR = 1.33; 95% CI 0.65–2.72. The data is shown in **Table 3**.

What is more, the influence of physical effort associated with professional works on the odds ratio increase was also analysed. In these calculations the

following time spans were established: up to 10 hours of physical effort a week, 20–30 hours per week, and more than 30 hours per week.

Table 3. Odds Ratio for the breast cancer development on the basis of the declared passive rest

Passive rest	Odds Ratio OR	Confidence Intervals 95%	Level of significance
600–1500 MET	1.51	0.81–2.81	p = 0.1968
≥ 1500 MET	1.33	0.65–2.72	p = 0.4416

Discussion

The role of physical activity in the cancer aetiology has been a subject of numerous research. In fact, it was proven in a number of analyses that regular participation in physical exercise has a substantial influence on lowering morbidity rates due to chronic diseases and cancer [8–14].

Furthermore, there are more data suggesting that in order to lower the risk of breast and colon cancer development, physical effort is optimal when it is performed 45–60 minutes at least 5 times a week. In addition, physical activity may reduce the risk of breast cancer by decreasing the time endogenous steroids affect breast gland epithelial cells, as well as by controlling a woman's weight throughout her life [8].

What is more, Henderson et al. suggest that physical activity presents beneficial influence on breast cancer development also in terms of decreasing insulin and insulin-like growth factor (IGF-1) concentration level. It is the IGF which stimulates cell division, slows cell death and decreases glucose level, at the same time increasing hormone binding globulin concentration. Another physical effort defensive mechanism type is enhancing the immune system where regular and moderate physical activity may decrease the risk of breast cancer development by active enzyme regulation, which possess the properties of free radicals inhibitors, as well as by an increase in biogenic antioxidants [9].

The majority of research papers indicates a decrease in the risk of breast cancer development reaching 10–60% in women who are physically active as compared to those who rarely participate in physical effort [15–17].

In our research, moderate physical effort during household duties decreased the risk of developing breast cancer. The odds ratio was OR = 0.52; 95% CI 0.06–4.53 as compared to low physical activity.

Similar results were obtained by Kruk J. who observed a decrease in breast cancer development in women declaring moderate physical effort associated with household duties and work in the garden. Additionally, the research indicated that 50% decrease in developing of breast cancer was presented in women participating in moderate physical activity in comparison to those who remained inactive [16].

In the course of analysis, it is clear that not all of the authors present the protective influence of physical activity on the development of malignant tumours. Research by Dosemeci et al. is a suitable example where the protective influence of increased physical effort on the relative risk of breast cancer development was not observed. In the group of women with high activity, the relative risk was estimated at 1.4 as compared with patients characterised by low physical activity which was confirmed in our study. An increase in breast cancer development is visible in patients with physical activity established at 1500 MET when compared to subjects with low physical activity [18, 19].

Regular physical effort contributes to a decrease in the risk of breast cancer development by means of hormonal regulations, and an increase in the immune system function. However, intense physical activity may contribute to a delayed first menstruation, as well as primary or secondary amenorrhoea. Furthermore, the production of steroid hormone binding globulin increases, thus decreasing oestrogen function [11, 20–22].

As far as prevention is concerned, three 30-minute intensive units of training are sufficient to reduce the risk of breast cancer development by half [12].

Therefore, physical effort should be one of the basic elements of a healthy lifestyle. What is more, in the course of health education, the importance of positive health behaviours should be stressed, particularly in terms of a proper diet, stimulants avoidance, as well as participation in regular physical activity.

Conclusion

1. In order to decrease the risk of breast cancer development in women, active lifestyle should be emphasised which can be expressed by participating in physical effort within moderate physical activity of 600–1500 MET.
2. Moderate and high physical effort associated with household duties decreases the risk of breast cancer development.

3. The promotion of increasing physical activity should be aimed at women presenting low physical activity, i.e. below 600 MET, especially in their spare time.

Acknowledgements

Conflict of interest statement

The authors declare no conflict of interest.

Funding sources

There are no sources of funding to declare.

References

1. Dorgan JF, Baer DJ et al. Serum hormones and the alcohol – breast cancer association in postmenopausal women. *J Natl Cancer Inst.* 2001;93:710–715.
2. Bergier B, Bergier J, Paprzycki P. Level and determinants of physical activity among school adolescents in Poland. *Ann Agric Environ Med.* 2014;21(1):75–78.
3. Bergier B, Bergier J, Wojtyła A. Various aspects of physical activity among Lithuanian adolescents. *Ann Agric Environ Med.* 2012;19(4):775–779.
4. Owłasiuk A, Chlabcicz S, Gryko A et al. Pedometer assessed physical activity of people with metabolic syndrome in Poland. *Ann Agric Environ Med.* 2014;21(2):353–358.
5. Zatoński W. Europejski kodeks walki z rakiem. Centrum Onkologii – Instytut im. Marii Skłodowskiej-Curie, Warszawa. 2011.
6. Ainsworth BE, Haskell WL, Whitt MC et al. Compendium of physical activities: an update of activity codes and MET intensities. *Med Sci Sports Exerc.* 2000;32:S498–504.
7. Friedenreich CM, Courneya KS, Bryant HE. The lifetime total physical activity questionnaire: development and reliability. *Med Sci Sports Exerc.* 1998;30:266–274.
8. Kruk A, Kładna A. Aktywność sportowa w młodości kobiet po mastektomii na tle grupy kontrolnej. *Medycyna Sportowa.* 1999;99:29–33.
9. Pukkala E, Poskiparta M, Apter D et al. Life-long physical activity and cancer risk among Finnish female teachers. *Eur J Cancer Prev.* 1993;2:369–371.
10. Thune K, Brenn T, Lund E et al. Physical activity and the risk of breast cancer. *N Engl J Med.* 1997;336:1269–1273.
11. Verloop J, Rookus MA, van der Kooy K, Van Leeuwen FE. Physical activity and breast cancer risk in women aged 20–54 years. *J Natl Cancer Inst.* 2000;92(2):128–135.
12. Plagens-Rotman K, Żak E, Pieta B. Odds ratio analysis in women with endometrial cancer. *Menopause Rev.* 2016;1:12–19.
13. Bergier J, Kapka-Skrzypczak L, Bilinski P, Paprzycki P, Wojtyła A. Physical activity of Polish adolescents and young adults according to IPAQ: a population based study. *Ann Agric Environ Med.* 2012;19(1):109–115.
14. Biernat E, Poznańska A, Gajewski AK. Is physical activity of medical personnel a role model for their patients. *Ann Agric Environ Med.* 2012;19(4):707–710.
15. D'Avanzo B, Nanni O, La Vecchia C et al. Physical activity and breast cancer risk. *Biomark Prev.* 1996;5:155.
16. Kruk J. Deklarowana aktywność fizyczna a ryzyko raka piersi. *Journal of Oncology.* 2007;6:677–684.
17. Borch KB, Lund E, Braaten T, Weiderpass E. Physical activity and the risk of postmenopausal breast cancer – the Norwegian Women and Cancer Study. *J Negat Results Biomed.* 2014;(1)13:3.
18. Engeland A, Andersen A, Haldorsen T, Tretli S. Smoking habits and risk of cancers other than lung cancer: 28 years' follow-up of 26,000 Norwegian men and women. *Cancer Causes Control.* 1996;7:497–506.
19. Dosemeci M, Hayes RB, Vetter R et al. Occupational physical activity, socioeconomic status, and risks of 15 cancer sites in Turkey. *Cancer Causes and Control.* 1993;4:313.
20. Kaleta-Stasiołek D, Szmigielska K, Jegier A. Aktywność ruchowa w profilaktyce wybranych chorób nowotworowych. *Polskie Archiwum Medycyny Wewnętrznej.* 2003;6(6):661–668.
21. Moorman PG, Jones LW, Akushevich L, Schildkraut JM. Recreational physical activity and ovarian cancer risk and survival. *Ann Epidemiol.* 2011;21(3):178–187.
22. Piłta R, Olszanecka-Glinianowicz M, Droszdol-Cop A et al. State of nutrition and diet habits versus estradiol level and its changes in the pre-season preparatory period for the league contest match in female handball and basketball players. *Ginekol Pol.* 2012;83:674–680.

Acceptance for editing: 2017-08-15
Acceptance for publication: 2017-09-30

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