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RISK OF BREAST CANCER AMONG FEMALE TEACHERS OF PHYSICAL EDUCATION AND LANGUAGES

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A retrospective follow-up study on 924 physical education (PE) and 3 239 language (L) teachers was performed to study whether life-long high physical activity affects the risk of breast cancer. The Finnish Cancer Registry found 128 malignant breast cancers among these women in a follow-up during 1967–1987. The standardized incidence ratio (SIR) for all PE teachers was 1.28 (n.s.) and for L teachers 1.59 ($p < 0.001$). Before the menopause (below age 50) SIR for PE teachers was 0.93 (n.s.) and for L teachers 1.51 ($p < 0.05$). These results suggest that before menopause the risk of breast cancer in physically active PE is smaller than in the less active L. A Poisson regression analysis, taking into account the reproductive factors together with age and observation period, did not show any significant difference between PE and L teachers, probably due to the relatively small number of cases ($n = 22$) in the PE teacher group.

Key words: Breast cancer, epidemiology, risk, physical activity, life-style.

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Endocrinological factors are crucial in the development of breast cancer. Efforts directed towards patients with the disease or towards different groups or populations at risk have, however, not revealed any major endocrine abnormalities as causes of breast cancer. Concepts of both the important endocrinological factors and of their mechanisms have changed considerably over the years. An important topic of discussion in recent years has been the importance of progesterone and therefore of ovulation and anovulation for the development of breast cancer. One previous fairly general belief was that anovulation, i.e. the lack of progesterone, is a risk factor (1). The more recent view is very different. One breast cancer risk group, i.e. women with early menarche, was found to be characterized by high serum estradiol concentrations, early onset of ovulatory cycles (2) and low serum SHBG-concentrations (3, 4). There are also other studies suggesting that early onset and long-lasting regular cyclic ovarian function is associated with increased risk of breast cancer (5).

The incidence of breast cancer is highest among women in the higher and better educated social classes (6). The factors associated with the differences in breast cancer risk can be related to certain features in the population studied, such as age at menarche, at full-time pregnancy and at menopause, total number of deliveries and abortions, dietary habits, alcohol consumption and weight.

Athletic activity and exercise may affect the risk of breast cancer. Frisch et al. (7) showed that a group of women participating regularly in athletic activity during their college years had a lower relative risk of breast cancer than their classmates who did not engage in such activities.

Breast cancer is a serious and increasing public health problem. Due to the great need to reduce the breast cancer

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risk, and since athletic activities for this purpose seem to be promising, the present retrospective cohort study on physical education and language teachers was performed.

Material and Methods

The cohort. All teachers of physical education (PE) and languages (L) who had graduated since 1920 were obtained from four teachers' registers. The registers indicated that there were 997 PE and 3 447 L teachers who were alive at the time for compilation (1954 and 1967 for L, and 1959 and 1973 for PE teachers). Because the central population registration system in Finland, with its unique personal identification numbers for all inhabitants, allowing automatic record linkages between different registries, was started in 1967, the search for cancer in the present study started on January 1, 1967. After excluding those who had died before 1967 or for whom no personal identification number was found, the final cohort sizes were 3 239 L and 924 PE teachers. The proportion of those who could not be traced was similar in the two teacher groups. Data concerning death, emigration, and numbers and year of birth of children were obtained from the Population Register Center of Finland. For each person, the search for cancer and the calculation of person-years started after completion of each register or on January 1, 1967, whichever occurred later. The follow-up ended at the time of death or emigration or on December 31, 1987, whichever was the earlier. The total number of person-years in the follow-up among PE teachers was 16 096 and among L teachers 65 050. During the follow-up period (1967–1987) 128 breast cancers were diagnosed in the women in the cohort and registered in the files of the Finnish Cancer Registry.

Calculations. A stratum was defined by the 5-year age group and the calendar period. The expected number of cases of breast cancer for the three consecutive periods (1967–1974, 1975–1981, and 1982–1987) was calculated for each 5-year age group, by multiplying the stratum-specific number of person-years by the stratum-specific national incidence figure. The standardized incidence ratio (SIR) was defined as the ratio between observed and expected numbers of cases. Poisson regression (8, 9) was used to study the effects of age, observation period, follow-up time, reproductive history and teacher group on the risk of breast cancer.

Questionnaire. It was assumed that the two teacher groups belonged to the same social class and that their physical activity differed at least during their university years because of the obligatory physical exercise in the PE teacher training programme. A structured questionnaire was sent to 278 PE and 278 L teachers. The inquiry aimed at clarifying the known risk factors of breast cancer, such as age at menarche and menopause, age at first birth, and total number of deliveries and abortions in our cohort. Physical activity of the teachers was also included. Two hundred and two PE teachers (73%) and 180 L teachers (65%) answered the questionnaire.

Results

Table 1 shows observed and expected number of breast cancer cases and SIR for the two subcohorts. The SIR for language teachers was 1.59 ($p < 0.001$ compared with total Finnish female population) and that for physical education teachers 1.28 (n.s.). Before 50 years of age, i.e. before the menopause, the respective figures were 1.51 ($p < 0.05$) and 0.93 (n.s.). The risk of breast cancer rose with increasing age of first birth and decreased with an increasing number of children, especially among language teachers, where the number of cases in each subgroup was larger than in those of the physical education teachers (Table 2).

The results of the Poisson regression analysis showed that language teachers had a 1.23-fold relative risk of breast cancer (not significant), compared with physical education teachers. The addition of age or observation period (1967–1974, 1975–1981 and 1982–1987) to the regression model did not improve the fit. The interaction between age and teacher group (Table 1) was not significant. Age at first birth proved to be a significant risk factor. Number of children was not a significant factor when adjusted for age at first birth. In the final model the risk of physical education teachers was not significantly lower than the risk of language teachers. The risk ratio

Table 1

Observed (obs.) and expected (exp.) number of breast cancer and standardized incidence ratio (SIR), by age group

Age years	Physical education teachers			Language teachers		
	Obs.	Exp.	SIR	Obs.	Exp.	SIR
All	22	17.21	1.28	106	66.67	1.59***
26–49	5	5.38	0.93	40	26.46	1.51*
50 or more	17	11.83	1.44	66	40.20	1.64***

* $p < 0.05$, *** $p < 0.001$, compared to total Finnish female population.

Table 2

Observed (obs.) and expected (exp.) number of breast cancer, and standardized incidence ratio (SIR), by age at first birth

Variable	Physical education teachers			Language teachers		
	Obs.	Exp.	SIR	Obs.	Exp.	SIR
Number of children						
1–2	9	6.0	1.5	42	21.8	1.9***
3 or more	11	7.4	1.5	19	15.7	1.2
Age at first birth (years)						
<25	–	2.1	–	6	6.5	0.9
25–29	13	7.3	1.8	25	15.9	1.6*
30 or more	7	4.0	1.8	30	15.1	2.0***
No births	2	3.8	0.5	45	29.2	1.5**

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, compared to total Finnish female population.

between the language and physical education teachers was 1.28.

The results of the questionnaire revealed no inter-group differences in age at menarche, age at menopause, mean number of children, or in social status. The estimates of life-long physical activity regularly had higher values among physical education than language teachers (data not shown). The inter-group differences decreased with age. The ages at first birth of both PE and L teachers in the complete cohorts were similar.

Discussion

The results of the present study suggest that, before menopause, the risk of breast cancer in physically active women is lower than in less active women.

The risk of breast cancer is related to the social class, and is higher in more highly educated women (6). The two groups now studied, teachers of languages and physical education, showed similar economical and geographical distributions. Other risk factors, such as age at menarche and menopause, age at first birth, and mean number of children, did not differ between the groups. As expected, the PE teachers displayed higher estimates of physical activity than the L teachers. These differences decreased with age.

We found a significantly higher (SIR 1.6) breast cancer risk in language teachers than in the total population, similar to what was earlier shown for women with an academic education in Finland (6). In contrast, the breast cancer incidence of premenopausal (below 50 years of age) PE teachers did not differ from that of the total population. This suggests that physical activity has a protective effect in premenopausal women. The 1.6-fold difference between premenopausal PE and L teachers in their breast cancer rates was, however, not significant, probably due to the small number of PE cases.

These results thus agree with those of Frisch et al. (7) that long-term physical activity may lower the risk of breast cancer. This decrease in breast cancer risk may stem from endocrine mechanisms. A decrease in the total number of ovulatory cycles may exert a protective effect against breast cancer (5). Several studies show that strenuous physical activity before menarche may lead to a delay in the onset of menarche, and that after menarche, irregular menstrual cycles and amenorrhea often occur in athletes (10). Even moderate physical activity has been found to affect menstrual cycle patterns and ovulatory frequency in adolescent girls, with a significant dose-related trend in the occurrence of anovulatory cycles with increasing levels of physical activity (11). Serum sex steroid levels established during adolescence seem to prevail into adulthood (4). Case-control studies have shown that women with breast cancer are more likely than controls to have established a regular menstrual cycle pattern early (12, 13), and to have maintained a regular long-life menstrual cycle pattern (13, 14). The results of the present study also suggest that physical activity has a protective effect on breast cancer risk through changes in ovarian function, as the difference between PE and L teachers in breast cancer incidence was observed at the premenopausal age. On the other hand, the extent of physical activity in PE teachers tended to decrease with age.

The most critical point of our regression analysis was the low number of cases among physical education teachers, especially in the premenopausal group. That may be one of the reasons why the analyses, even when taking into account all relevant variables (age, period, follow-up time, age at first birth and number of children), failed to show any significant difference between the two teacher groups.

A more comprehensive study is needed to firmly establish the protective effect of physical activity on breast cancer risk, and to address more specific questions, such as

the extent of exercise needed. It would be of interest to study whether, for instance, an extent of physical activity could be found that would reduce the breast cancer risk without causing major disturbances in the menstrual cycle pattern. Among the factors apparently reducing the risk of breast cancer, physical exercise might offer an ethically acceptable means for the prevention of breast cancer.

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