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PRACTICING SPORT IN THE AGE GROUP 21–34 AND THE RISK OF BREAST CANCER – ANALYSIS OF THE RESULTS OF A RETROSPECTIVE STUDY

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Abstract Breast cancer is the most common malignant tumor in women, so it is important to study the factors that can protect against it. One of them is physical activity, which has become the area of our interest, especially the practice of sports by women aged between 21 and 34.

The aim of this retrospective study was to check how practice of sport in the age group of 21–34 in women from the research group diagnosed with breast cancer and in the control group (healthy women from families burdened with this cancer) influences the risk of developing breast cancer.

The study showed that healthy women from families with a burden of breast cancer practiced sports in the age range 21–34 more frequently and intensively than women who had a history of breast cancer. (Sport 1 – highest intensity $P = 0.002$ Sport 2 – medium intensity $P < 0.001$ Sport 3 – the lowest intensity $P < 0.001$).

It can be concluded that practicing sport in the age group of 21–34 is an important factor in the prevention of breast cancer, although the influence of other protective factors in women from the control group cannot be ruled out.

Key words: breast cancer, retrospective study, physical activity, prevention

Introduction

Breast cancer is the most common malignant tumor among women in Poland, accounting for approximately 25% of all malignant tumours (Stec et al., 2021) In 2016, over 18,000 cases and over 6,000 deaths were reported in Poland (Jassem et al., 2019). This disease is also a significant problem in countries with a higher Human Development Index than Poland, for example in the United States in 2023, 297,790 new cases of invasive breast cancer are forecast, with 43,170 deaths. (*Cancer Facts & Figures 2023*, n.d.) This cancer is a problem so significant that a number of actions have been taken to prevent the disease - for example, October is internationally recognized as "Breast Cancer Awareness Month", while in Poland in women aged 50–69, every 24 months The National Health Fund reimburses mammography. One of the goals of this program is to reduce the mortality rate to the level of European Union countries, which shows the scale of the problem and is an important area of clinical interest for Polish researchers.

Over the years of research on breast cancer, many factors predisposing to the occurrence of this cancer have been identified (Kashyap et al., 2022). Some of them, such as sex, age or genetic predisposition, are of course unmodifiable, but many of them are directly influenced by the patient. One of such factors is physical activity, because as early as 1985, Robert Frisch's team noticed that in women who practice competitive sports in college (college athletes), the prevalence of breast cancer, as well as other cancers of the reproductive system, was lower than in women who did not practice sports (Frisch et al., 1985). As physical activity in the form of sports is one of the simplest, financially undemanding and most pleasant factors of cancer prevention for a woman, it has become the subject of research by our scientific team. To this end, we examined how the practice of sports was shaped in women who were patients of the International Hereditary Cancer Center – Department of Genetics and Pathomorphology of the Pomeranian Medical University in Szczecin in the years 2001–2021 during the age range between 21 and 34 years of age. The study compared the activity of 384 women who were diagnosed with cancer with the control group, i.e. healthy women from families burdened with breast cancer who were under the care of the Centre, 226. Thus, a total of 610 women's sports activities were examined, which allows for a statistically and clinically significant analysis.

As other studies have shown, coming from family with breast cancer history is a very important risk factor (Brody & Biesecker, 1998), so we decided to check whether the preventive factor in the control group was practicing sports. In this study, we chose the age range 21–34 because estrogen levels peak in women in the mid to late 20s (Lephart, 2018), and physical activity is a known factor in lowering estrogen levels (Ennour-Idrissi et al., 2015) whose high levels, both in form of early menarche and late menopause as well as hormone replacement therapy is a risk factor (Kashyap et al., 2022).

Materials and Methods

The correspondence survey was conducted for the study group from December 2020 to December 2022, and for the control group from June 2021 to December 2022, after obtaining a positive opinion on the purpose of the research and the method of its implementation, issued by the Bioethics Committee of the Pomeranian Medical Academy in Szczecin/Pomeranian Medical University in Szczecin – Resolution No. BN-001/254/02 of December 9, 2002, resolution No. BN001/254/02-A of June 29, 2020, resolution No. BN-001 /254/02-A of November 16, 2020, resolution No. BN-001/254/02-A of April 26, 2021. The study group consisted of women with an average age

of onset of 52.15 years from the West Pomeranian Voivodeship with histopathologically confirmed breast cancer – identified on the basis of data from the International Center for Hereditary Cancer of the Department of Genetics and Pathomorphology of the Pomeranian Medical University in Szczecin in the period from January 1, 2001 to September 30 2021. The control group consisted of healthy women from families with breast cancer history with an average age of 55.8 years from the West Pomeranian Voivodeship, matched to the study group in terms of place of residence and age range - identified on the basis of data from the International Hereditary Cancer Center of the Department of Genetics and Pathomorphology of the Pomeranian Medical University in Szczecin in the period from January 1, 2001 to September 30, 2021.

Invitation to participate in the study, the purpose of which was given, as well as consent to participate in the study - "Declaration of informed consent of the respondent" along with "Consent to the processing of personal data in a scientific study with an information clause" was sent by post in the first stage of research for the group of the study group and the control group via the Information Security Administrator of the International Hereditary Cancer Center of the Department of Genetics and Pathomorphology of the Pomeranian Medical University in Szczecin to 3,379 women with breast cancer and to 3,379 healthy women from families with breast cancer history. The materials were sent in two stages. By return mail, the Information Security Administrator of the International Hereditary Cancer Center of the Department of Genetics and Pathomorphology of the Pomeranian Medical University in Szczecin received 1516 questionnaires in the study group, of which 888 questionnaires were completed and confirmed in writing "Declarations" and "Consents" to participate in scientific research, and 628 surveys are unfilled and unsigned "Declarations" and "Consents" to participate in scientific research – without giving a reason. 1,861 women did not engage in any correspondence in the research study.

In the control group, the Information Security Administrator of the International Hereditary Cancer Center of the Department of Genetics and Pathomorphology of the Pomeranian Medical University in Szczecin received 473 questionnaires completed and confirmed in writing, "Declarations" and "Consents" for participation in scientific research. 2906 women did not engage in any correspondence in the research study without giving a reason.

The Information Security Administrator of the International Hereditary Cancer Center of the Department of Genetics and Pathomorphology of the Pomeranian Medical University in Szczecin provided personal data with the address of 888 women suffering from breast cancer in the study group and personal data with the address of 473 healthy women from families burdened with breast cancer, which constituted the control group, to the researchers in order to start the second phase of the study.

Questionnaires, together with instructions on how to answer the questions included in the survey, were sent by the researchers to 888 women diagnosed with breast cancer as the study group and 473 healthy women from families with breast cancer as the control group. By return mail, the researchers in the study group received 421 questionnaires, of which 2 questionnaires were not completed and without any information, in 35 cases the questionnaire was not fully completed. 467 women did not initiate any correspondence despite prior written consent to the research. The group of 421 ill women examined was reduced by 37 people questionnaires.

By return mail, the researchers in the control group received 228 questionnaires, of which 2 questionnaires were unfilled and without any information, 245 women did not undertake any correspondence despite their prior written consent to the research. The control group of healthy women was reduced by 2 people-questionnaires.

Finally, the data of 384 patients with breast cancer from the study group and 226 healthy women from families with breast cancer history in the control group were included in the statistical analysis. The course and aggregate

data of the survey process in the first and second stages for the research group and the control group are presented in Table 1 and Table 2.

Table 1. Characteristics of the study group

Number of women	Women with breast cancer identified on the basis of data from the International Hereditary Cancer Center - Department of Genetics and Pathomorphology of the Pomeranian Medical University in Szczecin, in the period from January 1, 2001 to September 30, 2021.
	I stage of research
3379	The Information Security Administrator of the International Hereditary Cancer Center - Department of Genetics and Pathomorphology of the Pomeranian Medical University in Szczecin sent by post, "Declarations" and "Consents"
888	By return mail, the Information Security Administrator of the International Hereditary Cancer Center - Department of Genetics and Pathomorphology of the Pomeranian Medical University in Szczecin received completed and confirmed in writing "Declarations" and "Consents" for participation in scientific research
628	By return mail, the Information Security Administrator of the International Hereditary Cancer Center - Department of Genetics and Pathomorphology of the Pomeranian Medical University in Szczecin received unfilled and unsigned "Declarations" and Consents "for participation in scientific research - without giving a reason
1863	Has not undertaken any correspondence in scientific research
Total: 3379	
	II stage of research
888	Surveys sent by researchers
467	No correspondence was undertaken - despite prior written consent for the study
2	By return, the researchers received blank questionnaires and no information
35	By return mail, the researchers received incomplete questionnaires
384	By return, the researchers received fully completed questionnaires
Total: 888	
384	Total surveys qualified for statistical analysis

Table 2. Characteristics of the control group

Number of women	Healthy women from families with breast cancer identified on the basis of data from the International Hereditary Cancer Center - Department of Genetics and Pathomorphology of the Pomeranian Medical University in Szczecin, in the period from January 1, 2001 to September 30, 2021.
	I stage of research
3379	The Information Security Administrator of the International Hereditary Cancer Center - Department of Genetics and Pathomorphology of the Pomeranian Medical University in Szczecin sent by post, "Declarations" and "Consents"
473	By return mail, the Information Security Administrator of the International Hereditary Cancer Center - Department of Genetics and Pathomorphology of the Pomeranian Medical University in Szczecin received completed and confirmed in writing "Declarations" and "Consents" for participation in scientific research
2906	Has not undertaken any correspondence in scientific research
Total: 3379	
	II stage of research
473	Surveys sent by researchers
245	No correspondence was undertaken - despite prior written consent for the study
2	By return, the researchers received blank questionnaires and no information
226	By return, the researchers received fully completed questionnaires
Total: 473	
226	Total surveys qualified for statistical analysis

Results

a) Study characteristics

The study involved 384 women from the research group diagnosed with breast cancer and 226 healthy control women from families burdened with breast cancer. The study was conducted in the form of questionnaires, the questions of which were formulated on the basis of sources [(Friedenreich et al., 1998), (Kriska et al., 1990), (Bergier et al., 2019), (Ainsworth et al., 1993), (Kośmicki, 1999)].

In the study group, the average age of breast cancer onset was 52.15 years. Among the respondents, 262 are or were married, which is 68.2%, and 121 declared their marital status as single, which is 31.5%. 1 person did not answer this question (0.3%). 206 (53.6%) respondents described their education as secondary, 123 (32%) as higher, and 48 (12.5%) declared primary education. 7 people (1.8%) did not answer. The mean body weight was 71.37 kg with the extreme values being 45 kg and 125 kg, with a median of 70 kg. The shortest woman measured 146 cm, the highest 181 cm, with a median of 162 cm.

In the control group, the mean age of the patient is 55.8. Among the surveyed women, 182 are or were married (80.5%), 41 were not married (18.1%), and 3 did not answer (1.3%). 139 respondents (61.5%) defined their education as higher, 69 as secondary (30.5%), and 17 as primary (7.5%), 1 person did not answer. The lowest weight of a woman was 45 kg, the highest 120 kg, with a median of 68.4 kg. The lowest height was 150 cm and the highest 179 cm, the median was 164.4 cm.

In the surveys, women were given the opportunity to enter three sports practiced by them in the age group of 21–34. For each of these sports, the respondent could assign the intensity of effort on a scale of 1 to 3, and each of these points was described as follows:

- little effort
- moderate exertion causing a slight increase in heart rate and light sweating
- strenuous exertion causing a strong increase in heart rate and heavy sweating

The collected data from women was analyzed and then the sports they practiced were sorted, so that sport no. 1 was always the sport for which the respondent indicated the highest intensity, no.

b) Description of the results

The first step taken by the team was to demonstrate the existence of a statistical relationship between practicing sports by women aged 21–34 and the age of breast cancer in women from the research group. As shown in Table 3, for each of the three sports practiced, a statistically significant relationship was demonstrated, because the "p" coefficient was many times lower than 0.05. The occurrence of this dependence showed that further analyzes made sense.

Table 3. Relationship between the age of breast cancer onset and sports practiced by women aged 21–34

Sport	P = chi square of independence
Sport 1 – highest intensity	P = 0.002
Sport 2 – medium intensity	P < 0.001
Sport 3 – the lowest intensity	P < 0.001

Another activity was to compare the percentage of women practicing sports in the age group 21–34, which is shown in Table 4 . In the research group, only 33.1% of women declared it, while in the control group it was 44.6%,

which gives a difference of 11.5 percentage points. The differences are even greater in the case of the second and third sport, where not only the percentage of women in the control group exceeds that of the study group, but they also gain an advantage in absolute numbers, despite the fact that the study group is 1.7 times larger. And so, in the case of the second sport, almost twice as many women from the control group practice it than women from the research group, and in the case of the third sport, this percentage increases as much as 2.6 times.

Table 4. Practicing sports in the age group 21–34

Sports/Group	research group	control group
All women	384	226
Not practicing sports	66.9% (257)	54.4% (123)
Playing sports	33.1% (127)	44.6% (103)
Doing another sport	13.3% (51)	25.2% (57)
Practicing a third sport	4.9% (19)	12.8% (29)

The next issue investigated by the team was to check how the intensity of the sport practiced by the subjects is distributed. As Table 5 shows, in the case of the highest intensity sport, the number of women declaring them in the case of sport 1 and sport 2 is higher both in percentage and absolute numbers in favor of the control group. In the case of sport 3, only the percentage is higher, although the number of women meeting this criterion is so small that one may have doubts as to the statistical significance of this result. According to Table 6, women from the research group scored 1.5% higher in practicing sport no. 1 with moderate intensity, compared to women from the control group. However, this is most likely due to the fact that in the case of women from the control group, most of them declared the sport of the highest intensity as their most exhausting, while those from the research group declared the sport of medium intensity. This thesis is confirmed by the result for sport no. 2 and 3, where the control group again prevails over the research group, both in percentages and in absolute numbers. Only in the case of sports with the lowest intensity in table 7, women from the research group get a better percentage result in the case of sports 2 and 3, but this is due to the fact that women from the control group declared practicing sports with higher intensity than those from the research group.

Table 5. Practicing sports with the highest intensity in the age group 21–34

Sports/Group	research group	control group
All women	384	226
sports 1	11.2% (43)	24.8% (56)
sports 2	3.6% (14)	8.4% (19)
sports 3	0.8% (3)	1.3% (3)

Table 6. Practicing sport of medium intensity in the age group 21–34

Sports/Group	research group	control group
All women	384	226
sports 1	18.8% (72)	17.3% (39)
sports 2	8.1% (31)	16.4% (37)
sports 3	3.1% (12)	10.6% (24)

Table 7. Practicing sports with the lowest intensity in the 21–34 age group

Sports/Group	research group	control group
All women	384	226
sports 1	3.1% (12)	3.5% (8)
sports 2	1.6% (6)	0.4% (1)
sports 3	1.0% (4)	0.9% (2)

Discussion

As a result of a retrospective survey study, we showed that practicing sports in women aged 21–34 may be associated with avoiding or at least delaying the age of breast cancer development. Women from the control group practiced sports much more often than those from the research group, moreover, while in the control group all women are patients of the International Center for Hereditary Cancer – Department of Genetics and Pathomorphology of the Pomeranian Medical University in Szczecin, they are healthy but from families burdened with breast cancer, in the case of the research group, this burden for the majority of patients has not been established, so it may even more indicate the preventive role of practicing sport in the age group of 21–34. Similar conclusions were drawn in a study (Boraka et al., 2022) showing that a high level of physical activity over 1 hour per day each week correlated with a 23% lower risk of developing breast cancer. This work, however, showed that physical activity as the only factor does not affect the risk of disease in premenopausal women. In the case of our project, however, we focused strictly on practicing sports, not physical activity, which could cause variability of results. In turn, a study (Matthews et al., 2020) showed that meeting the standard of physical activity (7.5–15 MET/h per week) can reduce the risk of getting sick by 6–10%. The result of our study also agrees with the observations of the RE team Frisch (Frisch et al., 1985), who showed that subjects who were involved in organized college sports developed breast and reproductive organ cancers less frequently than their peers who did not display similar activities. On the other hand, a study (Wu et al., 2012) showed that the risk of breast cancer decreases by 2% for each increase of 25 MET-h/week in recreational activity and by 5% for each increase of 2 hours per week for moderate and brisk activities. Thus, it can be assumed that for practicing sport, which by its nature has a higher intensity than recreational activity, these percentages may increase even more. A study that came to similar conclusions was (Guo et al., 2020), which showed that premenopausal women who confirmed at least 58.3 MET hours/week had a 23% reduced risk of developing breast cancer, compared to those with the lowest levels of activity. In contrast, for postmenopausal women, those in the top quartile of physical activity showed a 17% reduced risk compared to women in the lowest quartile. As study (Kruk, 2007) has shown, lifetime total physical activity among women was associated with a reduced breast cancer

risk. It is not contradictory to our results, because healthy women from families burdened with breast cancer were practicing sports more often than females with diagnosed malignancy.

The advantage of our work is the control and research group including over 600 women who are patients of the International Center for Hereditary Cancer – Department of Genetics and Pathomorphology of the Pomeranian Medical University in Szczecin, which takes care of patients from the entire West Pomeranian Voivodeship, covering about 1.7 million inhabitants. The disadvantage is that the assessment of physical activity by patients is subjective, and it is not possible to check whether the declared practice of sports by the patient actually took place. The study is retrospective, the advantage of this is that you can compare how the practice of sport and its intensity in the age range selected by us can be compared. The disadvantage of this type of study is the inability to control the patients' activity in real time, and on this basis calculate the percentage of breast cancer incidence depending on the declared sport activity. It cannot be ruled out that factors other than activity also influenced the incidence of the patients, although the lack of incidence of statistically active women from the control group, despite the fact that they come from families burdened with breast cancer, shows that isolated practicing of sports in the age group 21–34 affects the incidence of cancer.

Conclusions

Practicing sports in 21–34 age range may reduce risk of a breast cancer. We motivate this conclusion because our research has shown that women from the control group, healthy from families burdened with breast cancer, but without a diagnosis of this cancer, statistically more often practiced sports in the age group of 21–34, and their activity was higher than those from the research group with diagnosed cancer.

These findings could be important especially for adolescent women from families with breast cancer prevalence. Practicing sports for them could be an easy way to reduce risk of getting diagnosis of breast cancer, and also prevent most of civilization diseases like diabetes, ischemis heart disease or arterial hypertension.

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