Original Article

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The effect of length of sport experience on the prevalence of non-specific back pain and injury in soccer and ice hockey

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Abstract:
Background: Back pain is one of the most common health problems not only in the general population but also in athletes. However, there is a lack of evidence-based findings on the dose-response effect of athletic training on back pain and injuries. The aim of this study was to determine whether training experience affects the intensity of back pain and the number of injuries in moderate-to-high performance team sport athletes. Methods: A total of 147 male soccer players (age 27.8 ± 5.9 y; training experience 17.2 ± 5.6 y) and 179 male ice hockey players (age 29.2 ± 5.9 y; training experience 20.5 ± 6.1 y) were asked to complete questionnaires focusing on back pain and injuries: Oswestry Disability Index (ODI) and McGill Pain Questionnaire (MPQ). Results: Spearman correlation analysis revealed significant positive associations between length of training experience and the occurrence of thoracic pain (p=0.005), low back pain (p=0.016), thoracic injuries (p=0.006), and ODI (p=0.007) in soccer players. In hockey players, training duration was significantly correlated with low back pain (p<0.001) and injuries (=0.006), ODI (p<0.001), affective dimension (p<0.001), evaluative dimension (p=0.002), miscellaneous dimension (p=0.027), and total MPQ (p=0.029). Conclusions: The results of this study suggest that the length of training experience is another important factor influencing low back pain. Therefore, it is necessary to focus more attention on more experienced players and to include significantly more compensatory exercises and recovery time in their training process.

Keywords: soccer, football, ice hockey, back pain, McGill questionnaire, Oswestry Disability Index

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INTRODUCTION

Back pain (BP), especially lower back pain (LBP), is one of the most common health problems not only in the general population [1-3] but also in athletes [4,5]. The prevailing opinion is that appropriate exercise load has a strong influence on spinal health; however, there is a lack of data on the optimal dose-response relationship. Of particular importance is whether elite athletes are at greater risk of developing spinal pain than moderately active individuals. However, it can be observed that an increased incidence of back pain is associated with a sustained, systematized workload in sports training.

The lifetime prevalence of low back pain (LBP) ranges from 47 to 90% in the adult athletic population, with variability depending on the type of sport [4]. However, these findings cannot be generalized because there are many other factors besides sport that influence back pain, such as gender, training intensity, training frequency, and even sport technique.

GreaterMore severe pain has been reported by experts in sports that place greater demands on the spine [6–10]. These are mainly contact sports such as American football, soccer, hockey, and floor hockey, but also golf, weightlifting, and gymnastics [8,10,11].

Pain is often considered part of a sports injury [12]. BP itself can be associated with a variety of musculoskeletal complaints and neuromuscular disorders. And these disorders predispose athletes to lower extremity injuries [13]. However, as Rossi et al [4] suggest, deficits in lumbar and pelvic neuromuscular function may be a consequence rather than a cause of BP. On the contrary, as stated by Zemková et al [14], high workload and adequate muscular strength and endurance seem to be protective factors to prevent an increased incidence of sports-related injuries.

duration of sports experience on BP and the number of spinal injuries in different sports. The high demands of most sports, which include high training volumes, numerous games, and repetitive high-impact movement patterns (rapid starts, stops, changes of direction, etc.), lead to high musculoskeletal loads, which in turn lead to an increased potential for injury. BP is more common in active athletes who participate in sports with high spinal loads, such as soccer and hockey players [11,15–20].

Overall, there is a lack of knowledge about the effect of length of sports career on spinal pain and injury in most sports. In our study, we focused on BP and musculoskeletal injuries in players of two of the most popular sports in Slovakia: soccer and ice hockey. The aim of the study was to evaluate whether the length of sports experience influences the intensity of spinal pain and the number of injuries in active players of these two team sports. We hypothesized positive associations between the length of training practice and the occurrence of pain in LBP in both groups. We also hypothesized significant associations between practice duration and injuries in hockey players, but not in soccer players.

MATERIAL AND METHODS

Participants and settings

Individual sports clubs in Slovakia were approached with a request to participate in this cross-sectional study. For team sports, all clubs playing in the top two leagues of the two most popular sports in Slovakia - soccer and ice hockey - were approached.

Inclusion criteria: Adult males between 18 and 35 years of age, , member of a team sports club in the top two leagues in Slovakia, , at least 90 minutes of training performed 4 times a week, at least 4 years of training experience, physical activities with a MET score above 8 reported in the IPAQ questionnaire.

Exclusion criteria: Irregular training, failure to answer all questions, interrupted sports career of more than 2 months at the time of the research, BMI above 30 (in kg/m^2).

Table 1. Basic characteristics of athletes

Group	N	Age (years)	Weight (kg)	Height (cm)	BMI (kg/m^2)	Exercise experience (years)
All	326	28.6 ± 5.9	81.7 ± 9.2	181.5 ± 7.0	24.8 ± 2.4	19.0 ± 6.1
Soccer	147	27.8 ± 5.9*	77.8 ± 7.8***	180.5 ± 6.6	23.7 ± 2.3***	17.2 ± 5.6***
Ice hockey	179	29.2 ± 5.9	84.9 ± 9.0	181.6 ± 6.5	25.7 ± 2.2	20.5 ± 6.1

*Significantly different than ice hockey ($p<0.05$). **Significantly different than ice hockey ($p<0.01$). ***Significantly different than ice hockey ($p<0.001$). Data are presented as mean ± standard deviation.

Sample size

As we expected some attrition due to poor completion of questionnaires or refusal to participate in the study, we calculated the minimum sample size from a sample of 1300 athletes. From this number, one in four athletes was randomly selected, resulting in 326 participants in the study. Randomization was performed by an independent person in Microsoft Office Excel 2016. From the given number, all those approached completed the questionnaire. Data collection was anonymous. The data collectors were not involved in any other part of the study. All respondents answered all questions in the questionnaires. We calculated the minimum sample size according to the estimation given by Daniel [21], where n = Z2P (1 - P)/d2 (Z = 2.576 for the 99% confidence level; p = 0.5 for the expected sample proportion of 50%; d = 0.05 for the 5% margin of error). Based on this calculation, the minimum number was set at 296 athletes in team sports.

Protocol

After agreeing to cooperate with each club, members of the research team obtained the athletes' basic demographic data (year of birth, highest level of education) and basic training characteristics (type of sport, frequency and duration of training, years of sport participation, and other sport activities performed in addition to the main sport) during the initial interview. Subsequently, the subjects' height and weight were measured and recorded. Once these baseline characteristics were established, a brief instructional session was conducted with instructions on how to complete the questionnaire. The questionnaire was completed online by the athletes at home using a Google form. Each participant was sent a link to log in and complete the questionnaire. The questionnaire took approximately 30 minutes to complete. The questionnaires were completed in Slovak, and the data obtained were transferred to a database and checked for completeness by members of the research team. All information and data were processed by the GDPR.

severe back complaints that did not prevent participation in normal training. Therefore, it is likely that the prevalence and incidence of any back complaints are even higher in this population. In fact, in the baseline questionnaire, players were asked about any back complaints and LBP during the previous 12 months.

Procedures

A questionnaire survey was used to conduct the research. Data collection began in March 2022 and was completed in September 2022. Two valid, standardized, and internationally accepted questionnaires were used to assess spinal injuries and pain in athletes (McGill Pain Questionnaire - short form [22] and Oswestry Disability Index [23]):

The Short Form McGill Pain Questionnaire (SF-MPQ): It describes the intensity of current pain as well as sensory and affective dimensions. It consists of 15 questions describing the different types of pain and the intensity of current pain from zero to unbearable 5. The higher the score, the greater the pain intensity.

Oswestry Disability Index (ODI): It informs aboutThe Oswestry Disability Index (ODI) measures the extent of disability caused by back and joint pain. It consists of 10 sections: Section 1-Pain intensity. Section 2-Self-care (washing, dressing, etc.), Section 3-

Lifting, Section 4-Walking, Section 5-Sitting, Section 6-Standing, Section 7-Sleeping, Section 8-Sexual life, Section 9-Social life, Section 10-Traveling. Each section is scored on a scale of 0 to 5, with a higher number indicating a greater degree of pain-related disability. The questionnaire was filled out at the initial examination and thus before the end of the complex rehabilitation treatment.

Statistical analysis

The Shapiro-Wilk W test was used to assess the normality of the data distribution, and the results indicated that the data were not normally distributed. A nonparametric Mann-Whitney U test was used to test for differences in baseline characteristics between soccer players and ice hockey players. A nonparametric Spearman correlation with Bonferroni correction was performed to determine if there was an association between the length of training experience and the occurrence of BP and back injuries. The magnitude of the correlations was determined using the modified scale of Hopkins et al [24]: r < 0.1 trivial; 0.1-0.3 minor; > 0.3-> 0.5 moderate; > 0.5-0.7 major; > 0.7-0.9 very major; > 0.9 almost perfect; and 1 perfect. All analyses were performed with the STATISTICA program (TIBCO Software Inc., 2018; version 13). The significance level was set at $p< 0.05$. Data are presented as mean ± standard deviation (SD).

RESULTS

The study showed that out of 147 soccer players, 36% (n=53) reported pain in any part of the spine and 15% of the total number were injured in the past year (Table 2). Of these, 11 soccer players reported both cervical and lumbar spine pain, and 5 soccer players reported more than 1 injury during the survey. Of the total number of players followed, 14.3% had cervical pain in the past year, and even fewer (less than 3%) had thoracic pain. We recorded the highest number of soccer players with pain in the lumbar spine (26.5%). In terms of injuries, we recorded approximately the same percentage in the neck and lumbar regions (6.1% and 6.8%), but we found a much lower number of injuries in the thoracic region (similar to pain - only 3%). Overall, soccer players reported a relatively low percentage of spinal injuries (11%).

Table 2. Spinal pain and injuries in soccer (n=147) and ice hockey players (n=179)

Sport	Spinal pain (%)	Without	Injuries (%)	Without	Spinal pain (%)	Without	Injuries (%)	Without
	neck	thoracic	low back	BP	neck	thoracic	low back	BP
Soccer	14.29	2.72	26.53	64.63	6.12	2.04	6.80	89.12
Ice hockey	16.20	5.03	44.13	39.11	28.49	8.94	47.49	64.8

*BP = Back pain

Table 3. Number of pains and injuries in soccer players in relation to age and the length of training practice

Soccer n=147	Age (%)				Length of training practice (%)		
	≤ 20 y	21-25 y	26-30 y	≥ 30 y	≤ 10 y	11-19 y	≥ 20 y
	n=3	n=65	n=40	n=40	n=12	n=87	n=49
BP +	0.00	30.77	35.00	47.50	16.67	28.74	53.06
BP -	100.00	69.23	65.00	52.50	83.33	71.26	46.94
injuries +	0.00	7.69	10.00	20.00	0.00	8.05	20.41
injuries -	100.00	92.31	90.00	80.00	100.00	91.95	79.59

BP + = with Back pain; BP - = without Back pain

Table 4. The association between the length of a training practice and spinal pain and injuries

Indicator		Soccer		Ice hockey	
		r	p-value	r	p-value
Pain	Neck (n)	-0.007	0.934	-0.031	0.683
	Thoracic (n)	0.228	**0.005**	-0.039	0.605
	Low back (n)	0.197	**0.016**	0.336	**< 0.001#**
	ODI index (%)	0.220	**0.007**	0.248	**0.001#**
McGill	Sensory	0.030	0.714	-0.090	0.230
	Affective	-0.120	0.148	-0.259	**< 0.001#**
	Evaluative	0.047	0.568	-0.233	**0.002#**
	Miscellaneous	-0.070	0.401	-0.166	**0.027**
	Total	0.000	0.999	-0.163	**0.029**
Injuries	Neck (n)	0.059	0.472	-0.022	0.773
	Thoracic (n)	0.224	**0.006**	-0.089	0.236
	Low back (n)	0.155	0.059	0.205	**0.006**

Significant correlations are in bold. #Significant after Bonferroni correction (p=0.004).

Table 5. Number of pains and injuries of ice hockey players in relation to age and length of training practice

Ice hockey n=179	Age (%)				Length of training practice (%)		
	≤ 20 y	21-25 y	26-30 y	≥ 30 y	≤ 10 y	11-19 y	≥ 20 y
	n=3	n=57	n=53	n=66	n=1	n=88	n=90
BP +	0.00	40.35	60.38	81.82	0.00	50.00	72.22
BP -	100.00	59.65	39.62	18.18	100.00	50.00	27.78
injuries +	0.00	29.82	30.19	45.45	0.00	32.95	37.78
injuries -	100.00	70.18	69.81	54.55	100.00	67.05	62.22

BP + = with Back pain; BP - = without Back pain; INJ+ = with injuries; INJ - = without injuries

As expected, almost 48% of the soccer players over 30 years of age experienced pain most often, and injuries were also more prevalent in athletes with longer training experience (53%) (Table 3).

Spearman correlation analysis revealed significant positive associations between the duration of training and the occurrence of chest pain, LBP, chest injuries and the ODI index. However, these correlations were not significant after Bonferroni correction (p = 0.004). No other associations were observed in the group of soccer players (Table 4).

Ice Hockey

Out of 179 ice hockey players, up to 65.4% (n=109) reported pain in any part of the spine in the past year. Of these, 8 hockey players also reported pain in the cervical and lumbar spine. Hockey players most commonly reported pain in the lower part of the spine (44%), with a much smaller number of players reporting pain in the neck (16.2%) and thoracic region (5%) (Table 2). Regarding injuries, a relatively high percentage of hockey players reported an injury in the past year (35.2%; n=63), but several players reported 2 or more injuries during the observation period (85% of injured players).

Similar to soccer players, hockey players had the highest number of lumbar injuries (47.5%), but a relatively high number of neck injuries (28.5%) and the lowest number of thoracic injuries (9%).

The results for the variable "pain related to age" were not as conclusive as in the group of soccer players (Table 5). The table shows the highest percentage reported by ice hockey players between 21 and 30 years of age (70%), while players over 30 years of age reported a lower percentage (55%). Similar results were obtained for injuries, where players with 11 to 19 years of practice reported a higher percentage of injury occurrence (67%) compared to players with more than 20 years of practice (62%).

Correlated significantly with LBP and injury incidence, ODI, and McGill questionnaire in three dimensions (affective, evaluative, and miscellaneous) and total. After Bonferroni correction (p = 0.004), training practice was significantly correlated with LBP (ODI index) only in affective and evaluative pain in the McGill questionnaire. The correlation coefficients were small to moderate. Spearman correlation analysis revealed no other associations in the hockey players group (Table 4).

DISCUSSION

The study showed that 36% of soccer players and nearly 65% of ice hockey players experienced pain in some part of the spine during the past year, predominantly LBP in both sports. However, the survey only included athletes from two major leagues, and athletes who reported significant spine-related problems that would have prevented them from participating in training were excluded. In terms of injuries, soccer players reported a relatively low percentage of injuries (11%), whereas ice hockey players reported a higher percentage of injuries (35%). Even among the given number, a high number of ice hockey players reported recurrent injuries (63 players reported a total of 152 injuries). These results are not surprising given the hard tackles and impacts that players are exposed to during games. In this sport, we found that the length of training was significantly correlated with the occurrence of pain and injury only in the lower back. Interestingly, despite a lower number of reported pain and injuries, we found significant positive associations between training duration and the incidence of thoracic pain, LBP, and thoracic injuries in soccer players. Based on the subjective assessment of the athletes, the results of the ODI showed significant associations between individual sections as well as in most dimensions of the McGill questionnaire.

In ice hockey, we found that the length of training is significantly correlated with the incidence of LBP and injuries. A very interesting study was published by Baranto et al [25], who studied BP and MRI changes in the thoraco-lumbar spine of elite athletes in four different sports, including ice hockey players. At a 15-year follow-up, they found that new abnormalities occurring in the interval between baseline and follow-up were quite rare. The authors also found a high frequency of abnormalities at baseline in ice hockey players and weightlifters. On the other hand, they found a worsening of abnormalities, probably due to a combination of continued high-impact sports and normal aging.

A comprehensive study of BP in 1114 elite athletes is presented by Fett et al [16], in which they examined, among other things, the relationship between BP and age. They found a lifetime prevalence of up to 86% in elite athletes aged 13-18 years, rising to 87% in those aged 19-24 years, 89% in those aged 25-30 years, and 98% in those aged over 30 years.

The most popular sport in the world is soccer, and lower back injuries are not uncommon. A study by Hangai et al [18] found that among college athletes in Japan, the lifetime incidence of LBP was 76.6% in soccer players compared to 53.5% in non-athletes. A study conducted in the United Kingdom [20] followed more than 12,000 youth soccer players for five seasons and found that out of 10,225 injuries, only 310 (3%) were related to the lumbar spine. Of the 310 lumbar spine injuries, 49.4% were classified as LBP, 15.2% as sprains, and 4.2% as spondylolysis. Analysis by anatomical location showed that 45% of cases occurred in the lumbar region, 37 (12%) in the erector spinae muscles, and 18 (6%) in the quadratus lumborum muscles. In terms of recovery time from injury, fractures took the longest, with a median of 148.5 days, followed by bony injuries at 15.5 days and soft tissue injuries at 13 days. Not surprisingly, contact with other players was reported to result in significantly more injuries than non-contact play.

The results of the study by Çali et al [15] showed that lack of hamstring flexibility and the number of games played in a starting position were significant predictors of non-specific low back pain in male professional soccer players. In addition, the authors hypothesized that prolonged playing time could result in heavy and repetitive loads on the lower back. However, their study found that amateur, professional, and total years of soccer activity were not factors in the development of nonspecific LBP. According to Arundale et al [26], in men's professional soccer, one musculoskeletal injury increases an athlete's risk of a new musculoskeletal injury in the following season by a factor of 3.

CONCLUSION

Back pain is a common problem in the general population as well as in elite athletes. The question remains whether the length of a sports career influences back pain and the number of musculoskeletal injuries. We found significant associations between the duration of training and the incidence of LBP in soccer and hockey players and in the thoracic region in soccer players. With regard to injuries, we found inconsistent results. Length of practice was correlated with thoracic injuries in soccer and lumbar injuries in hockey.

The data suggest that the incidence of back pain increases with the age of the athlete and the length of training experience, but the lack of objective information regarding the diagnosis of existing spinal pathology in athletes precludes definitive conclusions. To the best of our knowledge, a similar study has not been carried out in Slovakia, so this work can provide valuable basic data for further research.

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Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Ethics Committee of Pavol Jozef Šafárik University in Košice [approval no. PJSU-1/2020, date: 2020-02-17].

Informed Consent Statement: Written informed consent was obtained from all subjects included in the study.

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