

INJURY PATTERNS AMONG HUNGARIAN PROFESSIONAL FOLK DANCERS*

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Abstract

The prevalence of musculoskeletal pain and injuries among dancers is high due to constant high physical strain and short recovery times. The aim of this study was to identify the most common pain and injuries among Hungarian professional folk dancers and to investigate their relationship with lumbopelvic function. Ninety-six professional dancers completed a standardized questionnaire about pain and injuries experienced over the past year, and 24 dancers were physically examined. During the physical assessment, the Knee Lift Abdominal Test (KLAT) and the Active Straight Leg Raise (ASLR) test were used to assess lumbopelvic motor control. In the study population, the most common injuries and pain in the past year occurred in the ankle (18.8% and 32.3%), knee (16.7% and 37.5%), and lower back (12.5% and 38.5%). The ASLR test showed a significant positive correlation with ankle and/or knee injuries ($r = .50$, $p = .007$). In conclusion, the prevalence of lower-limb injuries and lower-back pain is extremely high among Hungarian folk dancers. Ankle and knee injuries are associated with reduced lumbopelvic motor control.

Keywords: dancers, ankle injuries, knee injuries, lumbopelvic control, core-stability

1. INTRODUCTION

Dancers are exposed to significant physical and mental strain, which is why they are often compared to high-performance athletes (Koutedakis & Jamurtas, 2004; McCormack et al., 2018). Considering that they perform weekly, sometimes even several times a week, and must prepare for this with daily rehearsals and training, they need to be in top form all year round (Fauntroy et al., 2020; Koutedakis, 2000). As a result of excessive strain, lack of adequate rest and recovery, and mental pressure, the prevalence of injuries among dancers

* The first version of the English manuscript was received on 1. July 2025.

is very high: approximately 90% experience injuries during their carrier (Pollitt & Hutt, 2021) and approximately 50% of professional dancers have persistent or recurrent injuries (Crookshanks, 1999; Negus et al., 2005). The anatomical areas most affected are the lower limbs (ankles, knees; Campoy et al., 2011; Deu, 2020; Jacobs et al., 2012; Lai et al., 2022; Póvoa et al., 2023; Sun & Liu, 2024) and the lumbar spine (Angoules et al., 2018; Imhof et al., 2025; Kochman et al., 2024; Swain et al., 2019). Other areas can also be affected depending on the dance style; for example, upper limb injuries (shoulder, elbow, wrist) are common among hip-hop dancers (Deu, 2020).

Smith et al. (2015) analysed injury data from more than 2000 professional and amateur ballet dancers in their systematic review and found that 66% of injuries were overuse injuries, with this proportion narrowing to 57% when limited to professional dancers. Campbell et al. (2019) also concluded in their literature review that overuse is one of the most common causes of injury among ballet dancers. Junge et al. (2024) examined the prevalence and circumstances of injuries among professional ballet dancers and found that nearly half of the injuries gradually developed as overuse injuries, while approximately 20% were sudden, acute injuries.

The risk of musculoskeletal injury is multifactorial. The most common physical factors among dancers include hypermobility, fatigue, overuse, neuromuscular dysfunction, and core and lower extremity weakness (Campbell et al., 2019). As lower-limb injuries are most common among dancers, several studies have investigated their possible causes. One relationship that has been frequently researched is that between core-stability and lower limb injuries (Biernacki et al., 2021; Fadaei et al., 2021; Zazulak et al., 2007). In a systematic review of the most common causes of lower-limb injuries in dancers, Biernacki et al. (2021) concluded that poor lumbopelvic control plays a significant role in the occurrence of injuries among ballet dancers. Fadaei et al. (2021) studied the jump-landing mechanism of professional athletes and its relationship to lumbopelvic control and found that poor lumbopelvic control is associated with less efficient landing mechanics and altered muscle activation patterns, potentially increasing the risk of lower-extremity injuries, especially in the knee. Zazulak et al. (2007) also found that impaired trunk neuromuscular control may increase the risk of lower-extremity injuries in athletes.

According to Panjabi's (2003) model, spinal stability depends on the integrity of three subsystems: the bony elements (passive subsystem), the muscles (active subsystem), and the neural control unit. Based on this model, one of the keys to stabilization is proper neuromuscular control of the lumbopelvic muscles, particularly during limb motion. In addition, these muscles must be activated before limb movements begin in order to provide anticipatory stability to the trunk (Hodges & Richardson, 1997; Hodges & Richardson, 1998). Various methods are currently available for examining lumbopelvic motor control, such as 3D motion analysis systems (motion capture), electromyography (EMG), real-time ultrasound, MRI, and CT. However, such technical equipment is not always available in clinical practice, as in the case of sports clubs or the dance companies participating in the present study. However, field tests (Luomajoki et al., 2007) and smaller devices (Richardson et al., 1992) have been developed that can be used to assess lumbopelvic motor control in settings lacking the above-mentioned technical equipment.

Hungarian folk dance is extremely rich and varied in its movements, with some motifs requiring considerable athletic ability. It is characterized by powerful footwork with many jumps and leg gestures, often reaching head height. The dancers also perform also lifting movements, squats, and deep forward bends to relatively fast music. All of this places biomechanical stress on the joints of the lower limbs and the spine, which is why Hungarian folk dancers are at high risk of injuries to the lower limbs and low-back pain.

2. RESEARCH AIMS AND OBJECTIVES

The aims of present study were to identify the most common pain and injuries among Hungarian professional folk dancers and to analyse their physiological correlations, primarily regarding the dancers' lumbopelvic control. The following hypotheses were formulated to address these aims:

H1 – Considering the strenuous movements and footwork of Hungarian folk dance, and based on international findings showing that the most common injuries among dancers affect the lower limbs (Campoy et al., 2011; Deu, 2020; Jacobs et al., 2012; Lai et al., 2022; Póvoa et al., 2023; Sun & Liu, 2024), the first hypothesis is that lower-limb injuries are the most common among Hungarian folk dancers.

H2 – It is also hypothesized that with increasing age, the occurrence of injuries increases, given that several studies have found that the majority of injuries among dancers are due to overuse (Campbell et al., 2019; Junge et al., 2024; Smith et al., 2015).

H3 – Based on the findings of Biernacki et al. (2021), Fadaei et al. (2021), and Zazulak et al. (2007), it was also hypothesized that the occurrence of lower-limb injuries will be higher in those who perform poorly on the lumbopelvic stability tests.

3. METHODS

3.1 Sample and procedure

A cross-sectional study was carried out among Hungarian professional folk dancers between March and June 2024. Ethical approval was obtained under the number TUKEB BM/819-1/2024. There are currently four professional folk dance companies operating in Hungary, with approximately 130 professional dancers, all of whom were contacted through their company managers. The selection criteria were as follows: over 18 years of age, Hungarian as a native language, and employment as a full-time dancer. Exclusion criteria were severe pain or injury or medical treatment at the time of the physical assessment. The study consisted of a questionnaire and physical examinations. The questionnaire collected demographic data, information on dance-related injuries, and perceived pain levels. The physical assessment examined lumbopelvic movement control. Participation was voluntary and anonymous, and the dancers were informed that they could discontinue their participation at any time.

The questionnaire was completed by 96 dancers, representing approximately 74% of the total professional population. The physical assessment was conducted on a smaller sample of 24 dancers who volunteered to participate. The gender

distribution was fairly balanced, which is consistent with the paired nature of this dance form: the questionnaire was completed by 46 male (47.9%) and 50 female (52.1%) dancers. The average age of the respondents was 29.9 years ($SD = 8.5$, min = 19 years, max = 51 years). Participants reported an average of 21.5 years of dance experience ($SD = 8.6$, min = 6 years, max = 43 years). Professional dance experience ranged from 3 months to 39 years, with an average of 9.1 years ($SD = 8.8$). In terms of education, 73 participants held a university degree in dance (76%), while 23 had other dance-related qualifications (24%). The demographic characteristics of the physically assessed sub-sample did not differ significantly from those of the whole sample. Descriptive data for the sample are presented in *Table 1*.

Table 1. Descriptive statistics of the sample

		Whole sample ($N = 96$)		Physical assessment ($n = 24$)	
Sample characteristics		n	%	n	%
Gender					
	male	46	47.9	10	41.7
	female	50	52.1	14	58.3
Education level					
	university degree	73	76.0	17	70.8
	other qualification	23	24.0	7	29.2
Sample characteristics		M	SD	M	SD
Age (in years)		29.9	8.5	31.1	8.4
Total dance experience (in years)		21.5	8.6	20.4	8.9
Professional dance experience (in years)		9.1	8.8	9.9	8.9

3.2 Measurements

A standardized online questionnaire was used to collect demographic information and to assess musculoskeletal injuries during dancers' careers, as well as injuries and perceived pain that occurred in the past year and significantly limited or prevented dancers from dancing for an extended period of time. To clarify the difference between *injury* and *pain* for respondents, the questionnaire defined injury as "an event caused by a sudden force, such as a sprained ankle or a pulled muscle," while *pain* was defined as "an unpleasant sensation that develops gradually over a longer period of time or is present for a longer period of time." Dancers were asked to select and mark on a list the body parts that were injured or caused pain during the indicated period. They were allowed to mark more than one body part.

During the physical assessment, lumbopelvic movement control was assessed using the Knee Lift Abdominal Test (KLAT) and the Active Straight Leg Raise (ASLR) test, with movements of the examined areas monitored by the Pressure Biofeedback Unit (PBU – *Figure 1.*).



Figure 1. Pressure Biofeedback Unit (PBU – Stabilizer®, Chattanooga Group, Inc., Hixson, TN, USA)

Lumbopelvic movement control was assessed by evaluating the dancers' ability to control movement of the lumbopelvic region while performing hip flexion in the sagittal plane with a bent (KLAT) or extended knee (ASLR). The tests were performed in a supine position using a pressure measuring device, the PBU (Stabilizer®, Chattanooga Group, Inc., Hixson, TN, USA), which was used by Richardson et al. (1992) and has been shown to be suitable for measuring lumbopelvic control (Craστο et al., 2019). The device consists of a three-compartment inflatable cushion made of rigid material, a hand pump connected to it by a rubber tube, and a pressure gauge. In the present study, the device was placed transversely below the dancers' lumbar spine so that the lower edge of the cushion was aligned with the line between the posterior superior iliac spines (PSIS). The cushion was inflated to 40 mmHg. Dancers were instructed to take two breaths so they could lie in the most natural position possible; the pressure was then readjusted, and the dancer was asked to perform the task three times while being allowed to look at the pressure gauge. This way, they had the opportunity to observe and refine their stabilization during movement. Afterwards, the pressure gauge was removed and the result of the fourth execution was recorded, which participants performed with internal control. The aim of the tests was to minimize deviations from the baseline pressure. A decrease in pressure indicates lumbar extension or forward tilting of the pelvis, while an increase indicates lumbar flexion or backward tilting of the pelvis. Complete immobility and rigidity of the spine during various movements is not natural, but previous studies have shown that individuals with adequate neuromuscular control are able to maintain a neutral or near-neutral position while moving their lower limbs (Jull et al., 1993).

The same instrument was used for each dancer to avoid variability between devices. All measurements were performed by the same physical therapist, who has more than 10 years of professional experience. The tasks were presented and explained to the dancers prior to testing.

The KLAT examines the motor control of the lumbar spine during a short-lever sagittal hip movement. Dancers lay supine with their knees bent and were asked to lift one foot off the table with a bent knee to 90 degrees of hip flexion while maintaining a neutral lumbar spine position (see *Figure 2*). The PBU was placed under the participant's lumbar region, and the procedure was performed as described above. During the manoeuvre, pressure changes were observed on the PBU.

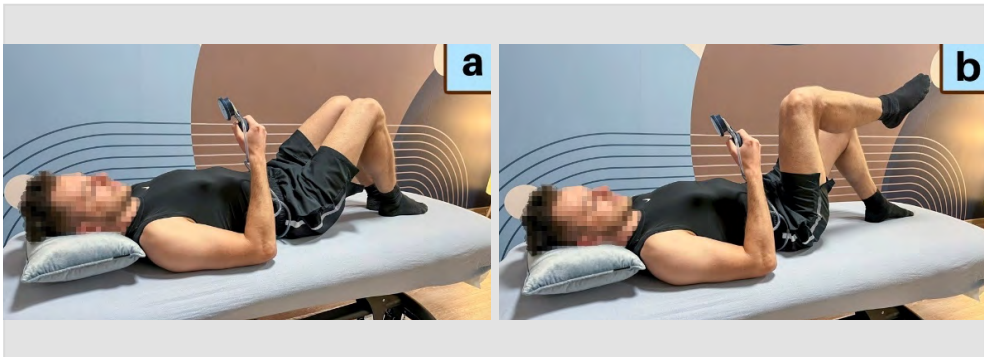


Figure 2. Knee Lift Abdominal Test (KLAT). (a) Start position. (b) Test movement

The ASLR test was also used to measure lumbopelvic movement control. This test is used to assess the stabilizing ability of the lumbopelvic area during long-lever movements of the hip joint in sagittal plane. For this test, participants lay supine with their lower limbs fully extended. They were asked to lift one extended leg 20 cm above the table and then lower it back down (*Figure 3*). During the manoeuvre, pressure changes were observed on the PBU.

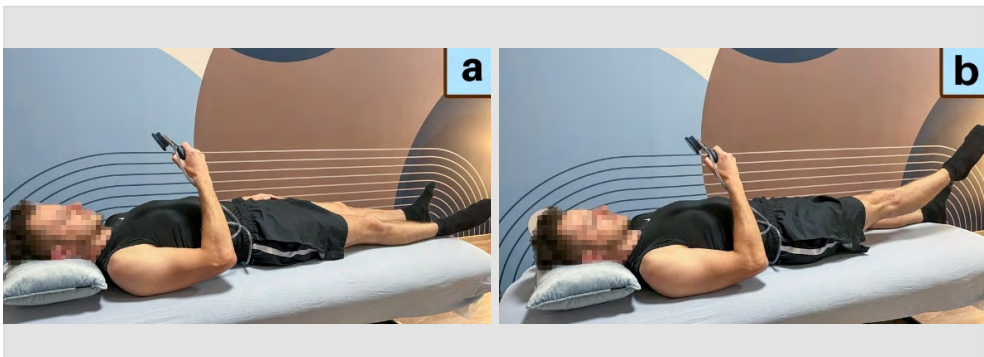


Figure 3. Active Straight Leg Raise test (ASLR). (a) Start position. (b) Test movement

3.3 Data analysis

We analysed demographic characteristics in the full sample of participants who completed the questionnaire ($N = 96$) and in the subsample of participants who underwent physical assessment ($n = 24$). In the full sample, we examined the prevalence of significant injuries affecting different body parts throughout the dancers' entire careers, as well as significant pain and injuries experienced in the last year. Participants could indicate multiple body parts for both the pain and injury questions. Comparisons between body parts were carried out using the McNemar test.

To highlight the early appearance of these problems, the prevalence of pain and injuries was also presented for dancers under the age of 30 ($n = 57$) and for dancers in the first 3 years of their professional career ($n = 31$).

Due to the small sample size, further analyses were performed only on data from the areas showing the highest prevalence (i.e., ankle, knee, and lower back). Using Spearman correlation, the relationship between age and the prevalence of pain and injuries was examined. Gender differences were examined using a chi-square test.

The results of the KLAT and ASLR tests were analysed in the subsample. After the descriptive analyses, age and gender differences were examined using Spearman correlation and the Mann-Whitney U-test. Spearman correlation was also used to examine the relationship between the occurrence of pain or injury in the last year and the results of the KLAT and ASLR tests. Due to the small sample size, the analyses were further limited therefore, only the combined prevalence of ankle and/or knee injury was examined.

All analyses were performed with JASP 0.18.3 software.

4. RESULTS

In our questionnaire, dancers were asked whether they had experienced any injuries during their career that significantly limited or prevented them from dancing for an extended period of time (*Table 2*). A significant proportion of the dancers reported some type of lower-limb injury. Ankle injuries had the highest prevalence, reported by 44.8% of the dancers. There was a slightly lower prevalence of knee injury ($p = .096$), while lower-back injuries had a significantly lower prevalence ($p = .016$), occurring in 34.4% and 31.3% of dancers, respectively. Lower-extremity muscle injuries were reported by 18.8% of dancers ($p = .040$ compared to the lower back). Injuries to other areas (neck, hip, shoulder, upper-extremity muscles, and back) occurred at significantly lower rates ($p = .030$).

When the time window for injuries was restricted to the past year, a similar pattern emerged (*Table 2*). Between 10–20% of dancers reported a significant ankle, knee, or lower-back injury that restricted their dancing and occurred in the past year. Injuries in other areas were significantly less frequent, below 10%. These proportions did not decrease when the sample was filtered to a sub-sample of dancers under the age of 30, where the prevalence of knee and ankle injuries remained at 19.3% and 17.5%, respectively. Similarly, worrying rates were observed when the sample was narrowed to those in the first three years of their professional careers. In this sub-sample, the high rate of knee injuries should be highlighted (19.4%).

Table 2. Prevalence of major injuries during career and in the past year

Body parts	Injury during career	Injury over the past year		
	Total sample (N = 96)	Total sample (N = 96)	Subsample age < 30 years old (n = 57)	Professional experience < 3 years (n = 31)
Ankles	44.8%	18.8%	17.5%	6.5%
Knees	34.4%	16.7%	19.3%	19.4%
Lower back	31.3%	12.5%	8.8%	3.2%
Muscles of the lower limbs	18.8%	8.3%	8.8%	9.7%
Neck	9.4%	7.3%	7.0%	3.2%
Muscles of the upper limbs	7.3%	5.2%	3.5%	3.2%
Hips	8.3%	3.1%	1.8%	3.2%
Back	6.3%	2.1%	1.8%	0.0%
Shoulders	8.3%	1.0%	0.0%	0.0%

In addition to injuries, dancers were also asked about pain that had been a major limiting factor in their dancing careers over the past year. A remarkable finding was that more than a third of the total population had experienced significant pain in the lower back, knees, and ankles over the past year. These proportions were not smaller in the sub-sample of dancers younger than 30 and were also present to a significant extent in the first three years of a professional dancer's career. Particularly worth highlighting is knee pain, which reached a remarkably high rate (45.2%) in this sub-sample (Table 3).

Table 3. Prevalence of major pains over the past year

Body parts	Pain over the past year		
	Whole sample (N = 96)	Subsample age < 30 years (n = 57)	Professional experience < 3 years (n = 31)
Lower back	38.5%	38.6%	29.0%
Knees	37.5%	40.4%	45.2%
Ankles	32.3%	35.1%	32.3%
Muscles of the lower limbs	20.8%	22.8%	29.0%
Back	19.8%	26.3%	22.6%
Hips	17.7%	21.1%	19.4%
Shoulders	13.5%	17.5%	12.9%
Neck	9.4%	10.5%	9.7%
Muscles of the upper limbs	6.3%	5.3%	3.2%

We examined gender and age differences in the prevalence of pain and injury in the ankles, knees, and lower back over the past year. A significant difference between genders was found only for knee injury, $\chi^2(1, N = 96) = 7.08$ $p = .008$ $\phi = .27$, with men being more likely to have this type of injury compared to women (47.8% versus 22.0%).

Using Spearman correlation, no monotone relationship was found between age and the occurrence of pain or injury over the past year for any body part. The prevalence of pain and injuries increased with age/dance experience, peaking around the age of 25–35, and then becoming significantly lower in the group of older dancers (except for lower-back injury, for which this pattern could not be demonstrated; see *Table 4*).

Table 4. Prevalence of ankle, knee, and lower-back pain and injury related to age

Age range	<i>n</i>	Significant pain over the past year			Significant injury over the past year		
		Ankles	Knees	Lower back	Ankles	Knees	Lower back
19–24	30	36.7%	30.0%	36.7%	16.7%	3.3%	10.0%
25–29	27	33.3%	51.9%	40.7%	18.5%	37.0%	7.4%
30–34	17	41.2%	35.3%	41.2%	23.5%	11.8%	5.9%
35–51	22	18.2%	31.8%	36.4%	18.2%	13.6%	27.3%

In the physical assessment sub-sample ($n = 24$), 10 individuals reported significant lower-back pain, 9 individuals reported significant ankle and /or knee pain, and five experienced neither significant pain nor injury during the period examined.

Comparison of the results of the two stability tests showed that dancers performed the KLAT test with significantly greater variation (i.e., with significantly worse results) than the ASLR test. The test results are presented in Table 5.

Table 5. Results of tests measuring lumbopelvic motor control

Test	Deviation (mmHg)*							
	0	1–2	3–5	6–10	>10	<i>M</i>	<i>SD</i>	<i>Max.</i>
	<i>n</i>							
KLAT ¹	2	10	7	3	2	3.75	3.47	14
ASLR ²	9	12	3	0	0	1.38	1.35	4

Note. $n = 24$. *Deviation from the baseline value (40 mmHg). ¹Knee Lift Abdominal Test.

²Active Straight Leg Raise

Regarding gender differences, both KLAT and ASLR scores were higher among men, $U = 125.0$ $p = .001$ $\rho = .78$ and $U = 109.0$ $p = .017$ $\rho = .56$. Age was not significantly correlated with the scores of either test.

For ankle and /or knee injuries, a significant strong positive correlation was found with the ASLR test scores ($r = .50$ $p = .007$), indicating that dancers with a major ankle and /or knee injury in the past year had a higher degree of lumbopelvic instability. No correlation was found with the scores of the KLAT test ($r = .16$ $p = .460$).

5. DISCUSSION

5.1 Main results and interpretation

The aim of this study was to identify the most common pain and injuries among professional folk dancers in Hungary and to examine whether these injuries are related to impaired movement control in the lumbopelvic region. A standardized questionnaire and a field test battery were used to investigate these factors.

The questionnaire addressed injuries and pain experienced both throughout the dancers' entire careers and during the past year. The results showed that ankle and knee injuries were the most common across both time frames. This finding is not surprising considering the fast and intense footwork of Hungarian folk dance and is consistent with previous research findings indicating that lower limbs are the most frequently affected body parts across different dance styles (Campoy et al., 2011; Deu, 2020; Jacobs et al., 2012; Lai et al., 2022; Póvoa et al., 2023; Sun & Liu, 2024). According to the findings, nearly half (44.8%) of professional folk dancers in Hungary reported ankle injuries during their careers, while nearly one-third reported knee injuries (34.4%) or lower-back injuries (31.3%). Knee injuries were twice as common among men compared to women (47.8% versus 22.0%), which likely reflects the more demanding movements performed by men in Hungarian folk dancing, which involve intense footwork and powerful jumps. Injuries to the lower-limb muscles were moderately common (18.8%), whereas injuries to other parts of the body were less common, occurring in less than 10% of cases. The results for the past year show a similar trend, with ankle and knee injuries again being the most common (18.8% and 16.7%, respectively). The occurrence of lower-back injuries is also significant at 12.5%, but the prevalence of injuries to other body parts remains below 10%. This injury pattern closely reflects the strain caused by Hungarian folk dance movements.

Pain was only asked about for the past year to avoid recall bias in the study. The results show that lower-back pain was the most common, with more than a third of dancers (38.5%) experiencing it. This is consistent with previous findings reporting a high prevalence of lower-back pain among dancers (Angoules et al., 2018; Imhof et al., 2025; Kochman et al., 2024; Swain et al., 2019). We suspect that this may be related to the footwork, which involves considerable impact, given that Hungarian folk dancers perform in hard-soled shoes and boots that provide no shock absorption during jumps and leaps. The prevalence of knee pain (37.5%) and ankle pain (32.3%) was similarly high. Nearly one-third of dancers suffer from this type of pain, which is considered significant and likely related to the many high-impact movements. Other parts of the body caused significantly less pain to dancers over the past year.

In summary, the results confirm the first hypothesis (H1): ankle and knee injuries are the most common among Hungarian folk dancers, which can be explained by the powerful footwork and many jumps and leaps performed at a fast pace in Hungarian folk dance. In contrast, the upper limbs, back, and neck are exposed to less strain.

The second hypothesis (H2) was that the prevalence of injuries and pain would be lower among younger dancers and increase with age, as overuse is one of the

contributing factors (Campbell et al., 2019). To test this, age differences in the prevalence of pain and injury in the ankles, knees, and lower back over the past year were analysed. In addition, the prevalence of pain and injury in a subsample of dancers under the age of 30 and those with less than three years of professional experience were also examined. Considering all factors, the second hypothesis was only partially confirmed.

The findings suggest that pain and injuries increase with age. The present study found that the prevalence of pain and injury does indeed rise with age, peaking in the 25–35 age group, but then decreases significantly among older dancers, with the exception of lower-back injuries, which are most common in the oldest age group (*Table 4*). All other types of pain and injury were more prevalent in younger age groups, particularly in the 25–29 age group, where knee pain and knee injuries were the most common (51.9% and 37.0%, respectively), and lower-back pain ranked second (40.7%). Another noteworthy finding is that one-third of the youngest age group (19–24 years) experienced ankle, knee, and lower-back pain (36.7%, 30.0%, and 36.7%, respectively) during the study period. Consequently, the prevalence of pain and injuries increases from the age of 19 but only up to a certain point, as a decline can be observed in dancers over the age of 35. This result may be related to the fact that those with more serious injuries or spinal problems leave the dance career earlier, meaning that the older and more experienced dancers in the study group are the more fortunate artists experiencing fewer injuries and pain. Thomas and Tarr (2009) obtained similar results in their study, but they attributed this phenomenon to the idea that more experienced dancers might recognise the signs of a potential injury or severe pain earlier and reduce their training load or take preventive measures, an assumption that the author of the present study can also agree with.

To provide a comprehensive picture of the onset of musculoskeletal problems over time and the role of overuse in the development of pain and injuries, the occurrence of these problems was examined among dancers under the age of 30 and those with less than three years of professional experience. In terms of injuries (*Table 2*), nearly one-fifth of dancers under 30 reported ankle and knee injuries (17.5% and 19.3%, respectively), while the prevalence of knee injuries was also high among those at the beginning of their careers (19.4%) during the past year. Even more striking results were observed with regard to pain (*Table 3*): more than one-third of young dancers (under 30 years of age) reported knee, lower back, and ankle pain (40.4%, 38.6%, and 35.1%, respectively), and among those with less than three years of experience, nearly half (45.2%) reported knee pain in the past year, while nearly one-third reported ankle, lower back, and lower-limb muscle pain (32.3%, 29.0%, and 29.0%, respectively). These findings suggest that pain caused by overuse, which is very common among dancers, can produce symptoms even within a very short period of time. Furthermore, these alarming results among young dancers draw attention to the need for measures aimed at preventing injuries and pain, such as stabilizing exercises, regeneration techniques, and sufficient recovery.

In this study, physical measurements were conducted to examine which functional abnormalities were associated with ankle and/or knee injuries. Several previous studies have highlighted the relationship between lower-limb injuries and

lumbopelvic motor control (Biernacki et al., 2021; Fadaei et al., 2021; Zazulak et al., 2007). To test the third hypothesis (H3), KLAT and ASLR tests were performed on a small sample of dancers, and the results were compared with their reported ankle and/or knee injuries. Due to the small sample size, ankle and knee injuries were combined for the analysis. The results show that lumbopelvic motor control during short-lever lower-limb movements (KLAT) did not show a significant correlation with lower-limb injuries. In contrast, a significant, strong, positive correlation was found between ASLR test scores and ankle/knee injuries, suggesting that during long-lever hip movements, greater deviation from the neutral position (indicating greater instability or poorer motor control) was associated with a higher frequency of ankle and/or knee injuries in the dancers' history.

It is interesting to note that the KLAT did not show a significant correlation with injuries, even though the measurement results indicate significantly poorer performance compared to the ASLR test (*Table 5*). A similar difference between the two tests was observed by Solana-Tramunt et al. (2019) in their study of professional swimmers, for which the authors offered the following explanation: during the KLAT test, the hip joint is flexed at approximately 90 degrees in the starting position, causing the abdominal wall to be completely relaxed. This relaxation reduces the tension of the muscle spindles, contributing to less effective stabilizing function. In contrast, during the ASLR test, the proprioceptors in the stretched abdominal muscles are under greater tension, enabling the nervous system to maintain more effective control over the area. This explanation appears to be consistent with the present findings.

Another possible explanation is that the position used in the ASLR test is closer to the functional position of dancers during performance (i.e., an upright stance), meaning that the test movement was carried out under biomechanical conditions that were more familiar to their nervous systems.

The result of the ASLR test confirmed the third hypothesis (H3), indicating that decreased lumbopelvic motor control is associated with lower limb injuries, which is in line with the aforementioned studies (Biernacki et al., 2021; Fadaei et al., 2021; Zazulak et al., 2007).

5.2 Limitations

The main limitation of this study was the small sample size. There are currently approximately 130 professional folk dancers in Hungary, of whom 96 completed the questionnaire, representing 74% of the total population. However, only 24 dancers participated in the physical examination, so the statistical power was insufficient to reveal stronger correlations.

A further limitation was that the research relied on a self-completed questionnaire, which may have introduced bias into the results, given that dancers may have underreported pain and injuries.

Lastly, another limitation is the cross-sectional nature of the study, which limits the ability to draw conclusions about causal relationships.

6. CONCLUSIONS

The results show that ankle and knee injuries and pain, as well as lower-back injuries and pain, are common among professional folk dancers in Hungary. These musculoskeletal problems are already common among young dancers under the age of 30 and those with only a few years of professional experience, suggesting that their development is not solely related to the length of time spent in the profession and that overuse can cause symptoms at a very early stage. The findings also show that lumbopelvic motor control is associated with lower-limb injuries. As serious injuries can lead to early career termination, the results presented here highlight the importance of measures to prevent injuries and pain, such as professional training programs that prepare dancers for the demands of folk dance and improve lumbopelvic motor control, as well as the use of appropriate recovery methods that reduce the risk of injury and pain, thereby promoting longer, more fulfilling artistic careers.

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