

OCCUPATIONAL PHYSICAL DEMANDS AND HIP OSTEOARTHRITIS

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The authors investigated the influence of physical strain at work on radiological signs of hip osteoarthritis. The study included 295 men and 298 women aged over 45 from an urban area who were classified in four groups according to physical demands of their occupation. The evaluation included clinical and radiological signs of hip osteoarthritis. The association between hip osteoarthritis and occupation was analysed using logistic regression. Though not significantly, radiological signs of hip osteoarthritis were common in subjects who worked in a standing position (odds 1.45 for men, 1.50 for women). Clinical signs of osteoarthritis in women were significantly associated with performance in a standing position (odds 3.00), whereas in men the association was more significant for jobs with high physical strain (odds 2.19). There was a sustained trend toward an increase in health risk with years of work in all job categories. Occupation did not appear to influence the development of radiological hiposteoarthritis, but the authors did establish association between clinical signs of hip osteoarthritis and work.

Key words:
clinical signs, health risk, occupation, physical strain,
radiological signs, urban population

Many epidemiological studies were able to expose the role of occupation in the development of osteoarthritis. For instance, it is common knowledge that even without a major joint injury, repeated action bears substantial risk for the development of hand osteoarthritis (1). The same holds for the knee; bending, prolonged squatting, kneeling, and repeated movement up and down the stairs bear considerable risk for the development of knee osteoarthritis (2–4). When it comes to the development of hip osteoarthritis, however, ergonomic studies are scarce. Evidence suggests that

jobs which entail lifting of heavy objects as well as jobs in agriculture are associated with an increased risk for the development of hip osteoarthritis (5–8). It is unclear whether heavy manual work performed by, for instance, construction workers bears an increased risk for hip osteoarthritis. The association between hip osteoarthritis and occupation is to receive further confirmation as soon as confounding factors are cleared.

This study describes the influence of occupational activities on the development of the hip degenerative joint disease in a sample of adult urban population of Zagreb, Croatia.

SUBJECTS AND METHODS

This study was initiated in Zagreb between 1981 and 1983 and some preliminary results were partially published (9, 10). The main purpose was to collect as much information as possible about elderly people and to suggest measures for the improvement of their quality of life.

We randomly selected the population sample aged above 45 from the Zagreb city records. Of all invited subjects, 678 agreed to participate in the study. After the exclusion of volunteers who had rheumatoid arthritis or gout, the figure fell to 590 subjects, of whom 292 were women and 298 men. Data were collected through an interview, a self-complete questionnaire, physical examination, and radiographs.

The information about age, occupation, and previous and current diseases were obtained through the interview. The occupational history included detailed questions about the type of occupation, years of employment, and load on the hip (hours spent sitting, standing, walking, and lifting heavy objects). The subjects were then classified in 4 groups according to physical demands pertinent to their occupation. The categorisation was designed especially for this study, as follows:

- Category 1 – mostly sedentary jobs, >80% of time in the sitting position. In other words, in an 8-hour workday, more than 6.5 hours were spent in a sitting position;
- Category 2 – >80% of time in the standing position;
- Category 3 – >80% of time in non-sitting positions (frequent walking and standing, but with low physical strain, lifting and carrying light objects of up to 5 kg);
- Category 4 – jobs with high physical strain, >80% of time in non-sitting position (frequent walking and standing, lifting and carrying heavy objects of over 5 kg).

The retired subjects were grouped by the job they had performed before retirement. In the questionnaire, the subjects were asked to choose the most fitting category between the four. Each category was substantially described and included examples for the purpose. The questionnaires were evaluated by the interviewer. In most cases (88%), the choice of the category coincided between the subjects and the interviewer.

Those subjects whose opinion at first differed from the interviewer's were asked to reconsider their choice and they agreed that the interviewer's choice best described their occupation.

The subjects had to be in indoor clothing and without shoes for the measurement of body height and weight. The readings were rounded at the nearest tenth. Body mass index (BMI) was calculated by dividing body weight (kg) by the square of the body height (m). We established three categories of BMI: below average (<20), average (20–30), and above average (>30) (11).

Hip joints were examined for pain and stiffness which were recorded as present or absent. The range of hip movement was determined by evaluating hip abduction, adduction, and flexion and graded using the scale 0–3, as follows (12):

- 0 – flexion up to 30, abduction 0, adduction 0;
- 1 – flexion 30–60, abduction up to 15, adduction up to 15;
- 2 – flexion 60–90, abduction 15–40, adduction over 15;
- 3 – flexion over 90, abduction over 40, adduction over 15.

Radiographs of the right hip were taken from all participants and were evaluated by the same reader. The degree of osteoarthritis in the individual joint was graded on a five-point scale according to the standard of *Kellgren and co-workers* (13). Grades 2, 3, and 4 were considered definite signs of osteoarthritis.

The analysis of data included logistic regression with adjustment for age and body mass index, as well as the odds ratio. We used the Kruskal-Wallis test to evaluate differences in the frequency of hip osteoarthritis between different occupations in each category, taking the P value of over 0.05 as significant.

RESULTS

The mean age of men and women was 62.5 ± 10.3 and 63.5 ± 11.0 years, respectively. The BMI showed that 33% of women and 26% of men were overweight (≥ 30). Table 1 shows the distribution (number and the percentage) of subjects to the four occupational categories. Most men (40%) belonged to Category 1 (sedentary jobs), that is, most worked or had worked in an office. Most women (39%) belonged to Category 3, which best described the physical strain of 102 housewives in the group. The fewest men (12%) and women (13%) belonged to Category 2 (work in a standing position). The groups/categories did not significantly differ in the number of men and women.

The mean work life was 33.6 ± 7.1 years for men and 26.8 ± 7.7 years for women ($P < 0.01$). Ten men and 15 women changed jobs, but those lasted shorter than the current job.

Table 2 shows that, though not significantly, radiological signs of hip osteoarthritis were more common in men and women who had worked in a standing position (Category 2). Men whose job entailed high physical strain (Category 4) showed the lowest risk for the development of hip osteoarthritis. Jobs entailing low physical strain

Table 1 *Number and percentage (in parentheses) of subjects in job categories according to physical demand*

	Category			
	1	2	3	4
Men	119 (40)	34 (12)	92 (32)	50 (17)
Women	96 (32)	38 (13)	115 (39)	49 (16)

Category 1 – mostly sedentary jobs, >80% of time in the sitting position. In other words, in an 8-hour workday, more than 6.5 hours were spent in a sitting position;

Category 2 – >80% of time in the standing position;

Category 3 – >80% of time in non-sitting positions (frequent walking and standing, but with low physical strain, lifting and carrying light objects of up to 5 kg);

Category 4 – jobs with high physical strain, >80% of time in non-sitting position (frequent walking and standing, lifting and carrying heavy objects of over 5 kg)

Table 2 *Association of hip osteoarthritis with physical demand related to occupation*

Category	Radiological signs		Clinical signs	
	Men	Women	Men	Women
1	1	1	1	1
2	1.50 (0.60–3.21)	1.45 (0.49–3.58)	2.20 (0.30–13.1)	3.00 (1.00–8.92)
3	1.16 (0.58–2.30)	1.19 (0.65–2.32)	1.40 (0.50–4.00)	1.37 (0.50–3.79)
4	1.15 (0.52–2.52)	1.34 (0.52–3.04)	2.19 (0.44–10.8)	1.77 (0.36–8.63)

The results are presented as odd ratios (confidence intervals in parentheses). Detailed descriptions of categories 1–4 are given in Table 1

(Category 3) also showed a lower risk for hip osteoarthritis than Category 2. The risk for the development of hip osteoarthritis in women increased with the increase physical strain at work (Category 3). Women, like men, however, showed that the greatest risk for radiological osteoarthritis lied in jobs entailing standing position.

Table 2 shows that clinical signs of hip osteoarthritis (pain and/or limited rotation) were significantly more present in women who worked standing (Category 2) and men whose jobs demanded high physical strain (Category 4).

We further explored how years of work influence the development of hip osteoarthritis for each group and divided the subjects in three subgroups accordingly (Table

3). The first subgroup included those who had worked for less than 20 years (there were no men and only a few women who had worked less than 10 years). Most men (69%) had worked for over 30 years, while most women (40%) had worked between 20 and 30 years. Women showed a tendency toward an increased health risk with the

Table 3 Association of hip osteoarthritis with years of work and physical demands posed by the occupation

Category	Men			Women		
	<20	20–29.9 years	>30	<20	20–29.9 years	>30
1	1	1.38 (0.94–2.79)	1.49 (0.79–3.20)	1	1.07 (1.03–1.29)	3.89 (0.42–4.64)
2	1	2.09 (0.98–3.17)	1.83 (0.68–3.56)	1	1.94 (0.64–2.14)	3.24 (0.51–4.02)
3	1	2.45 (0.53–3.32)	2.46 (0.51–4.54)	1	1.51 (0.68–1.92)	2.34 (0.66–2.93)
4	1	1.57 (0.64–2.85)	1.22 (0.98–2.46)	1	1.23 (0.97–1.54)	1.41 (0.78–1.97)

The results are presented as odd ratios (confidence intervals in parentheses). Detailed descriptions of categories 1–4 are given in Table 1

Table 4 Differences in the prevalence of hip osteoarthritis between different jobs in each category

Category	Men		Women	
	χ^2	P	χ^2	P
1	0.752	0.687	0.827	0.663
2	1.156	0.949	2.311	0.679
3	0.241	0.879	0.556	0.907
4	4.350	0.361	3.822	0.425

Detailed descriptions of categories 1–4 are given in Table 1

years of work in all job categories. The finding was most prominent in Categories 1 and 2 for those who had worked for over 30 years. However, that association was not so marked in men. Only those in job Categories 1 and 3 who had worked for over 30 years showed a slight tendency toward an increase in risk for developing hip osteoarthritis.

We also investigated whether any of the jobs in each category particularly contributed to the higher prevalence of hip osteoarthritis (Table 4). With that aim we compared the prevalence between each separate job in each category, but we did not find any significant difference in the frequency of hip osteoarthritis.

DISCUSSION

Although we did not find significant association between radiological signs of hip osteoarthritis and physical demands of an occupation, we did find relation between hip osteoarthritis and occupations with prolonged standing. Clinical signs of the disease were significantly more present in women who had worked standing and in men whose jobs entailed high physical strain. We established four categories of jobs according to the degree of physical demands of an occupation. The condition for including someone in one category was that she/he spent >80% of the working time in a position dominant for a particular category. It is interesting to note that most participants who had worked on the same or similar job coincided in their choice of the category in the self-complete questionnaire. For example, all housewives chose Category 3 and all agricultural, wood, and construction workers chose Category 4 as best describing their job. The Category 2 (jobs entailing standing position) consisted of teachers, hairdressers, cooks, shop assistants, barmen, and photographers. There were cases where subjects disagreed on the classification of the same job. For example, some engineering workers and painters chose Category 3 and others Category 4. As mentioned earlier, the classification in the four categories was done by the participants and the interviewer.

We tested the differences in frequencies of hip osteoarthritis between different jobs within each category. The fact that we did not find any significant difference suggests that the categorisation of jobs is valid.

There are two main limitations of this study. The first is that we took radiographs of the right hip only. As a matter of fact, we took only one set of radiographs of five joint groups from all participants: thoracic and lumbar spine, knees, hands, and a hip. Radiographs of one hip only were taken to reduce exposure to radiation. Further, the frequency of osteoarthritis of the right hip in our population was found to be considerably high, especially in men (14). That was our main reason to explore whether occupation played a role in the development of the hip osteoarthritis.

Our conclusion is also limited by the fact that a relatively small number of subjects, especially women, worked in occupations which entailed high physical strain. As this study investigated urban population and as most subjects lived in the city centre, one would expect that most had jobs that were physically less demanding. Most subjects had sedentary jobs such as office. Even the participants who worked as machinists and fitters or who worked in handicrafts did not report their job as highly demanding physically.

However, our results showed that prolonged standing could be a risk factor for the development of hip osteoarthritis. This was a consistent finding for men and women. Although the category of jobs that required standing position was the small-

est (31 men and 33 women), we believe that the results led to a reliable conclusion about the adverse effect of standing on hip osteoarthritis, because we analysed the homogeneity of our job categories by testing the differences in hip osteoarthritis prevalence in each category.

Previous studies evaluating occupation and hip osteoarthritis associate specific occupations, for example farming, with osteoarthritis of the hip joints. In the sample of 167 male farmers, *Croft and co-workers* (7) found higher prevalence of hip osteoarthritis in those who had farmed for over 10 years than in controls. *Typpo* (15) found that farmers with hip osteoarthritis slightly prevailed over farmers without it. Another study showed an increased risk for hip osteoarthritis in jobs with prolonged standing and lifting of heavy weights (16). In a recent study performed in two English districts, the risk for hip osteoarthritis in men increased progressively with job duration and heaviness of lifted objects (8). *Roach and co-workers* (17) showed that men exposed to heavy work had to undergo hip replacement more often than did controls. *Eastmond and co-workers* (18) reported that hip osteoarthritis was more common in teachers than in general population, though not to a statistically significant degree. This finding corroborates our results for the Category 2 which included most teachers. A Swedish study based on a hospital register found that hip osteoarthritis was more common in farmers, construction workers, and fire-fighters (19, 20). Still in Sweden, physically highly demanding work (occupation, work at home, and sports activities) until the age of 50 was shown to bear risk for the development of hip osteoarthritis in women (21).

We have found better association between years of work and hip osteoarthritis in women than in men. The reasons may partly lie in the fact that women are more involved in non-occupational physical activities than men. Namely, over 90% of women reported that they had to take care of the household and of the children after they came home from work. Compared to men who worked on jobs in the same categories, women generally worked substantially more.

To conclude, our results point out the possibility that prolonged standing may influence the development of hip osteoarthritis. Prevention of prolonged standing and other excessive workloads could be of importance in reducing the frequency of hip osteoarthritis.

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Sažetak

FIZIČKO OPTEREĆENJE PRI RADU I OSTEOARTROZA KUKA

U brojnim epidemiološkim istraživanjima procjenjivan je utjecaj zanimanja i fizičkog opterećenja na pojavu osteoartroze. U ovom istraživanju ispitivan je utjecaj fizičkog opterećenja vezanog uz zanimanje na pojavu osteoartroze kuka u gradskom stanovništvu. Istraživanjem je obuhvaćeno 295 muškaraca i 298 žena u gradu Zagrebu starijih od 45 godina. Prema fizičkom opterećenju vezanom uz zanimanje, ispitanici su bili podijeljeni u četiri kategorije. Učinjen je klinički i radiografski pregled desnog kuka. Osteoartrotske promjene stupnjevane su prema Kellgren-Lawrenceovoj metodi. Povezanost zanimanja i osteoartroze kuka analizirana je logističkom regresijom.

Činilo se da su radiološki znakovi osteoartroze desnog kuka češći u osoba koje su pretežno radile u stojećem položaju, no to nije potvrđeno statistički (odds 1,45 za muškarce i 1,50 za žene). U žena, klinički znakovi osteoartroze, bol i ograničena rotacija, bili su značajno povezani sa stojećim zanimanjima. U muškaraca, klinički znakovi bolesti bili su značajno povezani i sa zanimanjima koja su obuhvaćala teže fizičke aktivnosti (odds 2,19). Analizom utjecaja duljine radnog staža na osteoartrozu kuka činilo se da postoji povećan rizik za razvoj osteoartroze kuka u osoba s duljim radnim vijekom u svim kategorijama zanimanja, no ta povezanost nije bila statistički značajna.

Zaključeno je da u ispitivanom gradskom stanovništvu fizičko opterećenje vezano uz zanimanje nema značajan utjecaj na pojavu radioloških znakova osteoartroze kuka. Klinički znakovi osteoartroze kuka povezani su s fizičkim opterećenjem vezanim naročito uz zanimanja u stojećem položaju i ona s težim fizičkim opterećenjima.

Ključne riječi:

fizičko opterećenje, gradsko stanovništvo, klinički znakovi, radiografski znakovi, rizični faktori, zanimanje

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