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ORIGINAL ARTICLE

Prevalence and risk factors of low back pain among undergraduate students of a sports and physical education institute in Tunisia

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Introduction: For obvious reasons, athletes are at greater risk of sustaining a lumbar (lower) spine injury due to physical activity. To our knowledge, no previous studies have examined the prevalence of low back pain (LBP) in a Tunisian sports and physical education institute.

Aim: To assess the prevalence of LBP in different sports among students studying in a sports and physical education institute in Tunisia, to determine the causes of the injuries, and to propose solutions.

Methods: A total of 3,379 boys and 2,579 girls were studied. A retrospective cross-sectional survey was conducted on a group of students aged 18.5–24.5 years at the Higher Institute of Sport and Physical Education of Sfax to estimate the prevalence of LBP and its relation to the type of sports. Data on age, weight, height, smoking, and the sport in which the student was injured in the low back were collected from the institute health service records from 2005 until 2013.

Results: LBP was reported by 879 of the 5,958 study participants (14.8%). The prevalence of LBP was significantly higher ($p < 0.001$) in females (17.6%) than in males (12.5%). LBP prevalence did not differ by body mass index or smoking habit ($p > 0.05$). The sports associated with the higher rates of LBP were gymnastics, judo, handball, and volleyball, followed by basketball and athletics.

Conclusion: LBP is frequent among undergraduate students of a sports and physical education institute in Tunisia. It is strongly associated with fatigue after the long periods of training in different sports. Gymnastics, judo, handball, and volleyball were identified as high-risk sports for causing LBP.

Keywords: low back pain; sports students; sports training; risk factors

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Regular physical activity of moderate intensity, such as walking, cycling, or other sports, has significant benefits for health. Moreover, regular and adequate levels of physical activity reduce the risk of falls as well as hip or vertebral fractures, and are fundamental to energy balance and weight control (1). Unfortunately, these benefits are balanced by the risk of sports-related injuries (2, 3).

Low back pain (LBP) is the most common orthopedic problem worldwide and is known to affect both younger

and older adults (4). The relationship between sports and LBP in adolescents appears to be curvilinear, and all levels of physical activity are associated with an increased risk of LBP in adolescents (5, 6). The particularity of physical activity has also been related to risk of LBP in adolescents, and special risks are posed by activities that put a lot of stress on the lumbar spine (7–9), such as gymnastics, wrestling, rowing, diving, and football. Other sports such as swimming that put less pressure on the lumbar spine have a lower risk of causing LBP (6).

[†]These authors contributed equally to this work.

Van Hilst et al. (10) assessed the risk factors for and the prevalence of LBP among elite youth athletes in three sports: field hockey, speed skating, and football. They indicated that there is a strong connection between certain sports and LBP. The authors explained that certain motions, stresses, and actions of the athlete may influence LBP.

The literature review of Balagué et al. (11) on the epidemiology of LBP in children and adolescents shows that the prevalence of LBP is higher among girls than among boys (12–17). Moreover, both prevalence and incidence of back pain increase with age (12, 18–21), in addition to possible roles for genetic (22, 23) and psychosocial factors (24, 25), school performance (26, 27), and/or television watching (14, 21, 27). There are also associations between back pain and anthropometric parameters (16, 28), smoking (29), spinal mobility, and/or flexibility of muscles and joints (16, 19).

LBP is estimated to occur in 10–15% of young athletes (30), but the prevalence may be higher in certain sports (6, 14, 31–33). In sports institutes, students spend a substantial amount of time in individual and team sports. These activities, such as physically heavy work, lifting, bending, twisting, pulling, pushing, and vibrations, have often been associated with LBP (34).

This study aimed to determine the prevalence of LBP among students at a sports and physical education institute in Tunisia from 2006 until 2013.

Methods

Participants

This is a retrospective cross-sectional survey involving students at the Higher Institute of Sport and Physical Education in the city of Sfax. Students were both males and females aged 18.5–24.5 years. Data on age, weight, height, and smoking habits are collected routinely when students join the institute, and then the sport in which the student is injured in the low back is registered in the institute health service files. We collected information from the academic year of 2005–2006 until 2012–2013. Only students injured in the first or second year were taken into account, because the following years involve only athletics and gymnastics. Body mass index (BMI; kg/m^2) was determined for each participant by dividing the weight in kilogram by the square of the height in meter. In this study we used the standard BMI with categories of underweight (BMI of <18.5), normal weight (BMI of $18.5 - <25$), overweight (BMI of $25 - <30$), and obesity (BMI of ≥ 30). Smoking was categorized as non-smoker, <20 cigarettes per day, and ≥ 20 cigarettes per day. BMI, smoking habits, and history of any pain or injuries were taken for all the students in the beginning of the first grade. Thus, we registered only students who were injured in the institute. Students with a previous history of LBP were not included. On the basis of the

collected data, participants were dichotomized into those with or without LBP, while indicating the sports discipline in which they were injured or that they were injured after cumulative fatigue due to the large number of hours spent in practicing sports and physical activities. In 1 week, all students practice for a total of 16.5 h, spending 1.5 h in each of the following sports: soccer, handball, basketball, volleyball, judo, weightlifting, swimming, athletics, and gymnastics. In addition, athletics and gymnastics are practiced twice a week. LBP was defined as pain or discomfort in the low-back region, from the lower rib curvature to the lower part of the seat region. The question used systematically by the doctor of the institute health service to identify and estimate LBP cases was about the present injury and if and when they had LBP in the past. Thus, in cases of severe injuries the students are transported to the hospital. Furthermore, every registered injury causing LBP was recorded with its severity, but the most important detail for us was the sport in which the student was injured. Students who were injured more than one time were taken into account as subjects with LBP only for their first injury. The scientific council of the University of Sfax in Tunisia gave written permission for the study protocol.

Statistical analysis

Statistical analyses were done using the SPSS statistical package, version 11.5 (SPSS, Inc., Chicago, IL, USA). The chi-square test was used to test associations between LBP and other categorical variables (sex, obesity, and smoking habit), and to compare the prevalence of LBP between males and female. Statistical significance required that the p value be less than 0.05.

Results

Age and anthropometric data of the participants are presented in Table 1.

Table 2 shows that the prevalence of LBP was significantly higher ($p < 0.001$) among females (17.6%) than among males (12.5%). LBP prevalence did not differ by BMI or smoking habit ($p > 0.05$). LBP occurred in 17.1% of those classified by BMI as lean, 14.8% of those in the normal range, 14.3% among those who were overweight, and 12.7% of those who were obese. In addition, 13.9% of students smoking <20 cigarettes and 13.3% of students smoking ≥ 20 cigarettes had LBP.

In the analysis of risk factors for LBP in sports training, we found that in both sexes combined, LBP was positively associated with fatigue (caused by the long time spent in training), gymnastics, judo, handball, and volleyball. The increased prevalence of LBP is less in basketball and athletics and even lower in soccer, weightlifting, and swimming (Fig. 1).

Figure 2 shows that there is no significant difference ($p > 0.05$) in the prevalence of LBP among males and

Table 1. Anthropometric characteristics of subjects with and without lower back pain

Parameters	Without LBP (N = 5,079)	With LBP (N = 879)	Total (N = 5,958)	Range
Age (years)	21.1 ± 1.7	20.9 ± 1.7	21 ± 1.7	18.5–24.5
Weight (kg)	72 ± 9.5	70.8 ± 9.4	71.8 ± 9.5	50.7–89.8
Height (cm)	175.6 ± 10	175 ± 10.3	175.5 ± 10.1	152–195
BMI (kg/m ²)	23.5 ± 3.3	23.2 ± 3.3	23.4 ± 3.3	17.2–34.8

Data are mean ± SD. LBP = lower back pain.

females separately if they are compared in each practiced sport at the institute. However, if we analyze the prevalence of LBP in terms of sex in each sport, we find that the prevalence of LBP was significantly higher among males than females in handball ($p < 0.05$) and significantly lower in athletics ($p < 0.05$).

Discussion

Back pain is a highly prevalent health problem worldwide. Its incidence and prevalence are so high that it should be studied as an epidemic and social disorder (35). The first salient feature that emerges from this study is that LBP is widespread among students in high schools for athletes (14.8%). The students were injured mainly in gymnastics, judo, handball, and volleyball, in addition to LBP caused by fatigue due to the long time spent in training.

These findings are generally in accordance with the literature. In a study focused on identifying the types of physical activity associated with increased occurrence of LBP in schoolchildren, Skoffer and Foldspang (6) noted that LBP was increased by the number of hours jogging, playing handball, and doing gymnastics. In addition, Sato

et al. (33) found that the odds ratio for the risk of experiencing LBP was significantly higher in most sports items compared with the no-sports group. The most frequently implicated sports were volleyball, athletics, judo, gymnastics, golf, and rugby, where the odds ratio exceeded 2.

Gymnastics involves repetitive flexion, extension, and torsion. Kirialanis et al. reported that injuries among gymnasts are anatomically widely distributed (36). As in our study, much research (6, 33, 37) noted that gymnastics was associated with an increased prevalence of LBP.

Judo is a grappling style martial art with emphasis on dynamic throws and submissions, which can lead to substantial injuries due to the high velocity of the maneuvers (38). We registered a high prevalence of LBP in judo, as noted in the study of Sato et al. (33). Handball, which also includes repeated sudden and often rather violent movements, has been shown to be associated with LBP in our population and in other studies (6, 33).

A previous study (11) reported associations between participation in volleyball and LBP. Likewise, we noted that many students had LBP after volleyball sessions. This LBP may be due to the repetitive plyometric movements in this sport.

Table 2. Prevalence of lower back pain (LBP) by gender, obesity and smoking

	Without LBP (%)	With LBP (%)	Total	χ^2
Sex				
Male	2,955 (87.5)	424 (12.5)	3,379	χ^2 (1 df) = 30.18; $p < 0.001$
Female	2,124 (82.4)	455 (17.6)	2,579	
Obesity				
Underweight	329 (82.9)	68 (17.1)	397	χ^2 (3 df) = 2.8; $p = 0.423$
Normal weight	3,152 (85.2)	548 (14.8)	3,700	
Overweight	1,379 (85.7)	231 (14.3)	1,610	
Obese	219 (87.3)	32 (12.7)	251	
Smoking				
No smoking	4,363 (85.1)	764 (14.9)	5,127	χ^2 (2 df) = 0.68; $p = 0.713$
< 20 cigarettes	618 (86.1)	100 (13.9)	718	
≥ 20 cigarettes	98 (86.7)	15 (13.3)	113	
Total	5,079 (85.2)	879 (14.8)	5,958	

LBP: low back pain; Standard body mass index (BMI) categories: underweight (BMI of <18.5), normal weight (BMI of 18.5 – <25), overweight (BMI of 25 – <30), and obese (BMI of ≥ 30); smoking: cigarettes per day; no smoking: not currently smoking.

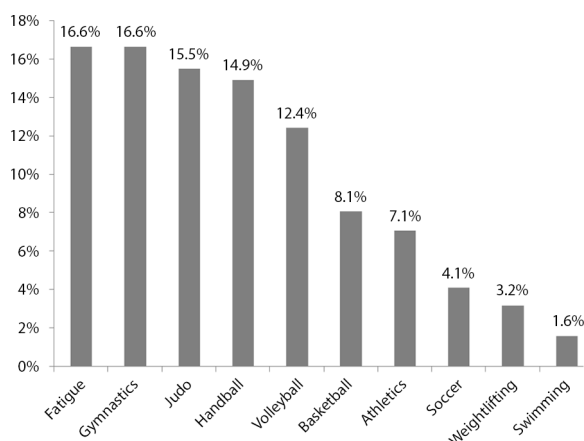


Fig. 1. Percent prevalence of lower back pain related to fatigue and type of sports in males and females combined.

We observed a high prevalence of LBP associated with the fatigue caused by the long time spent in physical activity (16.5 h per week). LBP occurrence depends on the amount and intensity of physical activity. However, this point of view is attractive in terms of prevention as physical activity is amenable to behavioral intervention, and physical training programs at school and leisure activities may be adjusted to aim at strengthening the back (6). Moreover, both physical inactivity and intensive sports activity have been associated with LBP in some studies (28, 32, 39–41). Our results show that a greater amount of physical activity increased the risk of LBP mainly in gymnastics, judo, handball, and volleyball. The time spent in athletics and basketball was associated with LBP to a lesser extent. Moreover, it appears that soccer, weightlifting, and swimming are correlated with relatively

low prevalence of LBP. Skoffler and Foldspang (6) reported that of several sports activities, only swimming was associated with a decreased prevalence of LBP. Swimming activates the muscles of the trunk, for example, the erector muscles of the spine, so swimming might be a means to prevent LBP. However, our results on soccer are at odds with those of Bejia et al. (42), who reported that soccer was positively associated with chronic LBP in Tunisian schoolchildren and adolescents. Similarly, our findings on weightlifting contrast with those of Calhoon and Fry (43), who reported that LBP was one of the most frequent injuries in this sport. The loads used in weightlifting may put the back at risk of injury. The relatively low prevalence of LBP in our study in soccer and weightlifting may be due to the system of this sports and physical education institute which is focused mainly on knowing how to teach these sports (gestural technique and pedagogy) and not on researching performance.

Our study shows that the percentage of females (17.6%) with LBP was significantly higher than that of males (12.5%), as frequently reported in the literature (12–17). However, the prevalence rates of LBP do not differ significantly between males and females ($p > 0.05$) if they are compared in each practiced sport separately. There was no significant difference in LBP by BMI ($p > 0.05$), in males and in females combined as reported in other studies (44, 45).

Altarac et al. (46) found that smoking was linked to training injury. In addition, many other studies have reported that active smoking is a risk factor for back pain (47, 48). However, we did not find a significant relationship between smoking and LBP ($p > 0.05$). A surprising finding in the study of Wirth et al. (49) was that parental

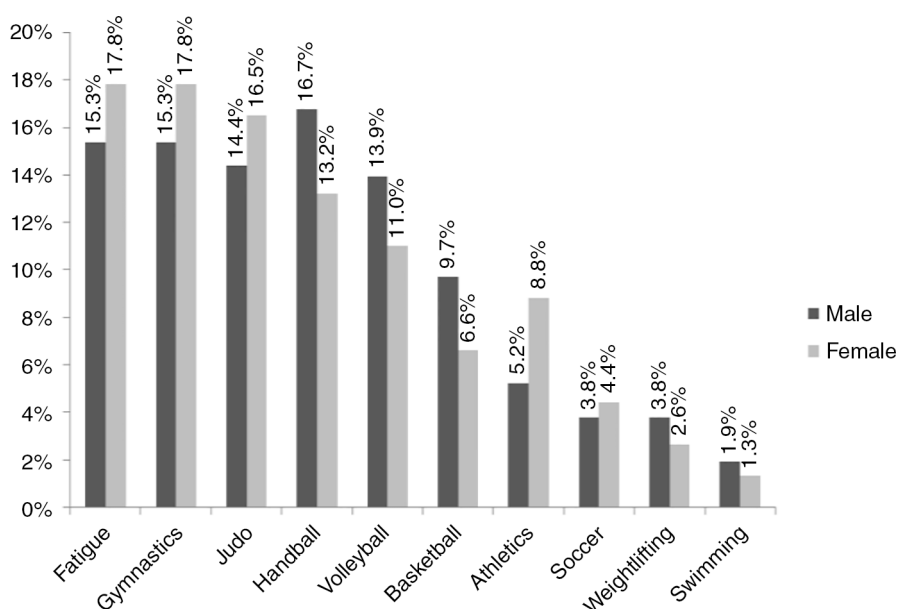


Fig. 2. Percent prevalence of lower back pain related to fatigue and type of sports in males and females.

smoking seemed to increase the risk of spinal pain for both genders. The role of smoking in the development of spinal pain needs further investigation.

We believe that students should perform exercises to strengthen the muscles of the arms and back, and increase coordination of the upper extremities and the lumbar region with regular activities that have been proven to be effective for the prevention of LBP. Swimming or gymnastics are the nearest sports to reach this aim as they seem to reduce LBP significantly (50).

This study was a survey based on data from the institute health service files of 8 years and therefore had some limitations. To closely evaluate the relationship between LBP and sports activities, more information on the students is needed, including basic information such as their physical activity outside the institute. In this study, the diagnosis of LBP was performed by the doctor of the institute health service and mostly without medical imaging, which could have shown the severity of LBP. Imaging is used to show the severity of the injury rather than the severity of the pain associated with it.

Conclusion

LBP was strongly associated with the amount of time reserved to practice the different sports planned in this sports and physical education institute. The sports identified as posing the greatest risk for LBP were gymnastics, judo, handball, and volleyball, followed by basketball and athletics. Moreover, the prevalence of LBP was significantly greater among females than males.

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Conflict of interest and funding

The authors declare that they have no conflicts of interest concerning this research.

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