ORIGINAL ARTICLE

Annals of Agricultural and Environmental Medicine
www.aaem.pl

Modifiable lifestyle factors and ovarian cancer incidence in women

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Plagens-Rotman K, Chmaj-Wierzchowska K, Pięta B, Bojar I. Modifiable lifestyle factors and ovarian cancer incidence in women. Ann Agric Environ Med. doi: 10.5604/12321966.1233565

Abstract

Introduction. A correct diet plays an important role in the prevention of malignant tumours. The risk of the disease may be reduced by introducing a number of changes to the daily diet. The most important changes concern the amount of fat in the diet, dietary fibre, antioxidants in the food and the reduction of substances having a significant impact on the development of malignant tumours.

Objective. The aim of the study is to analyse the role of selected modifiable lifestyle factors affecting the development of ovarian cancer.

Materials and method. The study covered healthy women and women with diagnosed ovarian cancer. A total of 850 women aged between 21–84 were studied.

The study included women visiting the Gynaecology and Obstetrics Hospital of the University of Medical Sciences in Poznan, Poland, between 2011–2013. Patients recognized with malignant ovarian cancer were qualified into the study based on the histopathological examination of the material obtained during surgery.

Results. Respondents who consumed fruit and vegetables several times a week have the odds ratio OR = 0.29 level; 95% CI 0.04–2.01 (p =.2085), compared to women not consuming fruit and vegetables at all.

Consumption of 100 g of French fries and potato chips several times a week, results in a 2-fold increase in ovarian cancer. The OR for this group of women amounts to 2.06; 95% CI 0.53–7.99 (p=.2966).

Conclusions. A diet rich in fruit and vegetables, including bulb vegetables, and grain products containing whole grains, should be introduced. It is recommended that the consumption of popular fast foods be eliminated.

Key words

ovarian cancer, risk factors, lifestyle, the odds ratio, disease.

INTRODUCTION

Ovarian cancer is the seventh cancer in incidence in women, immediately after breast cancer, cervical, colorectal, lung, gastric, and endometrial cancer [1]. According to the data from GLOBOCAN, the number of new cases of ovarian cancer incidence in 2008 was 225,484, representing 3.7% of cancer cases in women worldwide [1]. The highest incidence rates occur in Latvia, and the lowest in Lesotho, Tanzania, on the islands of Samoa and in the Gaza Strip. Poland has a relatively high incidence of ovarian cancer. According to the National Cancer Registry, 3,587 new cases of ovarian cancer occurred in 2010 in Poland, which is 5.1% of all cancers in women [2].

The average survival time varies from the moment cancer has been diagnosed depending on the severity, and amounts to (stating), respectively: Ia – 89.9%, Ib – 84.7%, Ic – 80.0%, II and – 69.9%, IIb – 63.7%, IIc – 66.5%, IIIa – 58.5%, IIIb – 39.3%, IIIc – 28.7%, fourth – 25%. A major contributor to the relatively high mortality rate observed in ovarian cancer is the frequency with which it is diagnosed at stage III and IV. Diagnosis of ovarian cancer in its earlier stages is typically incidental as the clinical symptoms of ovarian cancer are nonspecific. These symptoms include: pain in the pelvic area and a feeling of fullness in the abdomen. Abdominal perimeter enlargement is observed in 1/3 of patients. Cancers situated in the front part of the pelvis result in the ailment of the urinary tract, while those situated in the rectovaginal pouch and spread into the peritoneal cavity manifest themselves in gastric symptoms [3].

The adverse prognosis of ovarian cancer results in effective treatments being sought that would reduce the risk of metastasis or recurrence, thus extending the overall survival time of patients [2]. Given the high mortality and relatively high incidence of ovarian cancer, the need to improve prevention, including education on modifiable risk factors, is clear. The aim of this study is to identify additional modifiable risk factors related to the development of ovarian cancer.

MATERIALS AND METHOD

This study used a cross-sectional descriptive study design. The research was conducted among patients of the Gynaecology and Obstetrics Clinical Hospital of the University of Medical Sciences between October 2011–2013. The study covered healthy women and women diagnosed with ovarian cancer. A total of 850 women aged between 21–84 were subject to analysis.

The ovarian cancer diagnosis (n = 167) was formulated on the basis of the histopathological material sampled during a surgical procedure. Reproductive malignancy was ruled out in control (n = 683) by means of a standard physical examination and standard vaginal ultrasound.

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Received: 12 November 2015; accepted: 23 May 2016; *first published on February 2017*

A questionnaire consisting of 78 questions was used as a research tool. The questionnaire included questions on demographic data (age, education, place of residence), and anthropometric data (weight, height). The questionnaire also contained questions for the assessment of lifestyle factors, such as consumption of alcohol, smoking and consumption of certain food groups that may have an impact on the occurrence of malignant tumours.

The odds ratio for particular risk factors was then determined (Tab. 1).

RISK FACTOR	OCCURS	DOES NOT OCCUR	TOTAL
Study group	a	b	a+b
Control group	c	d	c+d
Total	a+c	b+d	a+b+c+d

The chance of ovarian cancer has been calculated in the case when a risk factor occurred:

$$\text{Chance}_{\text{yes}} = \frac{\frac{a}{a+c}}{1-\frac{b}{b+d}}$$

And in the case when it did not occur:

$$\text{Chance}_{\text{no}} - \frac{\frac{b}{b+d}}{1-\frac{b}{b+d}}$$

As a measure of the relative risk, the odds ratio (OR) and its 95% confidence intervals (CI) were calculated using the logistic regression model.

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

The research obtained the required approval of the Bioethics Committee of the Poznań University of Medical Sciences.

Data analysis. Estimations were made with the use of statistical package StatSoft, Inc. (2011), STATISTICA (data analysis software system), version 10. The odds ratio with 95% confidence intervals was determined with the use of the logistic regression model. The significance of the odds ratio was examined with a test using the following statistical hypothesis H0: ORi = 1, H1: ORi ≠ 1. The Wald test statistic was used in the research. The statistics have asymptotically $\chi 2$ distribution with 1 degree of freedom, and based on the p-value compared with a significance level $\alpha = 0.05$, the decision was made: if $p \leq \alpha$ rejected H0 accepting H1, and if $p > \alpha$, there was no reason to reject H0.

Ethical considerations. This study was approved by the Bioethics Commission at the Poznan University of Medical Sciences (No. 574/2011) All participants voluntarily agreed to participate in the study. Data confidentiality and survey procedures were reviewed with each participant before the commencement of the questionnaire. The researchers assured the participants that the content of the questionnaire would be used solely for research purposes.

RESULTS

The influence of lifestyle elements on the increase or decrease of the risk of ovarian cancer was been analysed and the odds ratio of developing cancer calculated. The parameter analysed was the value of BMI. The odds ratio of the disease occurrence for women with normal body weight amounted to OR = 0.79; 95% CI 0.47–1.32 (p=.3721), and for the respondents who are overweight (BMI 25–29,9) to OR = 0.98; 95% CI 0.57–1.67 (p=.9520). In contrast, the obese women with BMI of 30–34.9, and BMI of 35–39.9 had the risk increased by 1.3 times: OR = 1.3; 95% CI 0.71–2.4 (p=.3873) and OR = 1.31; 95% CI 0.57–2.97 (p=.5179).

The impact of coffee consumption, the number of cigarettes smoked and alcohol consumption on the increase or decrease in the odds ratio was tested. The results are presented in Table 1.

Table 1. OR of developing breast cancer depending on coffee consumption, number of cigarettes smoked and the consumption of alcohol

	n(%)	M±SD	ODDS RATIO	CONFIDENCE INTERVAL	p
Coffee (in years)					
1–10	*16(9.58%)*		*0.24*	*0.20–0.47*	*.00*
11–20	*45 (26.95%)*		*0.30*	*0.13–0.44*	*.00*
21–30	*24 (14.37%)*	*14 ±14,2*	*0.33*	*0.19–0.56*	*.00*
31–40	*13 (7.78%)*		*0.69*	*0.34–1.40*	*.3006*
>40	*3 (1.80%)*		*0.45*	*0.12–1.65*	*.2290*
50–100 ml of alcohol a day once a week	*3(1.79%)*	*48 ±89,1*	*0.41*	*0.17–1.00*	*.0496*
Smoking (years) 20	*3(1.79%)*	*1 ±3,3*	*0.27*	*0.06–0.88*	*.0301*

The impact of the consumption of dairy products such as yogurt and kefir enriched with live bacteria cultures on the decrease of the risk of ovarian cancer was analysed. The respondents consuming one portion of dairy products (125 g) a day had a reduced risk, and the odds ratio for developing the disease equals to OR = 0.81; 95% CI 0.49–1.34 (p=.4113), compared to women not consuming dairy products (Tab. 2).

Table 2. OR of ovarian cancer development depending on the amount of dairy products consumed daily

	n(%)	M±SD	ODDS RATIO	CONFIDENCE INTERVAL	p
Dairy products (125 g/day)	*126(75.44%)*	*1 ±0,5*	*0.81*	*0.49–1.34*	*.4113*
Dairy products (250 g/day)	*18 (10.77%)*		*0.61*	*0.31–1.22*	*.1603*

The frequency and the intake of fruit and vegetables are parameters for which the odds ratio of the disease occurrence were calculated, taking into account vegetables belonging to the brassica family (cauliflower, broccoli, cabbage, radish, lettuce), red vegetables (carrots, tomatoes, peppers, beets) and citrus fruits (oranges, tangerines, grapefruit, lemons, apples, bananas, kiwi). Women consuming 100 g of vegetables and fruit a day had an odds ratio of the disease equal to OR = 0.29; 95% CI 0.04–2.01 (p =.2085), compared to the women not consuming fruit and vegetables at all (Tab. 3).

The risk of developing ovarian cancer increases twofold for women consuming chips and crisps several times a week in the amount of 100 g, compared to women who rarely consume these products. The OR for this group of women amounts to 2.06; 95% CI 0.53–7.99 (p=.2966).

Table 3. OR developing breast cancer depending on the type of food consumed

	n(%)	M±SD	ODDS RATIO	CONFIDENCE INTERVAL	p
Consuming 100 g vegetables and fruits a day, once a week	*125 (74.85%)*	*288± 150*	*0.29*	*0.04–2.01*	*.2085*
One onion and one garlic a day, once a week	*111 (66.47%)*	*0,8 ±0,6*	*0.51*	*0.26–0.99*	*.0456*
Wholewheat bread	*54 (32.34%)*		*0.19*	*0.10–0.27*	.006950
Fish (100 g/day)	*74 (44.31%)*	*146± 75*	*1.46*	*0.86–2.47*	*.1598*
Once a fortnight or once a week (100 g/day)	*25 (14.97%)*		*1.53*	*0.99–2.36*	*.0579*
Barley (over 100 g/day)	119 (%)	79 ±46,5	*1.58*	*1.09–2.28*	*.0155*
Basmati rice once a week (over 100 g/day)	*20 (11.97%)*	*88 ±38,3*	*1.11*	*0.66–1.88*	*.6915*
Wild rice once a week (over 100 g/ a day)	*6 (3.59%)*		*0.41*	*0.18–0.98*	*.0447*
Long grain rice once a week (over 100 g/day)	*87 (52.09%)*		*0.80*	*0.57–1,12*	*.1885*
Buckwheat (over 100 g/ day)	*75 (44.91%)*		*0.80*	*0.42–1.54*	*.8625*

The subsequent parameters for which the odds ratio of developing ovarian cancer were calculated, and included the type and amount of fat. The respondents using sunflower oil in the amount of 10 tablespoons a day have the odds ratio slightly increased: OR = 1.12; 95% CI 0.79–1.58 (p=.5172), while for the respondents using rapeseed oil in the amount of 10 tablespoons a day, as well as clarified butter, the odds ratio equals: OR = 0.77; 95% CI 0.55–1.08 (p=.1364) and OR = 0.76; 95% CI 0.53–1.09 (p=.1046), respectively, compared to women not using fat at all.

Another parameters for which the odds ratio of ovarian cancer was calculated, was the frequency and type of pasta, cereal and rice consumed (Tab. 3). The respondents consuming white pasta once a week had the risk of ovarian cancer increased 1.2 times. The OR for this group of respondents amounted to 1.20; 95% CI 0.78–1.83 (p=.4096). Women consuming whole meal pasta, soy pasta, spinach pasta and durum wheat pasta had the OR rate as follows: 0.63; 95% CI 0.40–0.98 (p=.0404), OR = 0.55; 95% CI 0.19–1.59 (p=.2688), OR = 0.42; 95% CI 0.10–1.83 (p=.2478) and OR = 0.82; 95% CI 0.53–1.27 (p=.3680).

The current study proves that women eating white pasta once a week have the risk of ovarian cancer increased by 1.2.

DISCUSSION

Epidemiological research tends to determine the impact of environmental and genetic factors on the incidence of cancer. Factors significantly decreasing the incidence of are those related to one's lifestyle. Cessation of smoking and alcohol drinking, introducing elements of correct nutrition, physical activity, as well as regular check-ups may be the foundation for lowering the occurrence of tumours [4].

The impact of obesity on morbidity and mortality has been studied and documented in the literature. In the industrialized countries, it is second risk factor of chronic diseases' development, in particular diabetes, cardiovascular diseases and malignant tumours [5]. In 2002, overweight and obesity was reported in 1.4 billion people worldwide. Obesity was found in 365 million people with the BMI greater than or equal to 30 kg/m^2. More than 50% of the population is overweight, and 30% have been diagnosed with obesity in European countries. The above data concerns Greece in particular, where 51% of men and 37% of women suffer from overweight and 28% of men and 38% of women are obese. Overweight and obesity is a phenomenon observed least frequently in France, Sweden, Denmark and Norway [6].

Epidemiological studies [7, 8] indicate a relationship between increased body weight and the risk of ovarian cancer. Pan et al. [8] in their clinical-cohort study investigated the relationship between obesity and the risk of ovarian cancer. Based on the analysis, the authors proved an increased risk of ovarian cancer amounting to RR = 1.95 in women with the BMI above 30. In the presented study, the respondents with the BMI between 30–34.9 have a higher risk than 1.3.

Smoking is one of the best studied factors associated with the development of malignant tumours. The carcinogenic effects of tobacco smoking are associated with 90% incidence of lung cancer, 80–90% of cases of cancer of the oral cavity, pharynx, larynx, oesophagus, as well as 30% of cases of bladder cancer. Smoking increases the risk of gastric cancer (about 50–60%), pancreatic cancer (approximately threefold) and colorectal carcinoma (50–70%) [6]. The relationship between smoking and the occurrence of other cancers, including cervix cancer, has been demonstrated.

It has been proved that nicotine and other substances present in cigarette smoke affect the metabolism of sex hormones, the function of the fallopian tubes, and uterine perfusion- bearing. Their toxic and mutagenic effect on genital tissues has also been proved. In the current analysis, respondents' smoking caused a reduction in the risk of ovarian cancer.

It is estimated that about 20–30% of malignant tumours are diet-related cancers, where nutritional factors play an important role in the development of the disease. Breast, colon, oesophagus, stomach and pancreas cancers are included in this group of cancers. In this analysis, respondents' smoking causes a reduction in the risk of ovarian cancer.

It is estimated that about 20–30% of malignant tumours are diet-related cancers, where nutritional factors play an important role in the development of the disease. Breast, colon, oesophagus, stomach and pancreas cancers are included in this group of cancers. Predisposing factors include: intake of high energy, fat and sodium, insufficient amount of fibre, and low intake of calcium and vitamins.

Consumption of sugar or white flour – substances with a high glycaemic index – is the cause of a rapid increase of glucose in blood by the immediate release of insulin, which enables glucose to infiltrate into the cells. Furthermore, the secretion of insulin is accompanied by the release of IGF (insulin-like growth factor), to stimulate cell growth. The rapid insulin and IGF secretion causes not only the growth of tumour cells, but also infiltration into neighbouring tissues.

Correctly used and dosed **omega-3 acids** have a protective effect on the cardiovascular system, reduce high blood pressure and prevent obesity by its inhibiting effect on the lipogenesis [9, 10, 11, 12]. Moreover, they have an antidepressant effect by their correct action on nerve cell membranes of the cerebral cortex. Furthermore, omega-3 acids have an **anti-inflammatory and anti-allergic** effect aimed at inhibiting **excessive immune responses and** the **inflammation of bacterial and viral infection**. O**mega-6 acids are also taken with food.** Their **excessive consumption** can have fatal **consequences for the organism. In the course of a chemical processes** they **can be transformed into arachidonic acid in the body**. **Prostaglandins** may be formed from this four-u**nsaturated** fatty acid, **having proinflammatory effects [13].**

The consumption of fish is considered to reduce the risk of ovarian cancer. In order to evaluate the relationships between consumption of fish and the risk of ovarian cancer, Kolohdooz et al. [14] performed a meta-analysis on basis of 2 clinical cohort studies among women in Australia. In these studies, the relative risk of ovarian cancer was at a level of 0.76. A similar relationship has been demonstrated in studies of Jiang et al. [13].

In the presented analysis, women with ovarian cancer consumed an average of 146 g of fish a day, while patients in the control group – an average of 163 g. When analysing the odds ratio of developing the cancer, it can be noticed that women consuming up to 100 g of fish a day for a week, have the risk of developing an ovarian cancer increased by over 1.5- fold. Perhaps the differences between the study and the literature are due to the increasing pollution of the environment, thus the consumption of fish contaminated with heavy metals and other toxins.

The preparation of oils and fats used in the production of highly processed food leads to chemical changes which, in turn, adversely affect our health. This is connected with the so-called hardening of vegetable oils. During the process, a transition from liquid fats into solid fats takes place through their hydrogenation. This results in the saturation of unsaturated bonds between carbon atoms. In consequence of the above changes, solid fat suitable for lubrication is formed from liquid oil. The formation of trans fat acids occurs in the process of fats hardening.

Another important component of a healthy diet in the prevention of malignant tumours, except for low carbohydrate products, there occur products in which lactic fermentation occurs. These products include yogurt, buttermilk, cottage cheese, sauerkraut, sourdough and pickled vegetables. If cancerous cells already exist in the body, they are not provided with the glucose necessary for proper functioning, only lactic acid. As is well known, it cannot be re-fermented in the tumour cell, and therefore it is devoid of nutritional products and dies. The presented study shows that in the respondents declaring the consumption of a single piece (125 grams) of a milk product a day, the risk is reduced. The research of Merritt et al. [16] confirms this result.

A diet rich in fruit and vegetables is undoubtedly a health-promoting diet. Based on the epidemiological research it can be concluded that vegetables and fruit are the main source of folic acid, which is involved in the biosynthesis of purines and DNA methylation. Reduced levels of folic acid can result in the impairment of the synthesis of nucleotides and DNA damage [17, 18]. The respondents' consumption of 100 g of fruit and vegetables a day decreases the risk of ovarian cancer. The research of Tang et al. [19] and Schultz et al. [20] also confirmed this result.

Cruciferous vegetables belong to the group of cruciferous plants (Cruciferae) of Brassica genus. Vegetables essential in nutrition are: white cabbage, red cabbage, Italian cabbage, Chinese cabbage, broccoli, cauliflower, brussel sprout, radish, and rape. The advantages provided by cruciferous vegetables are associated with the high content of secondary metabolites, particularly glucosinolates. Tests on animals and *in vitro* tests drew attention to the degradation products of glucosinolates which suppress the division of cancer cells, and accelerate the controlled death of the cell with damaged DNA. Furthermore, the protective effect of the enzyme degradation products of glucosinolates is associated with the induction of detoxifying enzymes in the tissues of the gastrointestinal tract, particularly of glutathione transferase, levelling the active form of carcinogenic compounds [21, 22, 23].

Preclinical studies have proved [24] that eating garlic and onion has a preventive impact on the occurrence of malignant carcinomas among people. Garlic additionally shows antifungal, antibacterial, antiatherosclerotic and antithrombotic properties, as well as reducing the blood glucose level and regulating blood pressure. Their unique constituents include organosulfur compounds, flavonoids, oligosaccharides and arginine that slow down the inflammatory processes entailing an increased risk of malignant cancer. Alliin, methylaniline and propylaniline are precursors of bioactive organosulfur compounds, including allicin, the transitions of which contribute to the formation of the organosulfur compounds obtained from garlic, such as diallyl sulfide, diallyl trisulfide or diallyl disulfide [25, 26]. It appears that garlic and its compounds display the capacity to inhibit the growth of cancer cells and to slow down the cell division cycle. They influence the induction of atypical cells apoptosis and the inhibition of angiogenesis. They also show antioxidative properties [24, 25, 26].

CONCLUSIONS

1. The conducted study and the analysis of the collected data allowed the following conclusions to be made:
2. To reduce the risk of ovarian cancer a diet rich in fruit and vegetables, onions, garlic, whole grains and beans should be introduced.
3. Popular fast food such as French fries and chips should be eliminated.
4. To reduce the risk of ovarian cancer should be introduced whole-wheat pasta, soy pasta, spinach pasta and durum wheat pasta

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