Cigarette smoking and age at natural menopause of women in Poland
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Citation

Abstract
The work is based on material obtained from cross-sectional studies carried out in the years 1998 to 2002 among women living in Poland. The material included data from 3793 women aged from 35 to 69 years. The women who participated in the research varied with regard to age, education and socio-economic status. The menopausal status and (median and mean) age at menopause were estimated on the basis of retrospective and status-quo methods (ANOVA and probit analysis). The aim of this work was to determine whether and to what extent smoking of cigarettes influences the age of natural menopause. The mean age at natural menopause was 50.33 years. Smoking of cigarettes increases the risk of earlier menopause (F = 138.8, p < 0.0001). Non-smoking women have menopause on the average two years later than women who are habitual smokers. Also the number of cigarettes smoked every day affected the age of menopause, accelerating its occurrence in women who smoked more than five cigarettes per day (F = 50.81, p < 0.0001).

INTRODUCTION
Smoking cigarettes is one of the factors accelerating the process of human senescence.

Several studies (1-3) suggested that women who smoke have an increased risk of vascular and heart diseases, cancer and osteoporosis. Moreover, overall mortality rate among smokers is twice as high as in non-smokers (4-11). Postulated mechanisms for these associations include: direct toxic effect on the ovaries, an interference with gonadotropin release, and alterations in the metabolism of sex steroids (6). Polish population makes a group of inveterate smokers. Investigating the European Centers which took part in WHO MONICA Project (12), we may see that adult women a leading part among smokers. In Poland about 33 percent of women smoke.

Taking into account the above data, this study will try to determine whether and to what degree smoking cigarettes affects the age at natural menopause in women in Poland.

METHODS
The empirical basis for this work includes material collected from the cross-sectional studies conducted in years 1998 – 2002 among women living in Wiekopolska and ?lask regions of Poland. It comprises a group of 3793 women aged from 35 to 69 years. Women who participated in the study varied with regard to age, education and socio-economic status. The investigation instrument was a questionnaire including a range of questions which helped to establish the menopausal status in women and their smoking habits (Questionnaire).

Preliminary analysis revealed that 1326 women were still menstruating, whereas 2467 women were postmenopausal. Out of this number, 2117 women claimed to have had natural menopause, 156 women had hormonal therapy in their perimenopausal period.

Women who were undergoing supplementary hormonal therapy before the menopause, as well as women whose menopause was not a result of a surgical interference were included into this group. In the remaining 194 women the menopause was a consequence of a surgical intervention.

It is known that the age of menopause varies according to its character. The analyses included 2117 women whose menopause was of a natural character.

The obtained data were analysed statistically. The age at menopause of the investigated women was estimated by means of two different methods: retrospective and “status quo”. The retrospective method was used to evaluate the average and the median age of natural menopause, also the
exact date of the last menstruation and the exact date of birth were noted. Then we evaluated the average age at natural menopause, using probit analysis, to eliminate a mistake which results inevitably from retrospective calculations. To state whether and to what degree smoking cigarettes affects the age of natural menopause, we used analysis of variation. The analysis of variation was extended by a posteriori tests to compare particular groups. All the analyses were conducted according to their assumptions, as we have applied the statistical programme pack Statistica 6.0 (StatSoft, Inc 2004 Statistica for Windows).

RESULTS

Using the retrospective method we were able to obtain the mean and median age of natural menopause, based on the date of women’s last menstruation and their birth date. The mean age at menopause was 49.81; SD = 2.27, and the median age at menopause was 50.0, while the age ranged from 37.72 to 56 years. Next, in order to eliminate an error with which the retrospective method is unavoidably burdened (many women may not remember the exact date of their last menstruation), we estimated the median age at natural menopause applying probit analysis which enabled us to determine in each age group the percentage of women, who had their menstruation at least 12 months before they were examined. It appeared that median age at natural menopause, estimated by probit analysis, was 50.33 years (variation estimator was 0.02).

The aim of this study was to determine whether and in what way smoking cigarettes influences the age at natural menopause. The analyses included women whose menopause was of a natural character and only women who had never smoked cigarettes (1332 women; 68.38 %) as well as women who smoked habitually both during their menopause period and before (616 women; 31.62 %). Women who gave up smoking in their perimenopausal period were excluded from the analysis because they made a small group of 169. Besides they did not say how long and how many cigarettes per day they had smoked. The one-factor analysis of variation showed highly significant statistical relation between smoking cigarettes and the age at natural menopause (F = 138.8; p<0.0001). Women who had never smoked experienced their menopause later – their mean age was 50.05 years (SD = 2.04), whereas women who smoked habitually before and during the menopause experienced menopause earlier, at a mean age of 48.38 years (SD = 2.96). The results are presented in Table 1.

Furthermore we investigated whether the number of cigarettes smoked per day influences significantly the age of natural menopause. The results show highly significant statistical difference (F = 50.81; p<0.0001). Females who smoked more than 5 cigarettes per day on an average underwent their menopause two years earlier.

The results are presented in Table 2. Table 3 presents results of the T Tukey test or irregular numerical showing differentiated influence of smoking on the age of natural menopause in the examined women. Tukey test implies lack of differences between menopausal age in non-smoking females and in those who smoked up to 5 cigarettes per day.

Table 1: Smoking cigarettes and the age at natural menopause

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>(\bar{X})</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women who never smoke cigarettes</td>
<td>1332</td>
<td>50.05</td>
<td>2.04</td>
</tr>
<tr>
<td>Women smoking habitually</td>
<td>616</td>
<td>48.38</td>
<td>2.96</td>
</tr>
</tbody>
</table>

N= number of women, \(\bar{X}\) - average, SD= standard deviation

Table 2: Mean age of natural menopause by number of cigarettes smoked per day

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>(\bar{X})</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women who never smoke cigarettes</td>
<td>1332</td>
<td>50.05</td>
<td>2.04</td>
</tr>
<tr>
<td>Women smoking up to 5 cigarettes</td>
<td>214</td>
<td>49.77</td>
<td>2.07</td>
</tr>
<tr>
<td>5-10 cigarettes per day</td>
<td>211</td>
<td>47.70</td>
<td>3.10</td>
</tr>
<tr>
<td>10-20 cigarettes per day</td>
<td>154</td>
<td>47.79</td>
<td>3.19</td>
</tr>
<tr>
<td>More than 20 cigarettes per day</td>
<td>37</td>
<td>46.98</td>
<td>3.02</td>
</tr>
</tbody>
</table>

N= number of women, \(\bar{X}\) - average, SD= standard deviation
DISCUSSION

The analyses show explicitly that smoking cigarettes accelerates the risk of earlier occurrence of natural menopause in Polish women.

Habitual smokers have their menopause about two years earlier than women who have never smoked. The number of cigarettes smoked per day also influences the age of menopause. Women who smoked more than 5 cigarettes per day had menopause earlier than women who smoked occasionally or did not smoke at all.

The obtained results support the data from literature. Willet et al. in a prospective study demonstrated that current smokers were more likely to undergo an earlier menopause than non-smokers. Mean ages at menopause were 52.4 years for never smokers and 51.9, 51.7 and 50.4 years for women who currently smoked 1-14, 15-24, 25-34 and 35 or more cigarettes per day. Cramer et al. found that women who ever smoked, had a significantly earlier mean age at menopause of 50.1, when compared to women who never smoked (50.7).

In Kaufman et al. study, smokers had significantly earlier menopause than women who had never smoked. The mean age at menopause declined with increasing number of cigarettes smoked, although the trend was not significant. Women who smoked at least 15 cigarettes per day had their menopause on an average 1.8 years sooner than women who had never smoked.

Di Prospero et al. demonstrated that female smokers experienced menopause significantly earlier (mean age at menopause 47.1 +/- 3.3 SD) than non-smokers (49.4 +/- 3.6 years), what supports our observation. In their study the prevalence of cigarette smoking is more frequent in females with ovarian failure before 46 years of age.

Mattison and Thorgeirsson presented a very probable mechanism which could be responsible for the earlier age at natural menopause in women who had smoked habitually. They discovered that in mice benzopyrene - a polycyclic aromatic hydrocarbon which is one of the components of cigarette smoke, damages the primary ovary vesicles. If we assume that the same mechanism occurs in women, then, according to the interpretation that menopause appears when the ovaries knock out certain number of oocytes, we may expect earlier menopause even in those females who stopped smoking long before the menopausal period. According to the mechanism suggested by Mattison and Thorgeirsson, the more cigarettes women smoked and the longer they had done it, the more oocytes they had damaged. That is why they undergo earlier menopause in comparison to the women who had smoked occasionally or not at all. Smoking cigarettes may not only accelerate reduction of oocytes in the ovary but it may also influence involution of the ovary and the whole organism, because this is the factor increasing oxidation of the cellular membrane, caused by combustion products such as nitrogen dioxide. Baron et al. also pointed out that smoking cigarettes reduces the level of estrogens, and thus may endanger earlier occurrence of natural menopause in females. It is known that postmenopausal women who smoke and take oral estrogens have serum estron and estradiol levels lower than women who never smoke cigarettes. These data prove irrefutably that smoking influences the diverse metabolism of hormones. Women who smoke cigarettes produce more 2-hydroxyestriadiol, which has virtually no estrogenic activity, and less estriol, potentially leaving them with less circulating active estrogen than those who never smoke cigarettes.

The obtained results encourage further studies in this field so that harmful results of smoking cigarettes could be publicised and healthy lifestyle could be popularised among women who smoke in their reproductive period.
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Figure 4

Questionnaire

This questionnaire is anonymous and includes a number of questions we would like you to answer honestly, so that the proper care is given. The questionnaire is made for only scientific research and will not be published in any form. The results will be used for evaluation of Polish women health condition in the middle age and indicating preventing procedures in the public health care. We are grateful for your cooperation.

1. Date of birth: __________
2. Are you currently (____) or have you been (____) a smoker?
3. The state of the first period (age) (approximately) ________
4. Do you have periods (did you have): regularly ________ irregularly ________ If irregularly, please state ________
5. When it was: ________
6. Do you smoke more than 20 cigarettes a day __________ 20-30 cigarettes a day __________ longer than 32 cigarettes a day __________
7. How often do you smoke: daily __________ occasionally __________ never __________
8. Do you smoke in public places: yes __________ no __________
9. How much do you smoke: 1-5 cigarettes per day __________ more than 5 cigarettes per day __________
10. Do you have a habit of smoking cigarettes: yes __________ no __________
11. How often do you smoke: daily __________ occasionally __________ never __________
12. How many cigarettes do you smoke daily: __________
13. Do you smoke in public places: yes __________ no __________
14. How often do you smoke: daily __________ occasionally __________ never __________
15. How much do you smoke: 1-5 cigarettes per day __________ more than 5 cigarettes per day __________
16. Do you have a habit of smoking cigarettes: yes __________ no __________
17. How often do you smoke: daily __________ occasionally __________ never __________
18. How much do you smoke: 1-5 cigarettes per day __________ more than 5 cigarettes per day __________
19. Do you smoke in public places: yes __________ no __________
20. How often do you smoke: daily __________ occasionally __________ never __________
21. How much do you smoke: 1-5 cigarettes per day __________ more than 5 cigarettes per day __________
22. Do you smoke in public places: yes __________ no __________

References

15. Luoto R, Kaprio J, Uutela A. Age at Natural Menopause and sociodemographic status in Finland. Am J Epidemiol; 139 (1):64-76.
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