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ORIGINAL ARTICLE

Injuries and musculoskeletal pain among Norwegian group fitness instructors.

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Abstract

Objective: To examine the prevalence and factors associated with instruction-related injuries and musculoskeletal pain among group fitness instructors. **Design:** Descriptive epidemiology study. **Settings:** Online survey. **Participants:** Group fitness instructors from three fitness center companies in Norway (n=1473). Assessment of independent variables: questions regarding duration of working as a group fitness instructor, weekly instruction and exercise loading and modality, instruction-related injuries, musculoskeletal pain, use of alcohol, tobacco, snuff, menstrual dysfunction, and disordered eating (Eating Disorder Inventory, EDI). The respondents were divided into high instruction loading (HIL); ≥5 h/w with instruction, and low instruction loading (LIL); <5 h/w with instruction). **Results:** The response rate was 57% (n=837). Mean total loading (instruction and exercise) was 11.8 h/w and 6.3 h/w in the HIL and LIL group ($p<0.001$). The prevalence of acute (9% vs 6%, $p<0.05$), overuse (38% vs 24%, $p<0.001$) and both acute and overuse injuries (25% vs 10%, $p<0.001$) was higher in the HIL than in the LIL group (OR: 3.9, CI: 2.7, 5.5). The most prevalent injury locations were ankle and lower leg. The most frequent location for musculoskeletal pain was the shoulder/neck region. Factors associated with injury were instruction loading (h/w), years working as an instructor and EDI score. A high total EDI score predicted musculoskeletal pain. **Conclusion:** The high prevalence of injuries and musculoskeletal pain suggests a need for prevention strategies in the fitness industry. There is a need for limits regarding weekly instruction loading, especially for classes with high metabolic and/or mechanical loading.

Keywords: muscle injuries, general sports trauma, nutrition, disordered eating, fitness

Introduction

The number of attendees and employees in the fitness industry has increased rapidly in the last 10-15 years, and today almost 750 000 persons work within this industry in Europe, USA or Australia (Australia, 2012; EHFA, 2012). During this time, the industry has changed from a predominance of dance aerobics classes to include different types of high-intensity cardiovascular exercise, dance classes, indoor cycling, and classes aiming to enhance mindfulness, balance, strength and flexibility such as Pilates and yoga. Despite the numerous health related advantages of physical activity and exercise, a major drawback is the risk of injuries, which have been studied intensively among athletes in different sports.(Van Mechelen, Hlobil, & Kemper, 1992) The prevalence of injuries among dancers range from 47 - 84% among contemporary dancers to 91% among ballet dancers with the most frequent injury and pain locations being lower extremities and low back.(Garrick, Gillien, & Whiteside, 1986; Jacobs, Hincapie, & Cassidy, 2012; Nordin-Bates et al., 2011) Among aerobic dancers and participants in dance classes at fitness centers, one study reported that 49% of aerobic dancers had a history of at least one injury related to aerobic dancing.(Rothenberger, Chang, & Cable, 1988). Indoor cycling has also become a popular activity, and studies of competitive cyclists show that overuse injuries are common, particularly in the knee and low back.(Clarsen, Krosshaug, & Bahr, 2010) Even yoga may lead to acute injuries such as rupture of the lateral collateral ligament, and musculoskeletal pain in especially the low back (Holton & Barry, 2014; Patel & Parker, 2008)

Knowledge regarding injuries and injury prevention among group fitness instructors is limited. One study found the risk of injuries among instructors in aerobic dance to be twice as high as among the participants in these classes.(Garrick et al., 1986) A risk factor for injuries among the instructors was monotonous exercise loading.(Garrick et al., 1986) Another study presented prevalence numbers among aerobics instructors as high as 77% with the most frequent injury locations being leg, foot/ankle and knee.(du Toit & Smith, 2001) Romaine et al.(2003) found that 31% of cardio kickboxing instructors had experienced injuries related to such classes, and reported back, knee, hip and shoulder as the most frequent injury locations. Among step aerobics instructors, 73.5% reported chronic lower extremity injuries, and among others working hours and instructor experience were factors explaining the injury prevalence (Malliou et al., 2014)

Musculoskeletal pain is common among athletes (Foss, Holme, & Bahr, 2012; Jacobsson et al., 2012) and in the general population.(McBeth & Jones, 2007) In the study by Foss et al.(2012), high training loading and sports with specific back loading increased risk of low back pain. High training and competition loading has also been found as a risk factor for injuries and muscle soreness among athletes.(Luke et al., 2011; Montgomery & Hopkins, 2013) Knowledge of the prevalence of injuries and musculoskeletal pain among group fitness instructors in general is lacking.

Similar to findings among elite athletes, group fitness instructors show higher prevalence of disordered eating compared to the general population.(Hoglund & Normen, 2002; Olson, Williford, Richards, Brown, & Pugh, 1996) The prevalence is especially

high among instructors with a high exercise and instruction load.(Hoglund & Normen, 2002) Associations have between reported between one or more of the triad components (low energy availability/disordered eating, menstrual dysfunction and low bone mineral density) and injuries among athletes (Thein-Nissenbaum, Rauh, Carr, Loud, & McGuine, 2011; Wentz, Liu, Ilich, & Haymes, 2012), military recruits (Rauh, Macera, Trone, Shaffer, & Brodine, 2006) and dancers.(Jacobs et al., 2012; Liederbach & Compagno, 2001) However, the possible association between symptoms of disordered eating and injuries among group fitness instructors in general has not been investigated.

The aim of this study was to examine the prevalence of instruction-related injuries and musculoskeletal pain among group fitness instructors. Objectives were to examine life-time prevalence of instruction-related acute and overuse injuries, four-weeks prevalence of musculoskeletal pain and sick leave among instructors with high instruction loading (HIL) compared to low instruction loading (LIL), and to explore factors associated with instruction-related injuries and musculoskeletal pain among the instructors.

Methods

Sample.

Participants were recruited from the three largest fitness center companies in Norway (Sats, Elixia and Spenst). . These companies have small and large centers located in all counties in Norway. The instructors represented all fitness classes from indoor

cycling to dance aerobics, step aerobics, boxing/kickboxing, strength training, Pilates, yoga, mother/baby and low back pain exercise classes. Inclusion criterion for participation in the study was teaching a minimum of one class per week during the spring semester of 2009. Exclusion criterion from the study was inability to complete the questionnaire due to inadequate Norwegian language skills.

A total of 1473 instructors (18% males) from 59 fitness centers met the inclusion criterion and of these 78 instructors had invalid contact information. From the eligible sample, 837 instructors responded to the study (response rate: 57%).

Data collection.

The study was carried out as a cross sectional self-report study. The questionnaire was e-mailed to the respondents and they completed it through the online survey software Questback (Questback AS, Oslo, Norway). The fitness instructors e-mail addresses were provided from the head of each center to the research group. The respondents were contacted by e-mail with written information about the study in May/June 2009. A reminder email was sent to non-responders up to two times.

Questionnaire.

The questionnaire contained questions regarding age, height, body weight, education level, duration of working as a group fitness instructor, weekly instruction and exercise loading, and modality of classes and exercises. In addition, questions regarding use of alcohol, tobacco, snuff, and questions covering menstrual dysfunction were

provided. Menstrual dysfunction was defined as irregular periods and/or missing ≥3 consecutive periods. The questionnaire took 20-25 minutes to complete.

Injuries. All self-reported injuries related to their work as group fitness instructors were reported. They were asked to report injuries from their entire group fitness instruction career by answering the following question: “Have you experienced any injury related to your occupation as a group fitness instructor?”. If positive response, responders were asked to specify location of each injury, type of injury (acute/overuse), if they had seeked medical care, and if the injury resulted in time loss from the instructor occupation. The reported injuries were classified as either acute or overuse injuries, and these definitions were adapted from a consensus statement regarding injury registration.(Fuller et al., 2006) Acute injuries were defined as any physical complaint which occurred with a specific, clearly identifiable event during instruction irrespective of the need for treatment and/or time loss from instruction occupation. Examples given for such injuries were ankle sprain, ligament injury or fractures. Overuse injuries were defined as those occurring over time, without a specific, identifiable event responsible for their occurrence, giving symptoms like pain, reduced function and performance. The instructors were also asked to specify the location of the injuries.

Musculoskeletal pain. Questions related to musculoskeletal pain and sick leave were adapted from the Oslo Health Study.(Health, 2000) The respondents were asked to report musculoskeletal pain during the past four weeks, including severity duration, treatment and if the musculoskeletal pain had caused sick leave during this period. The

respondents were also asked to report if they had sick leave from their occupation as a group fitness instructor during the past 12 months.

Disordered eating. To examine symptoms of disordered eating, the Eating Disorder Inventory (EDI) was used.(Garner, 1991) The EDI consists of 64 items from eight subscales covering different aspects of disordered eating, including drive for thinness, body dissatisfaction, bulimia, perfectionism, interpersonal distrust, fear of maturity, ineffectiveness and interoceptive awareness. The items are rated on a six point Likert scale from “never” to “always”. Higher score indicates more disordered eating psychopathology. Cronbach’s alpha for the EDI in this sample was .74 for the male respondents and .79 for the female respondents. Total EDI score was used in the analyses.

Data classification.

To examine possible differences between respondents with high instruction loading (HIL) and low instruction loading (LIL), we decided a cut off at the 3rd quartile of hours per week (h/w) with instructing classes. The highest quartile was defined as HIL group; this group had ≥5 hours/week with instruction. The LIL group consisted of the instructors representing the three lowest quartiles, i.e. instructors with less than 5 hours/week with instruction. In addition, all instructors reported exercise besides instruction, and total exercise loading (h/w) was calculated by adding h/w with instruction with h/w with exercise besides instruction. High general educational level was defined as completing a college or a university degree. Higher exercise specific

educational level was defined as completing a college or a university degree within the field of sport and/or exercise science.

Statistical analysis.

The software IBM SPSS statistics version 18.0 was used for the statistical analyses. To check for normal distribution of the data, Q-Q plot was performed. Frequency analyses and mean(SD) were obtained, to examine possible differences between HIL and LIL groups, independent sample t-tests for ratio data and chi-square tests for nominal data were carried out. Respondents with missing data were excluded analysis by analysis. Odds ratio with 95% CI was calculated for each injury and pain location. Binary logistic regression analyses with step forward model were carried out to explore factors associated with instruction-related injuries and musculoskeletal pain among the respondents. Independent variables included in both regression analyses were: Gender, Instruction loading (h/w), High impact classes (h/w), Exercise loading besides instruction (h/w), Instruction experience (yrs), EDI-score, exercise specific higher education (yes/no), age (yrs), BMI (kg/m2), menstrual dysfunction (yes/no), use of cigarettes/tobacco, snuff, and alcohol (yes/no). The significance level was set to < 0.05.

Ethical considerations.

These data are presented from a larger study of group fitness instructors' self-reported health. Topics included in the questionnaire were nutrition, exercise history, dieting behavior and disordered eating, doping, urinary incontinence, injuries, musculoskeletal pain and sick leave. The study was approved by the Regional Committee

for Medical and Health Research Ethics in Southern Norway. The instructors were informed about the voluntariness of participation, and their anonymity to the research group. They were also provided with contact information to disordered eating counseling organizations and the Norwegian anti-doping hotline if they struggled with difficult thoughts after completing the questionnaire.

Results

Descriptive data.

A total of 837 group fitness instructors (152 males, 685 females, response rate: 57%) responded to the questionnaire. Mean total exercise and instruction loading (h/w) was higher among HIL compared to LIL instructors (Table 1). The HIL group reported less endurance training besides instruction compared to the LIL group, no differences were found in volume of strength training besides instruction. A higher frequency of the HIL group reported instructing both endurance and strength training classes, whereas a higher number in the LIL group reported teaching endurance training classes only (Table 1).

Insert Table 1 here

Prevalence of injuries and musculoskeletal pain.

Forty-seven percent of the instructors reported at least one incident of instruction-related injuries during their career as group fitness instructors. The prevalence of at least

one incident of instruction-related injury was higher in the HIL group compared to the LIL group (71% vs 40%, $\chi^2 = 62.2$, $p<0.001$, OR: 3.9, CI: 2.7, 5.5). The HIL group reported higher prevalence of instruction-related acute and overuse injuries, performing instruction despite injuries or sickness, and higher prevalence of sick leave from the instruction occupation during the past 12 months compared to the LIL group (Figure 1). Sub analyses showed higher prevalence of instruction-related overuse injuries (15.4% vs 26.2, $\chi^2 = 6.8$, $p<0.01$) and higher prevalence of sick leave during the past 12 months (39.7% vs 57.2%, $\chi^2 = 18.9$, $p<0.001$) between males and females in the LIL group. No gender differences were found with respect to injuries in the HIL group. The most prevalent injury locations were ankle (acute injury) and lower leg (overuse injury) (Table 2). The HIL group reported higher prevalence of acute injuries in ankle and low back, and higher prevalence of overuse injuries in lower leg, knee, low back and shoulder compared to the LIL group (Table 2). The injuries reported in the heads and faces were one concussion and two overuse injuries on the vocal cords. A total of 638 (76%) respondents reported musculoskeletal pain during the past four weeks. The prevalence of musculoskeletal pain in lower limbs was higher in the HIL group than in the LIL group (Table 2). Sub analyses showed higher prevalence of musculoskeletal pain among females (77.6%) than males (63.2%, $\chi^2 = 11.7$, $p<0.001$) in the LIL group. No such differences were found in the HIL group. The risk of sick leave from the instruction occupation due to musculoskeletal pain in the knee, upper back, shoulder, neck and/or head was twice to three times as high for HIL compared to LIL group (Table 2).

Insert Figure 1 here

Insert Table 2 here

Factors associated with instruction-related injuries and musculoskeletal pain.

A logistic regression analysis showed that instruction loading (h/w), high impact classes (h/w), years working as an instructor and total EDI score were factors associated with instruction-related injuries (Table 3). Total EDI score was associated with musculoskeletal pain (Table 3).

Insert Table 3 here

Discussion

The main findings were the high prevalence of instruction-related injuries and musculoskeletal pain among the respondents. The risk of an instruction-related injury was almost four times higher among instructors with HIL compared to LIL. Weekly instruction loading, but not additional exercise loading, was associated with injuries among the instructors. Instructors with HIL, and therefore less time to additional physical exercise, might be comparable to athletes with high competition load. Although the cut off of five hours per week with instruction might seem low, the mean total instruction and additional exercise loading among the HIL instructors was 11.8 h/w. Of these, an average of 7.5 h/w was instruction. This is less total loading compared to a study on elite football players(Montgomery & Hopkins, 2013), however group fitness instructors might have

other challenges with restitution compared to elite athletes. Many instructors have other full-time occupations in addition to being a part-time group fitness instructor. Balancing several jobs with family and social life may therefore be demanding, and recovery time might be insufficient. Therefore, it might be important to educate group fitness instructors about the importance of optimal recovery strategies. Athletes who have many competitions during an in-season period must reduce the exercise load during that period, and these athletes are at greater risk of injuries compared to athletes with a more balanced competition and exercise schedule.(Dupont et al., 2010) The instruction of exercise classes can be considered as an area of performance, which can be more physically and mentally demanding than participation in such classes. In addition, it is crucial that the instructors vary both the modality of classes they teach, and their modality of exercise besides instruction. Monotonous exercise modality has been found as a risk factor for overuse injuries in particular, and volume of high impact classes (h/w) was detected as one of the variables explaining injuries. However, the total instruction loading per se seemed to be a more important explanatory variable for injuries than the high impact classes.

The most frequent injury and pain locations reported were in the lower extremities and in the shoulder/neck region. This is in accordance with previous findings among fitness instructors.(du Toit & Smith, 2001; Romaine et al., 2003) As previous studies have described injuries on the vocal cords and hearing among instructors,(Rumbach, 2013; Wilsont & Herbstein, 2003) it was somewhat surprising that very few instructors reported injury in the head region. One explanation for this might be underreporting of

such injuries, and that specific questionnaires are necessary to detect this problem. Unfortunately, information about the sensitivity and specificity of the injury items were lacking, and a high sensitivity is important to detect all injuries. In addition, the specificity needs to be high to avoid a high number of false positive. Another possibility is that the fitness centers have improved working environment for the instructors through equipment such as microphones, and through guidelines for loudness of the music. The risk of sick leave from instruction due to musculoskeletal pain was up to 3.5 times higher for the HIL compared to the LIL respondents despite lack of differences in prevalence of musculoskeletal pain. This can indicate more severe pain among the HIL respondents, and can be seen in association with more HIL respondents reporting to perform instruction despite injuries and sickness.

A high EDI score, and hence more symptoms of disordered eating, was a predictor of both instruction-related injuries and musculoskeletal pain. This is in accordance with findings from previous studies.(Jacobs et al., 2012; Liederbach & Compagno, 2001; Wentz et al., 2012) Energy deficiency and disordered eating that may lead to medical complications on the musculoskeletal system, such as osteopenia/osteoporosis and myopathy.(Mitchell & Crow, 2006) Furthermore, functional impairments associated with low energy availability include a greater prevalence of injuries(Thein-Nissenbaum et al., 2011) and this can explain why such instructors are at higher risk of both injuries and musculoskeletal pain. Although menstrual dysfunction was not associated with injuries among respondents in this study, a significant number of both LIL and HIL female instructors reported such dysfunction. Therefore we believe

that both disordered eating and menstrual dysfunction need to be screened among injured instructors as suggested for active men and women in the recent position stand on the relative energy deficiency (Mountjoy et al., 2014).

Strengths and limitations. The main limitation of this study is the low response rate from the instructors. It was not possible to perform analysis on differences between respondents and non-respondents. A possible selection bias was the prevalence of injuries and musculoskeletal pain might be higher among the respondents compared to the non-respondents and thus influencing the results and the external validity of the study. Self-reporting of injuries and musculoskeletal pain is also a limitation, since it is impossible to verify the injury location and type. The injuries were also reported from the entire period of instructor occupation, this means that some injuries might have occurred more than 15 years prior to the respond to our survey. The differences in injuries between HIL and LIL groups might therefore be affected by the HIL group reporting a longer time of instruction experience. It is therefore a limitation that the injury reporting is retrospective, whereas present weekly instruction and exerciser loading is reported. The musculoskeletal pain is reported for the past four weeks, and is therefore concurring with the reported instruction loading. However, based on studies from athletes and dancers (Dupont et al., 2010; Garrick et al., 1986; Luke et al., 2011; Montgomery & Hopkins, 2013) it is plausible to hypothesize that high instruction loading leads to increased risk of injuries, and that these instructors might have had higher instruction loading prior to their injuries. Findings from athletes show that they continue training and competition despite overuse injuries and pain,(Bahr, 2009; Clarsen, Myklebust, & Bahr, 2013) this might also

be the case among group fitness instructors. Future studies should therefore aim to prospectively monitor occurrence of both acute and overuse injuries, and get trained personnel to classify the injuries according to the injury registration consensus.(Fuller et al., 2006)

Practical implications. The high prevalence of instruction-related injuries indicates a need for guidelines regarding maximum weekly instruction loading, especially for classes with high metabolic and/or mechanical loading. In addition, there is a need for injury prevention programs among group fitness instructors. Instructors with disordered eating should be identified and given support, and the fitness centers need an approach for preventing disordered eating among the instructors. Clinicians working in sports medicine need to be aware of the association with high instruction loading and disordered eating among injured group fitness instructors.

Conclusion.

The prevalence of instruction-related injuries and musculoskeletal pain was high among Norwegian group fitness instructors, with almost four times higher risk of injury for instructors with HIL compared to LIL. Factors associated with injuries were years working as an instructor, hours per week with instruction, hours per week with high impact classes, and EDI score. EDI score was the only variable that explained musculoskeletal pain among the instructors.

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Figure legend

Figure 1. Prevalence of instruction-related injuries and sick leave among the respondents.