

Life style and risk of development of breast and ovarian cancer

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Abstract

Introduction: Many risk factors may be monitored, and individual decisions concerning life style exert an effect on most factors associated with the development of cancer. It is estimated that the majority of malignant cancers, as much as 70%, are the result of the harmful effect of factors related with diet, life style, or those present in the surrounding environment.

Objective: The objective of the study was analysis of selected factors related with life style and their effect on the risk of development of breast and ovarian cancer.

Methodology: The study covered healthy women, without the diagnosis of focal lesions in the breast and ovaries, and women with the diagnosis of breast or ovarian cancer. The study was conducted during the period September 2007 – November 2011, and covered a total of 1,484 women aged 18-80. Odds ratio was calculated for individual risk factors. Statistical analysis was performed by means of the statistical packages STATISTICA v8, GrafPad Instat v 3.00, Analyse-it v. 2.2, and Cytel Studio StatXact-8. Statistical hypothesis were verified on the level of significance $p \leq 0.05$.

Results: Health-promoting life style related with physical activity and other health promoting behaviours, such as mode of nutrition, reduction or elimination of alcohol consumption and discontinuation of smoking considerably decrease the risk of development of malignant breast and ovarian cancer. The number and variety of factors which affect the risk of occurrence of cancerous diseases indicate that there is a need for monitoring of the hazard.

Conclusion: It is necessary to carry out preventive actions which would cover the health education of women, concerning life style-related risk factors and methods of their modification.

Key words

breast cancer, ovarian cancer, life style, risk factors

INTRODUCTION

At the beginning of the 21st century, the prevention and treatment of cancer has become the greatest challenge for the health care system. Therefore, it seems that the primary problems of public health are: primary prevention, i.e. prevention of cancerous diseases, as well as secondary prophylaxis, i.e. an early population diagnostics and clinical actions on behalf of early diagnosis and effective treatment of cancer.

Primary prophylaxis is based on finding the factors, the role of which in the etiology of cancer has been sufficiently confirmed by epidemiological studies. Knowledge of the causes of the development of malignant cancerous diseases, methods of prevention, or elimination or reduction of exposure to the risk factors is the precondition which allows the decrease in morbidity. It is estimated that a high percentage of cases of cancerous diseases may be ascribed to widely-understood environmental factors, including nutritional habits and socio-cultural behaviour. Therefore, according to the population examined, we have dealt with various risk factors. In the groups of immigrants, the to-date profile of morbidity due to specified types of cancer very frequently changes into the profile typical of the new place of residence [1, 2, 3, 4].

Many risk factors may be monitored, and individual decisions concerning life style exert an effect on most factors associated with the development of cancer. It is estimated that the majority of malignant cancers, as much as 70%, are the result of harmful effect of factors related with diet, life style, or those present in the surrounding environment [3, 5, 6].

Tobacco smoking is the best recognized and most important risk factor of the development of malignant cancer. Tobacco smoke contains approximately 4,000 substances, including about 40 carcinogens. Habitual smokers are exposed to lung cancer (90%), oral cavity cancer, throat, laryngeal and oesophagus cancer (80-90%), urinary bladder and pancreatic cancer (30%). A correlation was also confirmed between smoking and the occurrence of other carcinomas, including cervical cancer [1, 2, 7, 8].

Alcohol may also be the cause of development of oral cavity cancer, throat, laryngeal, oesophagus, and liver cancer. The effect of alcohol consumption on the occurrence of other types of cancer was also examined. It was confirmed that among women who consume alcohol, even sporadically, the risk of contracting malignant breast cancer is 1.5 higher than among those who abstain. It is suggested that the following three mechanisms explain the effect of alcohol on the development of breast cancer: an effect on the levels of estrogens and estrogen receptors, mechanism associated with the release of carcinogenic byproducts of alcohol metabolism, and a decreased supply of important nutrients in alcoholics [9].

It was also found that alcohol has a synergistic effect with tobacco smoking, and many times intensifies its carcinogenic

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properties. The risk related with alcohol consumption and cigarette smoking several times increases the risk caused by the use of each of them separately [1, 2, 7, 8].

Exceeding an everyday amount of alcohol equivalent to 20-25g pure ethanol (50g vodka, 250g wine, half a litre of beer) is considered as harmful for health [1].

Many reports were also devoted to the relationship between physical activity and the risk of development of malignant cancer. Many studies confirmed a positive effect of physical activity on reduced mortality due to chronic diseases, including cardiovascular diseases. It is considered that regular physical exercises decrease the risk of development of colon cancer, breast cancer, uterine and prostatic cancer. The mechanism by which an increased physical effort would contribute to the reduction of the risk of cancerous diseases may be explained by the beneficial effect on hormonal regulation, and an intensification of the activity of the immune system, and consequently inhibition of the process of carcinogenesis [10].

A health promoting life style, application of an adequate diet, care of physical activity and maintenance of a normal body weight are beneficial with respect to the reduction in morbidity due to cancerous diseases, as well as other diseases, including cardiovascular diseases [1, 6].

OBJECTIVE

The objective of the study was analysis of selected factors related with life style, and their effect on the risk of development of breast and ovarian cancer.

MATERIAL AND METHOD

The study covered healthy women, with no focal changes diagnosed in the breast and ovaries, and women with the diagnosis of breast or ovarian cancer.

The study was conducted from September 2007 – November 2011 among patients of Gynaecological-Obstetric Clinical Hospital on Polna Street in Poznań, and patients of the Transfiguration Clinical Hospital in the Oncologic Surgery Ward. A total number of 1,484 women were examined aged 18-80. Considering a wide age span of patients, they were additionally divided into two age groups: Group I – 18-45, and Group II – 46-80.

The criterion of qualification of women into the group of those healthy (n=1,144) was a normal result (without changes) in physical examination and medical history taking performed by a medical specialist, and mammography and/or ultrasound examination of the breast, and vaginal ultrasound not revealing deviations from the normal state. The subsequent criterion was family history taking, excluding the genetic risk factors. In the study, this group was marked as 'without change' (WC).

A basis for the qualification into the group of women with breast cancer (n=138) or ovarian cancer (n=202) was an histopathologic test result obtained after surgery or biopsy performed. The group of women with ovarian cancer was marked as CA-O, whereas the group of those with breast cancer – CA-M.

One of the research instruments was a questionnaire form consisting of 40 items, designed for the purpose of the study.

The questionnaire contained questions concerning socio-economic data. The women provided replies to the questions pertaining to the to-date life style and health promoting behaviours, and covered information concerning physical activity, stimulants used, information about performing self-examination of the breast, and efforts undertaken on behalf of self-control.

Odds ratio was calculated for individual risk factors.

Risk factor	Present	Absent	Total
Study group	a	b	a+b
Control group	c	d	c+d
Total	a+c	b+d	a+b+c+d

Odds ratio of developing breast and ovarian cancer was calculated when the risk factor was present.

$$\text{Odds ratio}_{\text{Yes}} = \frac{\frac{a}{a+c}}{1 - \frac{a}{a+c}}$$

and when the risk factor did not occur

$$\text{Odds ratio}_{\text{No}} = \frac{\frac{b}{b+d}}{1 - \frac{b}{b+d}}$$

Odds ratio (OR) was also calculated with a 95% confidence interval

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

Characteristics such as age, BMI, number of cigarettes smoked, and number of cups of coffee consumed was divided into specified intervals, and odds ratio calculated for the increasing values of the above-mentioned variables.

Calculations were performed by means of statistical packages: STATISTICA v8, GrafPad InStat v 3.00, Analyse-it v. 2.2 and Cytel Studio StatXact-8. Statistical hypotheses were verified on the level of significance of $p \leq 0.05$.

Consent for the study (No. 574/11) was obtained from the Bioethical Commission at the Karl Marcinkowski Medical University in Poznań.

RESULTS

The effect of the number of cigarettes smoked, number of cups of coffee consumed and frequency of alcohol consumption on an increase in odds ratios for ovarian cancer was examined. Among women who were non-smokers, compared to those who smoked 1-5 cigarettes daily, the risk was on the level of OR= 2.5; 95% CI 1.0-5.26, whereas with respect to those who smoked more than 5 cigarettes daily – OR= 1.5; 95% CI 0.90-2.5 (Tab. 1).

Among non-smokers aged over 45 the risk of ovarian cancer increased, and remained on the level of OR=2.12; 95% CI 1.42-5.00, compared to women at this age who smoked more than 5 cigarettes daily.

Women aged over 45 who did not drink coffee had OR = 2.0, 95% CI 1.42-3.33, compared to those who drank coffee at an amount of 1-3 cups daily, while compared to those who

Table 1. OR for the number of cigarettes smoked by women from the CA-O and WC groups

No. of cigarettes smoked (cigarettes/day)	Odds Ratio OR	Confidence interval 95%
<5	2.5	1.0-5.26
>5	1.5	0.90-2.25

consumed more than 3 cups of coffee daily – OR= 1.5, 95% CI 0.31-8.33. Table 2 presents the results.

Table 2. OR for the number of cups of coffee consumed by women of the CA-O and WC groups aged over 45

No. of cups of coffee consumed per day	Odds Ratio OR	Confidence interval 95%
1-3	2.0	1.42- 3.33
>3	1.5	0.31-8.33

Women aged under 45 who consumed more than 3 cups of coffee daily were at increased risk of ovarian cancer, and odds ratio was on the level of OR=1.2; 95% CI 0.25-6.16.

Among women who abstained from alcohol the odds ratio was on the level of OR=3.3, 95% CI 0.76-8.33, compared to those who consumed alcohol at an amount of 20-25 grams of pure ethanol once in two weeks, and OR = 2.0, 95% CI 0.83-5.00, in relation to women who consumed alcohol more frequently (Tab. 3).

Table 3. OR for the frequency of alcohol consumption in the group of women from the CA-O and WC groups

Frequency of alcohol consumption	Odds Ratio OR	Confidence interval 95%
Sporadically once a month	1.17	0.80-1.7
once in two weeks	3.3	0.76-8.33
once a week	2.0	0.83-5.00

For women who did not undertake any physical activity the odds ratio for ovarian cancer was OR=1.4, 95% CI 0.52-3.4, compared to those who performed exercises once in two weeks, and OR=1.1, 95% CI 0.58-2.5 in relation to women who undertook physical activity once a week. Women who performed physical exercises three times a week had odds ratio on the level of OR=1.3, 95% CI 1.36-4.0, compared to those who did not undertake any physical activity (Tab. 4).

Table 4. OR for the frequency of physical activity in the group of women from the CA-O and WC groups

Frequency of undertaking physical activity	Odds Ratio OR	Confidence interval 95%
once in two weeks	1.4	0.52- 3.4
once a week	1.1	0.58-2.5
three times a week	1.3	1.36-4.0

Similar to ovarian cancer, the risk of development of breast cancer was analyzed according to number of cups of coffee consumed daily, alcohol, number of cigarettes smoked, and frequency of undertaking physical activity. The relationship between the amount of coffee consumed, cigarettes smoked, alcohol consumption and breast cancer risk was analyzed in two age groups of patients: 45 and under, and over 45.

Among young women aged under 45 the consumption of more than 3 cups of coffee daily resulted in a decreased breast cancer risk – OR=0.8; 95% CI, in relation to those who did not consumed coffee at all. However, in the group of women aged over 45, the consumption of 1-3 cups of coffee daily caused a 2-fold increase in breast cancer risk – OR=2.01; 95% CI 1.03-3.9, whereas the consumption of more than 3 cups of coffee daily caused a 3-fold increase in this risk – OR=3.09; 95%CI 0.55-17.26, compared to the women who did not drink coffee.

In both age groups, cigarette smoking was associated with an increased risk of contracting breast cancer. Among women aged 45 and under, odds ratio was on the level of OR=0.8; 95% CI 0.25-3.04, while among those aged over 45 – on the level of OR=0.6; 95% CI 0.34-1.10, compared to non-smokers.

The consumption of alcohol was related with an increased breast cancer risk, irrespective of patients' age. Among women who consumed alcohol even sporadically once a month, at an amount of 20-25 grams of pure ethanol, the risk of development of breast cancer was 1.2- fold higher. Odds ratio for women who consumed alcohol was OR=1.17; 95% CI 0.80-1.7.

Women who performed physical exercises more frequently, three times a week, were at an increase risk, compared to those who did not exercise at all – OR= 1.3; 95% CI 0.65-2.86, whereas among those who practiced sports once a week the risk of cancer was lower OR= 0.9; 95% CI 0.44-2.09.

DISCUSSION

Approximately 35% of cancerous diseases are caused by dietary errors and nutritional factors. Low physical activity and lack of time for the preparation of meals of full value are factors related with the mode of life, potentially changeable, which play a role in primary prevention. The following factors result in the reduction of risk of breast and ovarian cancer: limitation of the calorific value of food products, regular physical exercises, limitation of the intake of carbohydrates and alcohol in diet, maintenance of the normal body weight, increased consumption of long-chain polyunsaturated fatty acids, vegetables and fruits [6, 11, 12].

A properly selected diet is important not only in cancer prevention, but may also support the treatment of a cancerous disease. Adequately selected dietary recommendations help to reduce side-effects associated with chemo- or radiotherapy. An adequate diet may also enhance the immunity of the organism, decrease the risk of complications and increase the effectiveness of treatment [12, 13].

The relationship between physical activity and cancer risk has been the object of many studies [1, 14, 15, 16, 17, 18, 19]. It seems that regular physical exercises result in the reduction of risk due to colon, breast, uterine and prostate cancer. In order to maintain the normal body weight, the BMI within the range of 18.5-25kg/m², the performance of moderate physical activity is recommended, a minimum of three times a week for half-an-hour, especially for those who lead a sedentary style of life. From the aspect of cancer prophylaxis, more intensive exercises are recommended [1].

The promotion of physical activity, counteracting overweight and obesity produce the best results when started at young age. The presented study showed that regular physical exercises performed at the age of 45 and under may result in a 5-fold decrease in the risk of breast and

ovarian cancer. Nevertheless, adopting a health-promoting life style, even at an older age, brings considerable benefits. In the literature [15, 16, 17] concerning analysis of the effect of physical activity on breast cancer risk, the protective role of an increase physical activity has been frequently indicated. It has been confirmed that in the group of most active women, this risk was reduced by 10-60%, compared to those who were less active. It is possible to reduce the risk by 52% in the group of women who undertake both occupational physical activity and activity during their leisure time. Analysis of literature reports [20, 21], also shows that some researchers have not observed an important effect of physical activity on cancer risk, while others reported even an increase in morbidity among physically active women. In the presented study, the risk of breast and ovarian cancer was even 3-fold higher among women aged over 45 who performed exercises twice a month. The differences observed may result from non-homogenous methods of measurement and classification of physical activity [1, 14,15].

In the presented study, while analyzing physical effort and the frequency of undertaking this effort, it should be noted that the majority of patients with ovarian cancer (72.77%) performed exercises more often than once a week; 54.2% of women in the control group undertook physical effort regularly three times a week, while 63.04% of women with breast cancer undertook physical activity regularly, more often than once a week. It may be concluded that too intensive physical effort, especially at an older age, may after all, increase the risk of cancerous diseases. The development of a cancerous disease usually takes a very long time, from several to several dozen years, therefore, the adoption of an hygienic style of life and undertaking physical effort too late would not stop the process of carcinogenesis which has already started at a younger age. It seems that an excessively intense, exhausting physical effort may only lead to weakening of the organism, and acceleration of the development of the disease.

Studies conducted by Kruk et al. [14] confirmed that an active practising of sports in an earlier period of life may be one of the factors protecting against the development of breast cancer. Sports activity was analyzed among 567 women who had undergone mastectomy, and 670 women in the control group. The respondents provided replies to the questions concerning, among other things, type of sports practiced, frequency and duration of practising sports. As many as 84.4% of women after mastectomy declared low sports activity in the past, while in the control group this percentage was considerably lower – 41.1%. The percentage of very active women in the control group was 12%, compared to 4.7% of those who had undergone surgery [14].

The effect of a regular, moderate motor activity on the reduction of the risk of contracting breast and ovarian cancer results from the beneficial effect of physical activity on the function of the immune system and hormonal regulation. An exhausting physical effort may result in the delay of menarche, irregular menstrual cycles, primary or secondary amenorrhoea, resulting in the reduction of ovulation cycles. Thus, an increased physical activity shortens the whole life endogenous hormones exposure. The effect on the functioning of the hormonal system in women during postmenopausal period is also associated with a decrease in the amount of fatty tissue, and in consequence, the amount of estrogens produced by this tissue. Under the effect of physical activity there also increases the production of steroid

hormone binding globulin, resulting in a decreased activity of estrogens [15, 19, 22].

Health promoting life style is associated, apart from physical activity, with other positive health behaviours, i.e. adequate mode of nutrition, limitation or elimination of alcohol consumption and discontinuation of smoking.

Tobacco smoking, apart from diet, is the main environmental cancer risk factor. In the developed countries, 25-30% of deaths due to cancer are related with tobacco smoking [1].

It is estimated that in Poland, over 9 million inhabitants are regular smokers. Nicotine and other substances present in tobacco smoke cause disorders of sex hormones metabolism, ovarian function, utero-placental perfusion, and also exert a direct toxic and mutagenic effect on the tissues of reproductive organs [23].

Smoke exhaled into the environment by a smoker is also very dangerous, frequently described as 'tobacco smoke in the human environment'. It forces passive smoking, unfavourably affects small children and pregnant women, it has been also confirmed that it increases the risk of lung cancer, cardiovascular and respiratory diseases [1].

The studies showed that the mechanism of carcinogenic effect of alcohol consists, among other things, in the enhancement of carcinogenic effect of tobacco and carcinogens, especially those of dietary origin. Also, consumption of an insufficient amount of fruits and vegetables is very important; however, the direct carcinogenic effect of ethyl aldehyde cannot be excluded, mainly that of its primary metabolite – ethanol. The amount of ethanol consumed is the main factor increasing risk [1].

No relationship was observed between tobacco smoking and alcohol consumption, and increased risk of ovarian cancer. Paradoxically, the studies confirmed that alcohol consumption may reduce the risk of ovarian cancer by decreasing the level of gonadotropins, which in physiological conditions may stimulate the development of ovarian tumours [24].

In the presented study, alcohol consumption, cigarette smoking and consumption of coffee by the respondents resulted in the reduction of ovarian cancer risk.

Women with ovarian cancer consumed 1 cup of coffee daily on average, while patients from the control group – 2 cups of coffee. The mean number of cigarettes smoked by patients with ovarian cancer was 1.3, and the maximum number – 20 cigarettes daily. In the control group, the maximum number of cigarettes smoked per day was considerably higher – as many as 45, and women in this group smoked 2 cigarettes daily, on average. Based on the analysis of odds ratio it was noted that the risk of ovarian cancer among women aged over 45 who did not consume coffee was twice as high, compared to those who drank coffee. Nevertheless, the consumption of high amounts of coffee is not recommended for women aged under 45, because in this age group the risk slightly increases in the case of drinking more than 3 cups of coffee daily, and results in a 1.2-fold increase in the odds ratio. Among non-smoking women, the risk of contracting cancer was 2.5-fold higher, compared to those smoking. A similar relationship was confirmed in the case of consumption of alcohol beverages. The risk of ovarian cancer was twice as high among women who did not consume alcohol, compared to those who did drink alcohol.

Similarly, while analyzing the effect of tobacco smoking, in the majority of studies no significant relationship was found

between smoking and the risk of breast cancer [25, 26, 27]. However, some researchers [23, 27, 28] express an opinion that tobacco smoking may exert a beneficial effect by reducing the risk of falling ill with breast cancer. The mechanism of this phenomenon is associated with aromatase inhibition by acyl derivatives of nornicotine and anabasine present in tobacco smoke and, therefore, the reduction in the total amount of estrone in the organism of a woman, and an earlier menopause [29]. According to Sajdak et al. [23], in women who smoke cigarettes, menopause occurs two years earlier on average, compared to the non-smokers. Among women aged 40-44, the risk of occurrence of premature menopause is 2.1-fold higher than among their non-smoking contemporaries, and this risk increases with the number of cigarettes smoked.

In the presented study, the mean number of cigarettes smoked among women with breast cancer was 2.1 cigarettes, the same as in the control group. The maximum number of cigarettes smoked daily was smaller than in the control group and was 21 cigarettes. The risk of breast cancer was 1.4-fold higher among non-smoking women.

The study by Gram et al. [30] showed that women who started to smoke in adolescence and continued to smoke for at least 20 years were at an increased risk of breast cancer, and the relative for this group of women was RR=1.34. This study, and also the Iowa Women's Health Study, confirmed that breast cancer risk was higher among women who began to smoke before the first childbirth and before the first menstruation [31], and the relative risk was 1.27 and 1.39, respectively. Cancer risk was related with the duration of the habit, after 40 years RR=1.50, and intensity of smoking – for those who smoke 40 cigarettes daily the relative risk was RR=1.20.

Nagata et al. [32] performed a metaanalysis, considering three cohort studies and eight control studies in order to estimate the presence of the relationship between life style and cigarette smoking, including cigarette smoking, and the risk of breast cancer among Japanese women. In these studies, the relative risk of this disease ranged from 0.71 – 6.26. However, in the majority of reports, the risk was elevated, therefore, the researchers concluded that among smoking Japanese women an increase was observed in the relative risk of breast cancer [33].

The results of studies indicate that the risk of breast cancer increases in women who consume alcohol, even in small amounts. Nevertheless, to-date, the threshold value above which the risk considerably increases has not been established, but high morbidity is observed among women who drink even small amounts of alcohol of various types – from low to high proof. It is estimated that the risk increases by 10% with each 10 grams of daily alcohol intake. The studies showed that the risk of breast cancer increases nearly twice among women who sporadically consume alcohol, compared to those who abstain from it. Based on the results of the presented studies, among women who sporadically consumed alcohol the risk was nearly twice as high as among women who abstained from drinking alcohol. This risk additionally increased when alcohol consumption was accompanied by low physical activity and insufficient intake of β -carotene [25]. The main cause of an increased risk of breast cancer is the effect of alcohol on endogenous steroid hormones. Estrogens and their metabolites converted into chinons and semichinons exert an effect on the process of carcinogenesis in hormone-dependent tissues by the generation of free oxygen radicals which directly damage the DNA [1, 25].

CONCLUSIONS

1. A health-promoting life style, associated with physical activity and other health promoting behaviours, i.e. adequate mode of nutrition, limitation or elimination of alcohol consumption and cessation of tobacco smoking, considerably reduces the risk of breast and ovarian malignant cancer.
2. The number and variety of factors which exert an effect on the risk of development of cancerous diseases indicates that there is a need for the monitoring of the threat.
3. It is necessary to carry out preventive actions which would cover the health education of women concerning life style-related risk factors and methods of their modification.

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