

SELF-REPORTED MUSCULOSKELETAL PAIN AND DISCOMFORT IN PROFESSIONAL BALLET DANCERS IN SWEDEN

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ABSTRACT. One hundred and forty-seven professional dancers belonging to the three major companies in Sweden were asked to fill out a standardized questionnaire about musculoskeletal trouble and their work situation. This study details the answers and suggests ways of dealing with this particular work situation. Of the 128 dancers who answered the questionnaire, 121 had experienced trouble some time during the preceding 12 months. The low back was the site provoking most complaints (70%) followed by complaints from ankles/feet (65%) and neck (54%). There were no significant differences between the sexes. Trouble during the preceding 7 days in ankles/feet and low back had been experienced by 30% and 27% of the dancers, respectively. Ankles/feet trouble had kept dancers from their daily work in 54% of the cases, while low back trouble had prevented them from working to a lesser extent (40%) and neck trouble even less so (20%). Of the total 472 problems, 168 (36%) had prevented the dancers from doing their daily work. The answers to what they thought caused their problems to increase and decrease were later categorized as either physical, psychosocial or environmental. Most of the circumstances believed to increase trouble were related to poor training, while the ways to decrease trouble were mostly related to passive therapeutic treatments.

Key words: musculoskeletal disorders, self-report, ballet dancers, work conditions, training.

Although several studies have dealt with the injuries of ballet dancers, only few have been published based on the self-reported prevalence of injuries in professional companies. In Canada, Perrault reported that 94% of the 80 dancers in the study had had at least one injury during a period of 16 months (8). Bowling reported that 42% of the 141 investigated dancers in England had been injured during the preceding 6 months, while 84% had at some time during their career experienced injuries that had affected their dancing (2).

Reported work-related injuries during the years 1984-88 at nine of the most prominent theatres in Sweden showed that dancers had reported more injuries than any other group of artists. From a total of 156 dancers, 98 persons had filed for Workmen's Compensation in 168 different cases. Almost 60% of the dancers had thus reported one or more work-related injuries during these 5 years (9).

The Swedish work environment act states that any injury that is sustained or made worse by a person's work is to be considered a work-related injury unless otherwise proven. Still many of the accidents and injuries among dancers are never reported. The naprapath employed by the Stora Theatre in Gothenburg had treated 376 different injuries over the same 3-year period during which 20 injuries had been officially reported by the 40 dancers in this company (5). The 376 injuries did not include recurrent problems and the severity of the injuries ranged from non-specific neck trouble to stress fractures.

Because there seemed to be a great discrepancy between the number of actual injuries and the official statistics it was important to find out from the dancers just how much trouble they experienced from their musculoskeletal system and what they felt could be done about it.

In this study, which was part of a larger project called "The theatre's working environment", we wanted to investigate the occurrence of experienced musculoskeletal disorders in professional ballet dancers. We also wanted to obtain the dancers' own opinion about their work and how it affected their musculoskeletal well-being.

METHODS AND SUBJECTS

Research circle

The research was partly carried out in a so called research circle within the framework of "The theatre's working environment". The research circle consisted of 5 researchers (two psychologists, one sociologist, one safety engineer and

Table I. Background data for the participating dancers ($n=128$, 75 women, 53 men)

Mean value and range.

	Women	Men
Age when starting* (years)	9 (4-16)	12 (7-22)
Present age (years)	27 (18-43)	28 (17-47)
Weight (kg)	51 (42-62)	70 (58-85)
Height (m)	1.66 (1.57-1.76)	1.79 (1.69-1.88)

* Dancing three times/week or more.

one of the authors, E.R.), 10 artists (among them one ballerina and one principal dancer) and 10 other professionals from theatres in different parts of Sweden. The research circle met four times during 1988-89, each time for 2 or 3 days to stimulate the feed-back between the researchers and the artists.

Questionnaire

For the present study a questionnaire was used which consisted of the standardized Nordic Questionnaire (7) and twenty-two extra questions.

The Nordic Questionnaire contains the following questions:

1. Have you at any time during the last 12 months had trouble (ache, pain, discomfort) in: neck, shoulders, elbows, wrist/hands, upper back, low back, hips/thighs, knees, ankles/feet?
2. To be answered by those who have had trouble: Have you at any time during the last 12 months been prevented from doing your day's work (at home or outside the home) because of the trouble?
3. Have you had trouble at any time during the last 7 days?

The extra questions concerned the dancers background, awareness of muscular tension and ways to deal with musculoskeletal problems. The answers were mostly multiple choice. The answers to two open questions concerning what the dancer's believed increased or decreased their trouble were afterwards categorized into three groups according to the given reasons: 1. physical, 2. psychosocial, 3. environmental.

Subjects

The following inclusion criteria were set up:

1. Dancers should be employed by theatres (i.e. not be freelance dancers) because the intention of the joint-project was to focus on working conditions in the Swedish theatres.
2. Dancers should be working in companies with more than 10 dancers to ensure best possible anonymity.

Table II. Dancers' self-reported dance time, hours/week ($n=128$)

Time (hours)	< 30	31-40	> 40
Number of dancers	10 (8)*	92 (72)	26 (20)

* Numbers in parentheses are percentages.

3. Dancers should be working on a permanent stage and not with a touring company, since a fairly stable working environment was expected to be important in discussing what measures to take.

The dance companies that fulfilled the inclusion criteria were those at the Royal Theatre in Stockholm, the Stora Theater in Gothenburg and the Malmö Municipal Theater with a total of 147 dancers. The two remaining professional companies, with a total of about 40 dancers, were excluded because they did not fulfil the inclusion criteria.

Most of the 147 dancers (63 men and 84 women) were asked to fill out the questionnaire in the presence of one of the authors. Two dancers who were temporarily abroad had the form mailed to them and 13 who were not present for other reasons received the questionnaire later from their colleague, one of the dancers in the research circle, and were asked to send back their form by mail.

Ten men and 9 women chose not to answer. Their mean age was 34 years. Among these were the 2 dancers abroad, another 2 who were just going on maternity leave and felt they had not danced "properly" for some time, and 5 who were on the verge of retirement.

A total of 128 dancers answered the questionnaire (87%). The mean age was 27 years and the women had in general danced 3 more years than the men (Table I). The majority of the dancers danced 31-40 hours per week (Table II).

Statistics

The Chi-square test and analysis of variance (ANOVA) were used in the statistical analysis of the results and a probability level of $p < 0.05$ accepted as statistically significant.

RESULTS

Of the 128 dancers who answered the questionnaire 121 (95%) had experienced trouble in the musculoskeletal system some time during the preceding 12 months.

Most dancers had had some kind of trouble from more than one part of the body, and 3 had experienced trouble from all nine different body regions (Fig. 1).

The most common site for complaint was the low back (70%) followed by ankles/feet (63%) and neck (54%). Pain during the preceding 7 days was most common in the same three body regions but with ankles/feet first (30%) low back next (27%) and then

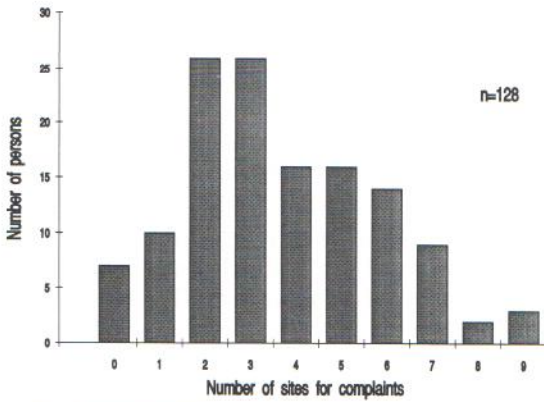


Fig. 1. Dancers divided into groups according to the number of sites for musculoskeletal complaints (some time during the preceding 12 months).

neck (20%). The answers to the question whether the pain, ache or discomfort had prevented the respondent from working showed a slightly different picture. Pain from the ankles/feet had been a hindrance for 35% of the dancers, the second most common site was the low back (25%) followed by the knees (19%) (Table III).

Five of the 7 dancers without problems were men who had been employed for between 2.5 and 17 years. The other 2 were young women who had been employed for less than a year.

No significant differences were found between men and women with regard to either number of persons with trouble or locations of complaints. Dancers with trouble in knees, ankles/feet and wrists/hands were taller ($p < 0.05$), and dancers with knee trouble were also significantly heavier ($p < 0.05$) than the ones without such problems. An analysis of variance

(ANOVA) showed that dancers with trouble in the shoulder- and in the ankles/feet regions were significantly older ($p < 0.01$ and $p < 0.05$, respectively) than those without such problems.

The nine different body regions were all tested against each other with the Chi square test in order to find possible correlations. All regions except ankles/feet and knees were significantly related to five or six of the other regions (Fig. 2).

The upper part of the body was especially strongly interrelated but no relation was seen between trouble in the low back and hips or between hips and knees or knees and ankles/feet.

Factors believed to increase or decrease trouble from the locomotor system were specified by 110 and 102 dancers, respectively. For example "not getting an even build-up and well planned training" would increase trouble, while "to do everything without forcing it, increasing control and doing it very slowly" was a way to decrease problems. Each dancer could give more than one factor, which gave a total of 136 factors that could increase trouble and 139 that could decrease it (Table IV).

In the physical category a subdivision was made. Factors related to training methods or self-treatment were considered "active" whereas the ones related to treatment from others such as massage and ultrasound were considered "passive".

The majority of the answers belonged in the category of physical factors. Thus about half of the answers about increasing problems (56%) were related to training (active) and none were passive. Active ways to decrease problems were, on the other hand, fewer than passive ways (40% and 56%, respectively).

Table III. Prevalence of trouble in the musculoskeletal system for the 128 dancers

	Sometime during the last 12 months (%)	Sometime during the last 7 days (%)	Dancers prevented from doing their job sometime during the last 12 months	
			(% of total)	(% of those with such trouble)
Neck	54	20	11	20
Shoulders	43	13	8	19
Upper back	34	17	12	35
Elbows	6	2	2	25
Low back	70	27	25	36
Wrists/hands	17	6	5	29
Hips/thighs	41	16	16	38
Knees	41	13	19	45
Ankles/feet	65	30	35	54

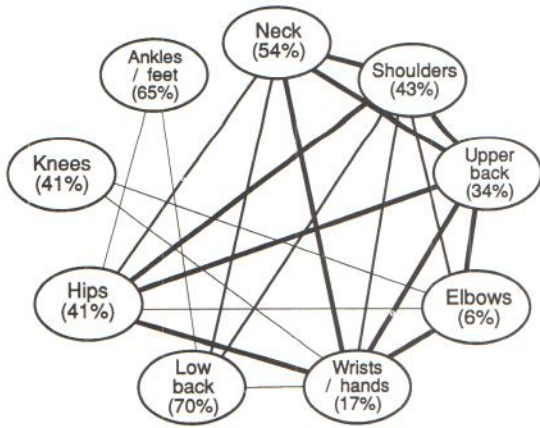


Fig. 2. Interrelations between complaints from different body regions. Prevalence in parentheses. — = $p < 0.05$ — — = $p < 0.01$ — — — = $p < 0.001$

The *psychosocial* category included such statements as “not having enough time” and “lack of money”. Also included in the psychosocial category were opinions about the planning of schedules and the organisation such as “long periods of inactivity and then suddenly an overload of work”.

The *environmental* category contained opinions about floors, temperature etc.

DISCUSSION

The high prevalence of pain, ache or discomfort in the musculoskeletal system reported by professional dancers seems to indicate that problems of this kind are “normal” in this occupation. It could be argued that the Nordic questionnaire, used in thousands of workplaces in Sweden, might not be relevant in a study on ballet dancers but to be able to somehow range different occupations it was important to use the same

Table IV. Number of factors dancers stated would increase or decrease their trouble from the locomotor system, divided into three categories

	Increase	Decrease
1. Physical (“active”: related to training) (“passive”: massage etc)	77 (56)*	56 (40) 77 (56)
2. Psychosocial	25 (19)	4 (3)
3. Environmental	34 (25)	2 (1)
Sum of factors	136	139

* Numbers in parentheses are percentages.

criteria for comparison. The 95% “trouble during the last year” prevalence was, however, in line with other studies on dancers (2) and dance students (6).

The most common site for complaints in studies using the terminology “trouble during the last 12 months” is usually the low back (12). Professional dancers were no exception but the prevalence of 70% found in the present study is higher than for example among gym teachers (65%) (13) but approximately the same as for construction workers (72%) (4).

Professional ballet dance is, however, an occupation that is difficult to match for comparison of workload because of the combination of great physical and psychological stress. A dancer’s ability to cope with the occupational mental stress is perhaps essential for being able to stay in the profession. In a cross-sectional study of soloists and principal dancers (i.e. the few truly elite dancers of a company), Hamilton et al. (3) could not find that the occupational (mental) stress and strain was clearly associated with injuries. The picture may be different, however, if entire companies are considered, i.e. including the chorus dancers who are the majority and who have not yet been weeded out.

Mental stress can cause tension in the muscular system especially in the neck, shoulder, and arm regions (10). The rather high prevalence of trouble in these body regions, and their strong interrelation in this study, might partly be due to the mental stress which some of the open answers in the questionnaire also suggested, but this possibility needs to be further examined.

Among dance medicine professionals many of the dancers’ musculoskeletal problems are usually blamed on poor external rotation (“turn out”) in the hips (11) and/or poor alignment (6). The outward rotation of the legs which is the base for all five ballet positions must come from the hips. Possible ways to compensate for a poor “turn out” may be to use the floor friction in positioning the feet and take the strain in the ankles (“rolling in”), in the medial ligaments of the knees or in the low back by tilting the pelvis forward to relax the iliofemoral ligaments. Bachrach (1) has suggested that in dancers a decreased range of external rotation of the hip due to iliopsoas insufficiency is a major factor in injury production especially in the lower extremities and the back. A lack of correlation between, for example, trouble in the low back and hips or between hips and knees or knees and ankles/feet in this study is not in favour of this hypothesis.

The fact that dancers with trouble from the knees or ankles/feet were heavier and/or taller than their fellow dancers without such problems may be explained in biomechanical terms; the extra kilos and the longer levers will cause a greater load on these joints.

Increasing age was not significantly associated with any musculoskeletal trouble other than in the shoulders or ankles/feet. It is not surprising that the wear and tear of the ankles/feet shows over time since this is perhaps the most crucial part of the body in ballet. Dancers' shoulders, on the other hand, need extreme mobility but are not normally exposed to heavy loads other than occasional lifts of other dancers (usually done by the men). The women use their arms mostly dynamically and mainly for balance and for estetic reasons. Shoulder trouble is perhaps not reason enough to stop dancing, which could be why dancers with such problems were significantly older. The "healthy worker effect" is otherwise strong in this occupation even though the retirement age normally is as low as 41 years for women and 43 for men. The results in a cross-sectional study like this should therefore be supplemented with a follow-up and further research in order to get a better understanding of the weeding-out factors in ballet.

Dancers are highly competitive and will tend to ignore pain to keep on working. This is why one way to estimate the severity of dancers' musculoskeletal trouble is to look at their inability to do their daily work. Problems with the ankles/feet were thus more severe for the dancers in the present study than, for example, neck problems, even though the neck caused complaints from more than every other dancer. There was less hindrance altogether with problems from the upper body (neck, shoulders, arms) than with the back and lower part of the body. This is not surprising since these dancers performed mainly classical ballet, which is especially demanding for the back, legs and feet.

Seven dancers had not experienced any trouble during the preceding 12 months. The 5 men (who had been working for between 2.5 and 17 years) thought that the reasons for this were "good body awareness" and "not letting pressure get too great". The two girls were both under 20 years and one of them also stated "too young to have had any injuries yet" as her reason for not having any musculoskeletal problems.

Although the dancers' own suggested explanations for increasing or decreasing trouble in the musculoskeletal system would sometimes fit into more than one of the three categories it was the main reason that

was sought and categorized. When "badly organized classes and rehearsals" and "getting cold between assignments", for example, were mentioned as the cause for a lack of proper build-up in the training, this would be considered a psychosocial (organisation) problem. But "practising one style and performing in another during the same day" would be "physical" (poor training).

About one fourth of the dancers in this study thought environmental factors would make their problems better or worse. The reason that the majority did not consider the environment was perhaps that the question was an open one and the environment was not what they first thought of. Hard floors and a low temperature in the dressing rooms were anyway given as examples of what could increase trouble. But even though the 4% tilt of the floor, such as at the Royal Theatre in Stockholm, was likely to be a contributing factor to musculoskeletal problems this was pointed out by only few of the dancers in the survey.

The complexity of reasons for dancers' musculoskeletal problems indicates that the remedy for ballet dancers must also be complex. It is necessary to question the traditional training methods and bring more of the physiological methods used in sports medicine, for example, into the dance world. But it is equally important to stimulate the psychological and mental side of a professional dancer's work. Many of the musculoskeletal problems may partly be due to a mentally stressful situation, which needs further research. Dancers should not only be top athletes, they should also, and maybe most important be great artists. When this duality is acknowledged by the theatres both these sides would ideally be given equal opportunities to develop and be equally important in the dancer's daily work.

CONCLUSION

Professional ballet dancers have more low back trouble than most other working groups and more than is normally known to orthopaedic consultants. This study showed no association between trouble in the low back and hips, nor between hips and knees or knees and ankles/feet which is contrary to earlier findings. Poor training was believed to be the main reason for increased trouble but poor psychosocial work conditions and environmental factors were also pointed out. Because a dancer needs to be both an athlete and, most important, an artist, the musculo-

skeletal problems in ballet dancers must be examined from both a physical and a psychological point of view.

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REFERENCES

1. Bachrach, R.: The relationship of low back/pelvis somatic dysfunction to dance injuries. *Kinesiology and Medicine for Dance* 9: 11-4, 1986.
2. Bowling, A.: Injuries to dancers: prevalence, treatment and perception of causes. *BMJ* 298: 731-4, 1989.
3. Hamilton, L. H., Hamilton, W. G., Meltzer, J. D., Marshall, P. & Molnar, M.: Personality, stress, and injuries in professional ballet dancers. *Am J Sports Med* 17: 263-7, 1989.
4. Holmström, E.: Musculoskeletal disorders in construction workers. Thesis, Lund University, Lund, 1992.
5. Högström, G.: (Naprath at The Stora Theatre, Gothenburg.) Personal communication, 1989.
6. Kerr, G., Krasnow, D. & Mainwaring, L.: The nature of dance injuries. *Medical Problems of Performing Artists* 7: 25-9, 1992.
7. Kourinka, I., Jonsson, B., Kilbom, Å., Vinterberg, H., Biering-Sørensen, F., Andersson, G. & Jørgensen, K.:

Standardized Nordic questionnaire for the analysis of musculoskeletal symptoms. *Appl Ergonomics* 18: 233-37, 1987.

8. Perreault, M.: Preventing injuries in theatrical dance: the Quebec dancers' and producers' viewpoints. Paper presented at International conference on medicine for the performing arts. Jerusalem, Israel, 1989.
9. Persson, L.: Safety engineer at The Royal Theater, Stockholm Workrelated injuries: Artists 1984-88. Personal communication, 1989. (In Swedish)
10. Theorell, T., Harms-Ringdahl, K., Ahlberg-Hultén, G. & Westin, B.: Psychosocial job factors and symptoms from the locomotor system—a multicausal analysis. *Scand J Rehabil Med* 23: 165-73, 1991.
11. Thomasen, E.: Diseases and injuries of ballet dancers. Universitetsforlaget, Århus, Denmark, 1982.
12. Ydreborg, B., Brynglesson, I.-L. & Gustafsson, C.: Reference data to the Örebro questionnaires. Stiftelsen för yrkes- och miljömedicinsk forskning och utveckling. Report 6. Närke-Tryck AB, Hallsberg, 1989. (In Swedish.)
13. Ydreborg, B. & Kraftling, A.: Reference data to the questionnaires. Stiftelsen för yrkes- och miljömedicinsk forskning och utveckling i Örebro. Report 6. Närke-Tryck AB, Hallsberg, 1987. (In Swedish.)

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