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Review Article

Factors Associated with Hip Pain in Ballet Dancers: A Systematic Review

Geovana Minikovski[1*], Paula Andryelly Gomes Giendruczak[2], Lucas Menghin Beraldo[3], Cláudia Tarragô Candotti[4]

[1]Master's degree in the Program in Human Movement Sciences, Universidade Federal do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil.

[2]Physiotherapy student, Universidade Federal do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil.

[3]Doctorate in the Program in Human Movement Sciences, Universidade Federal do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil.

[4]Phd in Human Movement Sciences, Universidade Federal do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil.

***Corresponding author:** Geovana Minikovski, Master's degree in the Program in Human Movement Sciences, Universidade Federal do Rio Grande do Sul, Porto Alegre – RS, 9153000, Brazil

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Abstract

Hip pain represents a significant burden for dancers, as it is one of the most stressed joints during ballet movements. Despite reports of high pain rates, there is still limited knowledge about the factors associated with hip pain. In this context, the question arose: what are the factors associated with hip pain in the population of ballet dancers? Systematic searches on databases were conducted following the PRISMA guideline. The selection, data extraction, and assessment of the methodological quality of the studies were carried out by two independent reviewers, and in case of conflicts, a third reviewer intervened. Out of 377 studies found, 11 met the eligibility criteria and were included. The main characteristics of dancers reported in the studies were pathologies followed by bone morphology, generalized joint hypermobility, and coping skills. Factors that have some association with hip pain include alpha angle, acetabular version angle, femoroacetabular translation, rupture of the right round ligament, history of current or past hip problems or injuries, and injuries in other regions of the body, as well as synovitis and cartilage defects in females. Therefore, there is moderate evidence that factors most associated with hip pain in dancers are related to hip pathologies and morphology. These findings can assist professionals working with dancers in detecting and treating hip pain, aiming to provide dancers with a longer career. However, further studies are needed, as many other factors have not yet been investigated.

Keywords: Musculoskeletal Pain; Hip; Dance; Ballet.

Introduction

Ballet dancers are athletes in that sophisticated physical abilities are required for high-level performance [1]. They often require extreme ranges of motion in the hip region, with emphasis on external rotation and abduction, which in many cases can result in injuries as these movements exceed physiological structures [2]. These unique demands of ballet create a distinct range of hip symptoms and pathologies in this cohort, which may differ from other sports [3].

A 10-year retrospective study revealed that, on average, each ballet dancer experienced 1.1 injuries per year [4]. Additionally, in 2017, a systematic review reported that the incidence rate of hip and groin injuries was 0.09 per 1,000 hours of dancing [5]. It is noteworthy that hip and pelvic injuries are particularly prevalent in ballet dancers (44%), when compared to other sports [6]. It is not surprising that 27.6% of the professional dance population and 14.1% of student dancers report hip and/or groin pain [5].

Furthermore, in the same systematic review, it was demonstrated that as ballet dancers age and refine their skills, the risk of hip injuries increases. This poses a significant concern for dancers' health at all skill levels, as evidenced by an injury rate of 17.7% [5]. Although hip pain is not always indicative of injury, the main cause of injuries in dancers occurs due to overuse (75%) [7], and overuse injuries typically manifest primarily as pain [8].

Hip pain "represents a significant burden for dancers due to the biomechanical role of the hip during ballet performance [9]". It is not by chance that hip pain and injury are the leading causes of work loss and performance time, ultimately resulting in a shorter career for dancers [2].

Dance medicine has been striving to define injury rates in ballet dancers in recent years, aiming to identify risk factors and develop enhanced prevention techniques for the unique injury patterns observed [5]. However, considering that pain often precedes an injury, it underscores the importance of understanding the factors associated not only with injury but also with hip pain.

Considering that factors associated with hip pain in the context of dance are not well understood, and acknowledging the high rate of hip pain in dancers, the question arises: What are the factors associated with hip pain in the population of ballet dancers?

Materials and Methods

Study Design

This systematic review was registered on PROSPERO (CRD42023368824) and follows the PRISMA guideline [10] (Preferred Reporting Items for Systematic Reviews and Meta-Analyses).

Search Strategies

The systematic searches were conducted in November 2022 and updated in March 2023, with another update in March 2024, utilized the following databases: PubMed, EMBASE, Scopus, and Web of Science. The Medical Subject Headings (MeSH) terms used were Hip [MeSH] AND Pain [MeSH] AND Dancing [MeSH], along with their synonyms. Entry terms such as "ballet dancer" AND "Hip pain" was also employed in the corresponding database (Embase and Scopus). Additionally, the words 'coxalgia', 'coxodynia', 'hip joint pain' was added to the term "Hip pain", linked by the Boolean operator OR. In the database Web of Science, the descriptors "Hip AND Pain AND Dancing" were used. Table 1 presents the search strategy used in the PubMed database in March 2024.

Search (#1 AND #2 AND #3)	
#1	Hip [Mesh] OR Hip OR Hips OR Coxa OR Coxas OR "Hip Joint" [Mesh] OR "Hip Joint" OR "Hip Joints" OR "Acetabulofemoral Joint" OR "Acetabulofemoral Joints" OR Groin [Mesh] OR Groin OR Groins OR "Hip Injuries" [Mesh] OR "Hip Injuries"
#2	Pain [Mesh] OR Pain OR "Burning Pain" OR "Burning Pains" OR "Physical Suffering" OR "Physical Sufferings" OR "Migratory Pain" OR "Migratory Pains" OR "Radiating Pain" OR "Radiating Pains" OR "Splitting Pain" OR "Splitting Pains" OR Ache OR Aches OR "Crushing Pain" OR "Crushing Pains"
#3	Dancing [Mesh] OR Dancing OR Dance OR Ballet OR Dancer [tw] OR Dancers [tw]

Table 1: Search strategy conducted in the PubMed database in March 2024

Eligibility Criteria

Characterized as a Population, Exposure, Outcome, and Type of study (PEOT), the eligibility criteria used for article selection were as follows: "P" (population) limited to individuals involved in ballet dance, with no restrictions on age or gender; "E" (exposure) was hip pain; the outcome "O" (outcome) was associated factors; and "T" (type of study) was not delimited, with only review studies and case reports being excluded.

In consideration of these criteria, the inclusion criteria were: (1) studies conducted with ballet dancers; (2) identification of at least one factor associated with hip pain. The exclusion criteria were: (1) not related to the hip; (2) a review or case study; (3) comparing ballet dancers with athletes from other modalities. There were no restrictions on language or publication date for study selection.

Study Selection and Data Extraction

Following the search, the initial step involved blinded review by two reviewers of the titles and abstracts of potential studies, based on the pre-established criteria highlighted earlier. Studies for which full access to the research was not possible were excluded from the selection. Conflicting studies were resolved through consensus, and if necessary, a third reviewer (C.T.C.) was consulted. The management of studies was conducted using Rayyan – Intelligent Systematic Review.

To extract data from the selected studies, a table was constructed in Microsoft® Excel. This stage was also carried out by the same two blinded reviewers responsible for article selection. The extracted data included author, publication year, sample characteristics (number of participants, gender, dance experience), study type, associated factor, and effect size measurement. Discrepancies between individual assessments were discussed, and in cases of disagreement, the third reviewer intervened.

Assessment of Methodological Quality

Two blinded reviewers assessed the quality of each study. Scales were employed according to each study type (ARHQ Methodology Checklist for cross-sectional studies; Newcastle Ottawa for cohort and case-control studies). Discrepancies between the reviewers' judgments were resolved between them, and in cases of disagreement, the third reviewer intervened. To classify the scores obtained in each study, a categorization method based on percentages was adopted [11]. Studies that scored above 80% were considered of high quality, those with scores between 50% and 80% were classified as moderate quality, while studies scoring below 50% were designated as low quality.

Statistical Analysis

There was an intention to conduct a meta-analysis to establish the factors associated with hip pain in dancers. However, among the included studies, there was a wide range of factors associated with hip pain, as well as various assessment instruments used, making the meta-analysis unfeasible.

The effect measures presented in the studies were diverse, and therefore most of them were listed in the table with the p-value. Therefore, to facilitate the qualitative analysis of the data, it was decided to group the studies into five categories of analysis, based on the characteristics studied: [1] pathology; [2] pathology and coping skills (PCS); [3] morphology; [4] morphology and hypermobility (MH); and [5] hypermobility.

Analysis of the Level of Evidence

The Best Evidence Synthesis (BES) system, as represented in Table 2 [12], was employed to assess the quality of evidence in this review, indicating the confidence in the information used. When there is significant heterogeneity among included studies, and researchers choose not to conduct a meta-analysis, the BES method can be utilized [13].

Level of Evidence	Minimum quality	Minimum quantity	Consistency
Strong	High (>80%)	Three	Three high quality studies agree, If more than three studies, 3/4th of the medium and high quality studies agree
Moderate	Medium (50 - 80%)	Two high quality	Two high quality studies agree
		OR	OR
		Two medium quality and one high quality	Two medium quality studies and one high quality study agree. If more than three studies, more than 2/3rd of the medium and high quality studies agree
Limited	Medium (50 - 80%)	One high quality	If two studies (medium and/or high quality), agree
		OR	OR
		Two medium quality OR One medium quality and one high quality	If more than two studies, more then 1/2 of the medium and high quality studies agree

Table 2: Best Evidence Synthesis guidelines

Results

In the initial search, 377 studies were found. Of these, 46 were potentially eligible studies. After reading the full texts, 11 studies met all eligibility criteria and were included in the systematic review. Figure 1 illustrates the flowchart of the study selection process. Although the search was recently updated, no new studies were included because they did not meet the eligibility criteria.

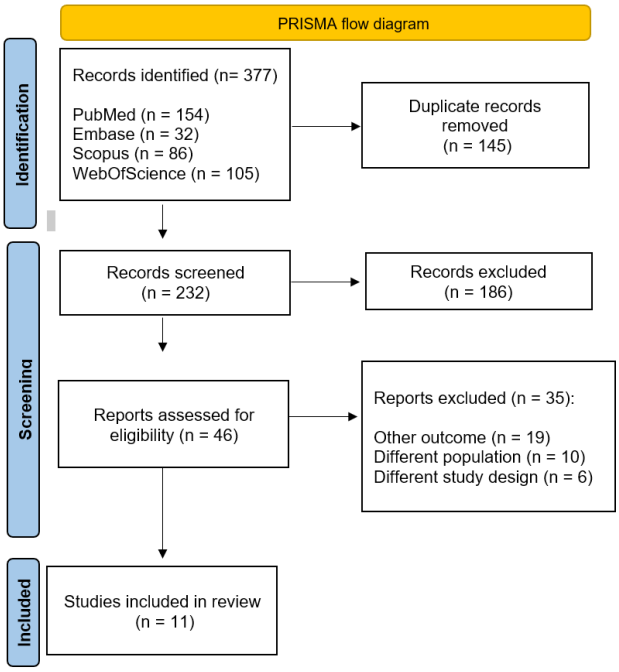

Figure 1: PRISMA flow diagram for the studies selection (10).

Some studies initially appeared to meet the inclusion criteria but were ultimately excluded because the comparison between symptomatic and asymptomatic individuals was not made exclusively among ballet dancers. Additionally, the associated factors studied were related to injuries rather than pain, such as labral and/or cartilage injuries[14], average muscle cross-sectional area (CSA) of the iliopsoas, rectus femoris, tensor fasciae latae, and sartorius muscles [15], average CSA of the deep external hip rotators (piriformis, combined superior and inferior gemelli, and quadratus femoris muscles) [16], CSA of the internal and external obturator muscles [17] and size and quality of the gluteal muscle [18]. In addition to these, two other studies were excluded because hip pain was a secondary outcome: low back pain and hip pain [19] and significantly greater shoulder tilt during the analyzed tasks (pied-en-main and developpé à la seconde with and without a bar [20].

The Table 3 presents the main characteristics of the included studies, separated by analysis categories. It is possible to observe that out of all the included studies, only 3 evaluated only females, while the others assessed both sexes. Additionally, all included studies were conducted with professional ballet dancers, mostly in companies in Australia, followed by North America. It is estimated that a total of 283 dancers were evaluated in this review. However, this is only an estimate because several of the included studies were conducted in the same ballet company. Therefore, for our estimate of the sample size, we assumed that in different studies from the same company, they involved the same dancers.

The instruments used to assess hip pain varied from the visual analog scale to self-report questionnaires such as HAGOS, HOOS, and IHOT-12. According to a consensus statement from the International Hip-related Pain Research Network, the Hip and Groin Outcome Score (HAGOS) and International Hip Outcome Tool (iHOT) (both long and short versions) are the most appropriate Patient-Reported Outcome Measures (PROMs) for use in active young and middle-aged adults with hip-related pain [21].

Analysis Category	Country	Author / year	Sample			Data Collection Instrument	Design
			N°	Sex	Dance Level		
PATHOLOGY	United States	Gross, C. et al. / 2018 [22]	37 ballet dancers	female and male	professional	HOOS and Medical History	Cross-sectional
	Australia	Mayes, S. et al / 2020 [23]	49 ballet dancers and 49 athletes	female and male	professional	HAGOS and 3T magnetic resonance imaging for Hip Osteoarthritis MRI Scoring System (HOAMS) for synovitis	Case-control
	Australia	Mayes, S. et al / 2021[24]	21 ballet dancers (52% male)	female and male	professional	HAGOS - pain subscale; bone morphology measured at baseline using 3T magnetic resonance imaging (MRI)	Longitudinal (Cohort)
	Australia	Mayes, S. et al. / 2016 [25]	49 ballet dancers e 49 athletes	female and male	professional (33) or retired (16)	HAGOS; magnetic resonance	Case-control
	Australia	Mayes, S. et al. / 2016 [26]	49 ballet dancers, both female and male, current and retired, and 49 athletes	female and male	professional	HAGOS; 3T magnetic resonance	Cross-sectional
	Australia	Mayes, S. et al. / 2018 [27]	33 ballet dancers (15 male e 18 female)	female and male	professional	Visual Analog Scale for hip pain; 3T magnetic resonance	Cross-sectional
PCS	North America	Biernacki, et al / 2018 [28]	26 ballet dancers	female	professional	ACSI-28; Past history of hip and non-hip injuries interview; iHOT-12	Cross-sectional
MORPHOLOGY	North America	Biernacki, J. L. et al./2020 [29]	25 ballet dancers	female	professional	IHOT 12 questionnaire; Ultrasound; Measurement of the Alpha angle	Cross-sectional
	Australia	Mayes, S. et al / 2017 [30]	33 ballet dancers and 33 athletes	female and male	professional	HAGOS and 3,0 T magnetic resonance	Case-control
MH	United States	Scott, C. P. et al. / 2021 [31]	171 athletes or ballet dancers	female	professional	Dynamic Ultrasound of the Hip (UDUS); Beighton score, BMI, radiographic markers of dysplasia	Cross-sectional
HYPERMOBILITY	Australia	Mayes, S. et al / 2021 [32]	40 ballet dancers and 23 from the 5-year follow-up study	female and male	professional	HAGOS and Beighton score	Prospective cohort

PCS: pathology and coping skills; MH: morphology and hypermobility; HOOS: Hip Disability and Osteoarthritis Outcome Score; HAGOS: Copenhagen Hip and Groin Outcome Score; ACSI-28: Athletics Coping Skills Inventory 28; iHOT-12: International Hip Outcome Tool.

Table 3: Characteristics of Included Studies.

Table 4 presents the factors associated with hip pain and the main statistical results of the studies. The factors associated with hip pain in ballet dancers studied so far include: Generalized Joint Hypermobility (GJH); Femoroacetabular translation; Acetabular version angle (AVA); Alpha angles; Past injuries and coping skills; Acetabular labral tears; Cartilage defects; Ratings of round ligament (LT) tear, and Synovial effusion in the hip joint.

Author / year	Associated Factor	Results
		Size of Effect Measurement
Gross, C, et al. /2018[22]	History of hip injuries or problems in dancers	Hip problems: Fisher's Test p=0.013 / Unpaired T-Test p=0.006
Mayes S, et al. /2020 [23]	Synovial effusion in the hip joint	Synovitis in symptomatic and asymptomatic female dancers: Mann-Whitney r = 0.57 p=0.002 Synovitis in male dancers: Mann-Whitney r = 0.08 p=0.07 Synovitis with HAGOS (pain): (female) Mann-Whitney r = 0.63 p=0.001 (male); Mann-Whitney r = 0.06 p=0.78
Mayes S, et al. /2021[24]	Cartilage defects (Osteoarthritis)	Cartilage defects: Mann Whitney p=0.12
Mayes, S. et al. /2016 [25]	Ratings of round ligament (LT) tear	Left round ligament tear: Kruskal–Wallis p=0.62 / Right round ligament tear: Kruskal–Wallis p=0.04
Mayes S, et al./2016 [26]	Cartilage defects	Cartilage defects. Male: Mann Whitney p=0.28. Female: Mann Whitney p=0.04
Mayes S, et al. /2018 [27]	Acetabular labral tears and articular cartilage defects..	Cartilage defects: Pearson correlation p=0.79 / Labral tear: Pearson correlation p=0.36
Biernacki, et al. /2018 [28]	Past injuries and coping skills (ACSI-28)	Coping skills: Pearson correlation r=0.250 p=0.087 / Past hip injuries: Pearson correlation r=-0.609 p<0.001. Mann-Whitney p=0.477 / Past injuries outside the hip: Pearson correlation r=-0.628 p<0.001
Biernacki JL, et al. /2020 [29]	Alpha angles	Alpha angles: Mann-Whitney p=0.001
Mayes S, et al. /2017 [30]	Acetabular version angle (AVA)	Acetabular version angle: Pearson correlation r=-0.43 p=0.02 Lateral center-edge angle / Neck-shaft angle / Anterior alpha angle / Superior alpha angle had no significant correlation (article did not report values)
Scott CP, et al./2021[31)	Femoroacetabular translation in neutral, neutral with contralateral hip flexion (NF), and apprehension/position of concern with contralateral hip flexion (EER-F)	Age: T-test p=0.80 Height: T-test p= 0.36 Weight: T-test p= 0.8 Body mass index: T-test p= 0.50 Propensity score: T-test p= 0.23 Beighton score: T-test p= 0.84 Hypermobility (Beighton ≥5): Chi-square p= 0.57 Dynamic Ultrasound Neutral flexed: T-test p<0.001 / Dynamic US Neutral: T-test p=0.05 / Dynamic US EERl flexed: T-test p<0.001 / Max US - Min US: T-test p=0.06
Mayes S, et al./2021 [32]	Generalized Joint Hypermobility (GJH)	Beighton score: Mann Whitney p=0.87

Table 4: Factors Associated with Hip Pain

Tables 5 and 6 present the results of the methodological quality assessment for the included Case-Control and Cohort studies, respectively. These studies had scores ranging from 50% to 80%, categorizing them as having moderate methodological quality. The main points deducted in the assessment of the methodological quality of these studies are related to aspects that could introduce biases, such as: the definition 1of controls, who had a history of the disease; the determination of exposure (hip pain) was done without blinding; and the non-response rate was different between the groups.

Study	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Total score	Possible score	% Total
Mayes S, et al. /2017 [30]	1	1	1	0	2	0	1	0	6	9	67% Moderate
Mayes S, et al. /2020 [23]	1	1	1	0	2	0	1	0	6	9	67% Moderate
Mayes S, et al. /2016 [25]	1	1	1	0	2	0	1	0	6	9	67% Moderate

Item 1: Is the case definition adequate?
Item 2: Representativeness of the cases
Item 3: Selection of Controls
Item 4: Definition of Controls
Item 5: Comparability of cases and controls on the basis of the design or analysis
Item 6: Ascertainment of exposure
Item 7: Same method of ascertainment for cases and controls
Item 8: Non-Response rate

Table 5: Methodological Quality Assessment of Included Case-Control Studies.

Study	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Total Score	Possible score	% Total
Mayes, S. et al / 2021[24]	1	1	0	0	2	1	1	1	7	9	78% Moderate
Mayes, S. et al / 2021[32]	1	1	0	1	0	1	1	1	6	9	67% Moderate

Item 1: Representativeness of the exposed cohort
Item 2: Representativeness of the exposed cohort
Item 3: Ascertainment of exposure
Item 4: Demonstration that outcome of interest was not present at start of study
Item 5: Comparability of cohorts on the basis of the design or analysis
Item 6: Assessment of outcome
Item 7: Was follow-up long enough for outcomes to occur
Item 8: Adequacy of follow up of cohorts

Table 6: Methodological Quality Assessment of Included Cohort Studies

Table 7 presents the results of the methodological quality assessment for the included Cross-Sectional studies. Two of the studies scored above 80%, considered to have high methodological quality. The other 4 studies had percentages between 50% and 80%, classified as having moderate methodological quality. The main points deducted were items 3 and 7, related to not indicating the period used to identify patients and providing an explanation for the exclusion of individuals.

The level of evidence in this review, according to the Best Evidence Synthesis system, is considered moderate. According to the classification in Table 2, this review included two studies of high quality and the others of medium quality.

Study	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11	TOTAL score	Possible Score	% Total
Biernacki, et al / 2018 [28]	YES	YES	NO	YES	NO	NO	NO	YES	NOT APPLICABLE	YES	NO	5	10	50,00% Moderate
Biernacki JL, et al. / 2020 [29]	YES	YES	NO	YES	YES	YES	YES	YES	NOT APPLICABLE	YES	YES	9	10	90,00% High
Gross C, et al./ 2018 [22]	YES	NO	YES	NO	NO	NO	NO	YES	NOT APPLICABLE	YES	YES	5	10	50,00% Moderate
Mayes S. et al. / 2016 [26]	YES	YES	YES	NO	YES	YES	NO	YES	NOT APPLICABLE	YES	NO	7	10	70,00% Moderate
Mayes, S. et al. / 2018 [27]	YES	YES	NO	NO	YES	YES	NO	YES	NOT APPLICABLE	YES	NO	6	10	60,00% Moderate
Scott, C. P. et al. / 2021 [31]	YES	YES	YES	YES	NO	YES	YES	YES	NOT APPLICABLE	YES	YES	9	10	90,00% High

Item 1: Define the source of information (survey, record review)
Item 2: List inclusion and exclusion criteria for exposed and unexposed subjects (case and controls) or refer to previous publications
Item 3: Indicate time period used for identifying.
Item 4: Indicate whether or not subjects were consecutive if not population-based
Item 5: Indicate if evaluators of subjective e components of study were masked to other aspects of the status of the participants
Item 6: Describe any assessments undertaken for quality assurance purposes (e.g., test-restes of primary outcome measurements
Item 7: Explain any patient exclusions from analysis
Item 8: Describe how confounding was assessed and/or controlled
Item 9: If applicable, explain how missing data were handled in the analysis
Item 10: Summarize patient response rates and completeness of data collection
Item 11: Clarify what follow-up, if any, was expected and the percentage of patients for which incomplete data or follow-up was obtained

Table 7: Evaluation of methodological quality of included cross-sectional studies.

Discussion

The findings of this review allowed the identification of factors associated with hip pain in dancers, as reported in the literature. Hip pain and injury are the main causes of work loss and performance time for dancers [2]. Therefore, understanding the factors leading to this condition is crucial for promoting a longer and healthier career for this population.

The evidence from this study indicates that professional ballet dancers are the most studied population. The turnout position (external rotation of the hip) in ballet and extreme ranges of motion required by classical repertoire may contribute to labral wear and tear [33], potentially leading to pain in this population.

Data collection methods for pain in the included studies varied from validated questionnaires such as HAGOS, HOOS, and IHOT-12 to even more subjective criteria such as self-report of the presence or absence of pain.

The factors associated with hip pain found in this review were divided into 5 categories (Table 2) for a more careful analysis: [1] pathology; [2] pathology and coping skills; [3] morphology; [4] morphology and hypermobility (MH); and [5] hypermobility.

The most mentioned factors are those related to pathologies: labral and/or cartilage injuries [24,26,27], hip joint effusion (synovitis) [23], and a history of injuries [22,28]. Previous hip injuries, injuries outside the hip, and general hip problems were reported in studies demonstrating significant correlations with pain in the same region [22,28].

Within the category of pathologies, symptomatic female dancers had a higher prevalence of synovitis compared to asymptomatic ones. However, this association did not exist for male dancers [23]. The association between hip pain and defects in acetabular and/or femoral cartilage varied across studies, suggesting a potential gender-related influence. A study that investigated overuse injuries in professional ballet dancers found a significant difference for hip pain injuries between men and women [8]. The results highlight a difference between female and male dancers, possibly related to the emphasis on hip joints in female dancers [34].

Rupture of the round ligament also showed an association with hip pain, significant for the right ligament but not the left [25]. This asymmetry could be explained by the predominance of right-handed individuals in the population, leading to more stress on the right hip.

Bone morphology, the second most studied category associated with hip pain in dancers, was a common factor among the studies. Alpha angles $\geq 60°$ were associated with higher levels of hip pain in dancers [29], as well as higher acetabular version angles (AVA) [30]. The ideal morphology for ballet, allowing for maximum hip range of motion while avoiding impact, includes relatively low AVA and femoral version angles [35].

However, one study analysed the angles of lateral center-edge angle (LCEA), alpha angles in the anterior and superior positions, and femoral neck-shaft angles. According to the authors, none of these characteristics showed a significant association with hip pain [30]. One factor that may have influenced this difference in the association of alpha angles with hip pain in dancers is the assessment method used. The study that quantified the alpha angle through ultrasound [29] showed an association with hip pain, while the study that quantified the alpha angle through magnetic resonance imaging [30] did not observe a significant association. The study that identified a significant association between the alpha angle and hip pain had a methodological quality of 90% [29]. Therefore, in this review, the alpha angle will be considered as a factor associated with hip pain in dancers.

Another observation within the morphology category was that symptomatic female dancers had greater femoroacetabular translation, measured through dynamic hip ultrasound, compared to asymptomatic dancers [31]. Excessive translation of the femoroacetabular joint is indicative of hip instability [36].

Other factors mentioned in the literature, such as generalized joint hypermobility [31,32] and coping skills [28], did not show an association with hip pain in dancers.

These results provide a comprehensive insight into the biomechanical, anatomical, and functional elements interconnected in the manifestation of hip pain among dancers. Such understanding is essential not only for the early identification and proper management of hip pain in this population but also for informing preventive strategies that can optimize the musculoskeletal health of dancers.

Limitations

There is significant heterogeneity among the included studies, making it challenging to combine results and conduct a meta-analysis. Additionally, 50% of the studies included in this review seemingly used data from individuals associated with a single ballet company, implying a high sampling bias in this review. A third limitation involves the low number of studies with high methodological quality.

Conclusion

According to the studies found in the literature up to this point, there is moderate evidence that factors most associated with hip pain in dancers are those related to hip pathologies and morphology.

In the pathology category, factors associated with hip pain include a history of current or past hip problems, previous injuries outside the hip, right-sided round ligament rupture, synovitis, and cartilage defects in females.

Among the studied morphologies, those associated with hip pain include an alpha angle equal to or greater than 60°, increased acetabular version angle, and increased femoroacetabular translation.

Further research is needed to explore other potentially associated factors with hip pain in dancers, such as overload and excessive use of the hip joint, improper technique, postural and/or muscular imbalances. Additionally, different dance styles should be investigated to determine if the associations found persist.

Declaration of Conflicting Interests

The author(s) declare that there are no financial, personal, or institutional conflicts of interest that could influence our ability to conduct this research or impartially interpret the results.

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