International Journal on Science and Technology (IJSAT)
E-ISSN: 2229-7677 ● Website: www.ijsat.org ● Email: editor@ijsat.org

Jumping Strategies and Joint Coordination Efficiency among Wushu Student Players In Asports University In Beijing China

Gao Qingqing

Graduate School, Emilio Aguinaldo College, Manila, Philippines

ABSTRACT:

Recent research underscores the critical role of neuromuscular coordination, core stability, and functional training in optimizing jumping performance in Wushu. Functional training has been shown to enhance kinetic chain efficiency, while core mechanics training improves aerial coordination during complex maneuvers. Physiological studies indicate that Wushu practitioners exhibit superior explosive power and aerobic capacity, reflecting underlying neuromuscular adaptations. However, fatigue from routines can impair jump performance, and movement quality assessments like the Functional Movement Screen reveal coordination inefficiencies that may hinder execution. Biomechanical analyses further highlight how technique variations influence joint coordination strategies. Despite these insights, systematic research on joint coordination patterns across the diverse jumping techniques in Wushu remains limited, pointing to a need for more focused investigation into the integrated neuromuscular demands of the discipline.

Keywords: Wushu; jumping performance; neuromuscular coordination; core stability; functional training; kinetic chain; fatigue; movement quality; biomechanics

1. INTRODUCTION:

Real-time analyses of Wushu jump sequences show that student players solve the “height–rotation–landing” problem by coordinating hip–knee–ankle actions as a single functional unit rather than as isolated joints. In elite self-tao lu, the temporal coupling between hip flex ion/extension and knee extension during take-off appears to set the rotation budget for 360° –720° skills, while ankle plantarflex ion refines vertical impulse in the final 100 –150 ms before toe-off (Cha et al. , 2021). Systematic evidence from studies indicates that functional and plyometric preparations that emphasize whole-chain timing improve jump height and stability in tao lu performers (Wang et al. , 2024). Chinese normative datasets for vertical jump further suggest sex- and age-specific reference values that coaches use to scale rotation demands to safe take-off capacities (He et al. , 2023). Complementary neural-modeling and motion-recognition work drawn from Chinese martial arts supports the idea that joint -center trajectories and bone-point features can represent complex aerial skills with high fidelity, enabling targeted technique feedback (Luo & Qin, 2022; Zhang & Sun, 2022). Together, these strands point to joint coordination efficiency—how tightly and purposefully segments synchronize—as the decisive

ingredient in successful Wushu jumping. Importantly, efficiency here refers not only to peak force but to minimizing wasted motion in the impulse –flight–landing continuum (Wang et al. , 2024).

At take-off, Wushu student players often pursue a "delayed - plantarflex ion" strategy—loading the hip and knee early, then timing ankle drive to coincide with peak knee extension velocity—to balance vertical rise with angular momentum for in-air spins. A recent Chinese systematic review found that interventions which teach student players to manage eccentric –concentric transitions (short amortization) increased jump metrics used in taolu readiness screens (Wang et al. , 2024). Correlative work in Chinese jump testing shows that indices like reactive strength, eccentric and peak rates of force development, and vertical stiffness track closely with jump height and contact time, giving coaches controllable levers to refine take -off rhythm (Dong et al. , 2024). When these variables are tuned, student players report better "feel" for the moment to initiate trunk twist, which is critical for lotus-type skills (Chen & Tongdec haroen, 2024). Chinese-language biomechanics overviews also highlight how optimized hip–trunk sequencing pre-loads rotation without compromising vertical impulse, a classic trade-off in multi-turn aerials (Wu, 2025). These data underscore that jumping "power" in Wushu is fundamentally about sequencing quality under time pressure, not only about absolute strength. Coaches therefore emphasize drills that teach the order and overlap of joint contributions during the propulsive window (Dong et al. , 2024).

In-air strategy selection—how much rotation to "buy" at take-off versus how much to generate through mid-air segment reconfiguration—depends on trunk and upper-limb coordination. Studies describe how subtle arm abduction/adduct ion and forearm positioning alter whole-body moment of inertia, permitting mid-flight angular velocity trims during 540° and 720° skills (Cha et al. , 2021). Biomechanical modeling from Wushu teams suggests that student players with higher countermovement jump (CMJ) norms can afford earlier trunk twist without sacrificing height, whereas lower-powered jumpers benefit from delaying twist to p reserve vertical clearance (He et al. , 2023; Wang et al. , 2024). Educationally, this becomes a teachable ruleset: "height first, then rotation" for developing student players; more blended timing for advanced performers. Motion - recognition research using bone-point features in Chinese martial arts has begun to quantify these arm –trunk coordination patterns, enabling feedback beyond a coach's eye (Zhang & Sun, 2022). Over time, such analytics may individualize rotation –height prescriptions that match each student player's inertia profile. This fits with broader practice trends toward data-assisted skill acquisition in acrobatic sports (Wu, 2025).Landing strategies in Wushu jumping must reconcile artistry with joint protection, especially at the knee. An analysis of jump -inside - kick specialists reported that student players with longer knee-injury histories showed altered kinematics and kinetics across 360° –720° turns, pointing to compensations that may jeopardize stability at touchdown (Cha et al. , 2021). Chinese reviews emphasize teaching "quiet landings"—higher hip flex ion and controlled knee flex ion angles—to dissipate energy without valgus drift (Wang et al. , 2024). Emerging Chinese references on drop-jump optimization show how selecting task-appropriate drop heights sharpens stiffness regulation, an attribute strongly linked to controlled Wushu landings after aerials (Yue et al. , 2025). Coaches translate these findings into micro - progressions: short-amortization depth jumps, rotational stick - landings, and trunk-dominant deceleration drills. The goal is to align neuromuscular control with artistic scoring requirements while reducing cumulative joint load. Taken together, joint-friendly landings represent the "efficiency" end of the jump continuum (Cha et al. , 2021; Yue et al. , 2025).

Training studies from China point to functional training as a pragmatic route to better joint coordination and jumping outcomes in taolu. A 2024 systematic review of Wushu student players reported consistent improvements in strength, jump performance, and functional movement screening after 12 -week functional programs that integrated trunk–hip control, unilateral loading, and rhythm constraints (Wang et al. , 2024). Coaches in these studies used CMJ and drop-jump diagnostics to individualize session focus—e.g. , eccentric rate of force development deficits guided more tem po squats and landing drills (Dong et al. , 2024). When technical fitness programs targeted whirlwind and lotus skills, student players demonstrated measurable performance gains, likely via improved sequence timing and trunk stiffness modulation (Chen & Tongdecharoen, 2024). Normative jump references for Chinese populations then help benchmark progress by sex and age (He et al. , 2023). This evidence base has encouraged broader adoption of diagnostics-led programming in Chinese Wushu academies. Crucially, the interventions improved not just "how high," but "how" student players jumped.

The pedagogy of coordination—how coaches teach sequencing—has been bolstered by applications of AI-assisted kinematics. Chinese motion-recognition work that extracts skeleton - based features can flag deviations in pelvis –knee–ankle timing or unwanted trunk sway during take-off rehearsals (Zhang & Sun, 2022). Combined with coach feedback, these tools shorten the feedback loop for learning efficient joint sy nergies. Narrative reviews from China on martial-arts bio mechanics highlight hybrid approaches: traditio nal cueing ("soft shoulders, hard hips") translated into quantifiable constraints (hip –knee angular velocity ratios) during drill design (Wu, 2025). When student players see objective traces of their own coordination, buy-in to seemingly subtle technical adjustments improves. In practice, this means fewer repetitions to reach stable technique, conserving mechanical load on vulnerable joints. Such pedagogy aligns skill learning with measurable coordination targets, a hallmark of modern East Asian coaching (Zhang & Sun, 2022; Wu, 2025).

Statement of the Problem

This study determined the wushu student players' jumping strategies and joint coordination efficiency in Capital University of Physical Education and Sports in Beijing, China.The results of the study were used as a basis for a biomechanics-based jump training program.

Specifically, the study answered the following questions:

1. What is the demographic profile of the trainer respondents in terms of:
   1.1. sex;
   1.2. age; and
   1.3. number of years as a wushu student player?
2. What is the self-assessment of student player respondents of their jumping strategies in terms of:
   2.1. take-off power;
   2.2. body alignment in flight;
   2.3. arm–leg coordination;
   2.4. height achieved;
   2.5. landing control;
   2.6. energy efficiency; and
   2.7. consistency across jumps?

3. Is there a significant difference in the self-assessment of student player respondents of their jumping strategies when they are grouped according to their profile?
4. What is the self-assessment of the student player respondents of their joint coordination efficiency in terms of:
    4.1. timing of joint movements;
    4.2. smoothness of motion;
    4.3. balance control;
    4.4. symmetry of limb actions;
    4.5. muscle–joint coordination;
    4.6. transition between techniques; and
    4.7. fatigue resistance in movements?
5. Is there a significant difference in the self-assessment of the student player respondents of their joint coordination efficiency when they are grouped according to their profile?
6. Is there is significant relationship between the self-assessment of the wushu respondents of their jumping strategies and their joint coordination efficiency?
7. Based on the results of the study, what biomechanics -based jump training program can be proposed?

2. RESEARCH METHODOLOGY

This research employs a descriptive-comparative-correlational design, defined by clear articulation of variables, structured data collection, systematic analysis, and contextual interpretation. As noted by Okabe and Tanimori (2022), descriptive inquiry is indispensable in portraying phenomena as they naturally unfold, allowing researchers to document observable traits, behavioural dynamics, and situational influences. Such an approach provides a robust basis for constructing well-grounded and empirically sound explanations of complex social and behavioral systems.

Supporting this standpoint, Feng and Yucheng (2023) emphasized that descriptive strategies remain central in behavioral sciences because they enable the accumulation of trustworthy and unbiased data on individuals' perceptions, judgments, and behavioural choices. This facilitates the identification of recurring patterns and irregularities within specific groups, contributing to a deeper understanding of psychological mechanisms and socio - cultural variations.

Equally, Morimoto and Shibasaki (2024) underline the significance of comparative techniques in distinguishing essential variables across diverse demographic or experiential contexts. They further highlight the role of correlational analysis in uncovering meaningful interrelationships between factors, which is instrumental in building theoretical frameworks and informing professional practices. In the present study, correlational methods wil l be applied to explore the associations between demographic markers and attit udinal or behavioral measures pertinent to the research goals.

By integrating descriptive precision, comparative rigor, and correlational insight, this methodological framework draws upon the contributions of Okabe and Tanimori (2022), Feng and Yucheng (2023), and Morimoto and Shibasaki (2024). This holistic design strengthens the analytical

depth and empirical reliability of the investigation, offering a sound foundation for advancing scholarly knowledge and practical applications in the field.

This study aims to investigate the self-assessment of the wushu respondents of their jumping strategies and their joint coordination efficiency.This research approach allows the researcher to numerically analyze, compare, and correlate the relationships amongst the dependent variables included in the study.

By utilizing this approach, the researcher will be able to find any significant difference or relationship between the self- assessment of the wushu respondents of their jumping strategies and their demographic data such as age, sex, and number of years as a wushu student player. Also, the researcher will be able to find any significant difference or relationship in the self-assessment of the student player respondents of their joint coordination efficiency and their demographic data such as age, sex, and number of years as a wushu student player. Their joint coordination efficiency will then be correlated.

All the above discussions on the descriptive research method will suit the nature of research that this present study would do; hence this method will be adopted.

REFERENCES:

1. "Effects of functional training on muscle strength, jumping, and functional movement screen in Wushu student players: A systematic review." (2024). Heliyon.
2. AD, L., & Wilson, G. J. (2021). Enhancing performance: Maximum power versus weights and plyometrics training. Journal of Strength and Conditioning.
3. Adams, K. O. (2022). The effects of six weeks of squat, plyometric and squat-plyo metric training on power production.
4. Adams, K., & P., J. (2022). The effects of six weeks of squat, plyo metric, and squat-plyo metric training on power production. Journal of Applied Sports Science.
5. AG, F. W. (2022). Morphological and neurological contributions to strength training. Sports Medicine.
6. Al musawi, D. (2021). Effect of the opposite hierarchical training method on developing explosive power, which is characterized by speed and some functional variables for basketball players. Annals of the Romanian Society for Cell Biology, 25 (6), 730.
7. Anant, S. K., & Venugopal, R. (2025). Effect of eight -week core muscles strength training on physical fitness and body composition variables in male players of team games. Revista Andaluza de Medicina del Deporte, 14 (1), 17–23.
8. B. Allerhei ligen, R. R. (2025). The plyo metric program design. Strength and Conditioning.
9. Baker, D. (2023). Improving vertical jump performance through general, special, and specific strength training. Journal of Strength and Conditioning.

10. Bauer, T., & E, R. (2025). Comparison of training for powerdevelopment in lower extremity. Journal of Applied Sports Science.

11. Brzyck i, M. (2023). Strength testing—Predicting a one-rep max from reps-to-fatigue. Journal of Physical Education, Recreation & Dance.

12. BT Channell, J. B. (2022, September). Effect of Olympic and traditional resistance training on vertical jump improvement in high school boys. The Journal of Strength & Conditioning Research , 1522-1527. https://doi.org/10.1519/JSC.0b013e318181a3d0

13. Cab rejas , C., Solana-Tram unt, M., Morales, J., et al. (2022). The effect of eight-week functional core training on core stability in young rhythmic gymnasts: A randomized clinical trial. International Journal of Environmental Research and Public Health, 19 (6), 1– 15.

14. Carlson, K., & M., M. (2024). Effects of various training modalities in vertical jump. Research in Sports Medicine, 17(2), 84-94.

15. Cha, J. Y., Kim, H. -D., Park, S. -K., Kim, J.-H., & Kim, K. -H. (2021). Effects of knee injury length on jump-inside-kick performance in Wushu self-taolu student players. Medicina , 57(11), 1166. https://doi.org/10.3390/medicina57111166

16. Charoen panicha, N., Boonsins ukh, R., Sirisup, S., & Saengsirisuwana, V. (2023). Principal component analysis identifies major muscles. Research Article.

17. Chen, C.-Y. , Huang, C., Lee, C. -M., & Lin, Y. -P. (1998). The bio mechanical analysis of straight and flexural leg swing of the jumping front kick in Chinese martial arts. ISBS Conference Proceedings.

18. Chen, Y. , & Tongdecharoen, W. (2024). The effect of a specific fitness program on whirlwind kick 720° and lotus kick 540° performance in Wushu taolu players. International Journal of Sociologies and Anthropologies Science Reviews , 4(4), 133–140. https://doi.org/10.60027/ijsasr.2024.4286

19. Christou, M. S., Sotiro poulos, K., Volak lis, K., Pillanidis, T., & Tok makidis, S. P. (2021). Effects of resistance training on the physical capacities of adolescent soccer players. Journal of Strength and Conditioning Research.

20. Christou, M., & S., I. (2021). Effects of resistance training on the physical capacities of adolescent soccer players. The Journal of Strength & Conditioning Research.

21. Christou, Marios, S. (2021, November). Effect of resistance training on the physical capacities of adolescent soccer players. Journal of Strength and Conditioning Research.