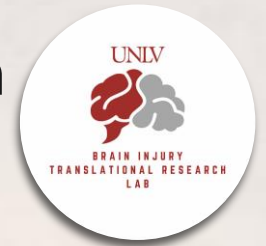# A Scoping Review of Biomechanical Research on Hip-Hop & Street Dance Movements

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INTRODUCTION

Hip-hop and street dance styles are widely practiced in performance, instructional, and recreational settings, yet remain underrepresented in biomechanical research. Despite their physical demands and cultural significance, these movement forms warrant deeper analysis to advance understanding of performance optimization, injury prevention, and healthcare applications.

OBJECTIVES

★ To synthesize existing peer-reviewed literature examining biomechanical characteristics of hip-hop and street dance movements
★ Identify methodologies, movement types studied, and knowledge gaps within the current body of research
★ Inform future work in dancer health, performance, and rehabilitation.

Table 1. Search Strategy and Inclusion Criteria

#	Keyword	Combination
1	"Hip-Hop Dance"	1 & 3
2	"Street Dance"	1 & 4
3	Biomechanics	1 & 5
4	Biomechanical	1 & 6
5	Motion Analysis	2 & 3
6	Movement Analysis	2&4, 2&5, 2&6
Inclusion Criteria		**Details**
Publication Date		2000-2025
Language		English
Population		Humans Subjects

METHODS

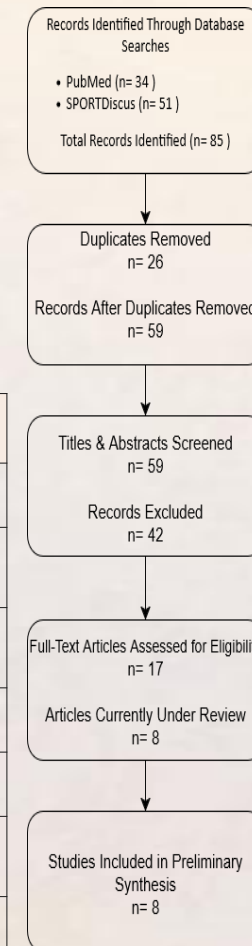★ **Design:** A scoping review was conducted following the PRISMA-ScR framework.

★ **Search Strategy:** Database searches were performed in PubMed and SPORTDiscus after preliminary scoping in other databases to refine feasibility and relevance.

★ **Inclusion Criteria:** Studies were included if they examined biomechanical or movement characteristics of hip-hop or street dance in human participants. Extracted data were charted by study design, movement type, biomechanical focus, and methodological approach to identify trends and gaps.

Table 2. Summary of Studies Included in Preliminary Synthesis (n = 8)

Study Design	Dance Style/ Movement Type	Biomechanical Focus	Methods Used	Key Findings
Experimental (3D motion capture)	Breaking, House, Toprock	Lower-limb kinematics (ROM at hip, knee, ankle)	Vicon 3D motion capture (120 Hz), ANOVA	Breaking showed highest joint ROM and load; potential injury risk.
Experimental (3D motion capture)	Hip-Hop (Side-step)	Temporal coordination, face inclination	Vicon motion capture, judge ratings	Experts had smoother coordination; facial motion correlated with performance scores.
Experimental (3D motion capture)	Hip-Hop ("Down" technique)	Temporal phase delays, COM displacement	Vicon motion capture, Stick-figure evaluation	Expert dancers showed smoother rhythmic motion and timing accuracy.
Observational (Video Analysis)	Breaking, Cypher Battles	Spinal/impact movement frequency	Video coding (YouTube, Jamovi)	Hip-hop had more flexion/falls, indicating higher back-loading risk.
Experimental (3D motion capture)	Hip-Hop (Wave motion)	Upper-limb coordination, propagation velocity	Vicon motion capture (60 Hz), ANOVA	Experts maintained smoother and consistent wave propagation.
Computational (ML classification)	10 Hip-Hop genres	Full-body kinematics, genre differentiation	AIST++ Dataset, ML model	ML model classified genres with 76% accuracy; biomechanical "fingerprints."
Computational (TD-PCA)	10 Hip-Hop genres	Beat alignment, rhythmic synergies	AIST++ Dataset, TD-PCA	Showed how biomechanical timing aligns with music across genres.
Experimental (PCA Analysis)	Locking	Upper-limb synergies, rhythmic coordination	PCA on 3D motion capture data	Upper-limb joints dominated coordination; rhythm structured by synergy patterns.

Note. Key Characteristics and Biomechanical Foci of Eight Studies Included to Date (Screening in Progress).

Records Identified Through Database Searches
- PubMed (n= 34)
- SPORTDiscus (n= 51)

Total Records Identified (n= 85)

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Duplicates Removed
n= 26

Records After Duplicates Removed
n= 59

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Titles & Abstracts Screened
n= 59

Records Excluded
n= 42

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Full-Text Articles Assessed for Eligibility
n= 17

Articles Currently Under Review
n= 8

↓

Studies Included in Preliminary Synthesis
n= 8

Figure 1. PRISMA-ScR Flow Diagram Summarizing Screening and Inclusion Process. Screening Ongoing as of October 2025.

RESULTS

A total of 85 records were identified through database searches (PubMed = 34, SPORTDiscus = 51). After removal of 26 duplicates, 59 records remained for title and abstract screening. 42 records were excluded, leaving 17 full-text articles for eligibility review. Eight studies have been included in the preliminary synthesis, with screening still ongoing.

DISCUSSION

Preliminary review of 8 biomechanical studies on hip-hop and street dance reveals high joint loading, complex inter-joint coordination, and genre-specific motor synergies. While computational motion analysis is increasingly applied, foundational groove and isolation movements remain underrepresented. Expanding biomechanical inquiry into these core dance forms is essential to inform dancer health, injury prevention, and clinical rehabilitation contexts.

ACKNOWLEDGEMENTS