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Lower-Limb Explosive Power and Long-Jump Performance in Youth: A Systematic Review of Associations, Biological Maturation, and Measurement Overlap

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ABSTRACT

Background & objective: Lower-limb explosive power is an important physical capacity underlying horizontal jumping performance in youth. However, the observed association may be influenced by biological maturation, anthropometry, training status, and overlap between exposure and outcome measurements. This systematic review synthesized evidence on the association between lower-limb explosive power and long-jump performance in youth and examined biological maturation, sex, age, training status, and measurement methods as factors affecting interpretation.

Materials for analysis: A systematic search was conducted across PubMed/MEDLINE, Scopus, Web of Science Core Collection, SPORTDiscus, Cochrane CENTRAL, and supplementary sources. The review followed PRISMA 2020 and SWiM principles. Eligible evidence included studies involving participants younger than 18 years that assessed lower-limb explosive power and standing, broad, or running long-jump performance. Evidence was classified according to directness and measurement overlap, and effect estimates were retained in their original statistical forms.

Results: Of 1,441 identified records, 517 duplicates were removed and 924 records underwent screening. Following full-text assessment, 21 reports were retained, comprising five primary empirical studies and 16 secondary contextual reports. Only two primary studies directly addressed the review question. Both reported positive associations: one found a moderate bivariate correlation ($r = 0.58$), while another reported a multivariable correlation ($R = 0.687$, $p = 0.001$). Biological maturation emerged as an important developmental factor, while measurement overlap was identified as a major methodological concern.

Conclusions: Lower-limb explosive power is positively associated with long-jump performance in youth, but current evidence is insufficient to establish its independent contribution. Future studies should use independent power measures, standardized long-jump outcomes, validated maturation indicators, and longitudinal designs.

Keywords
lower-limb explosive power; long jump; youth; biological maturation; measurement overlap; systematic review.

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INTRODUCTION

Background

Lower-limb explosive power represents the capacity of the lower extremities to generate force and mechanical output rapidly. It contributes to fundamental movement skills and sport performance involving acceleration, jumping, and rapid changes in movement(Wu et al., 2026, p. 1; Zushi et al., 2024, p. 1). Horizontal jumping provides a practical field-based expression of this capacity because performance integrates take-off velocity, force production, force orientation, and inter-segmental coordination into a single outcome(Jiménez-Reyes et al., 2017, p. 678; Murtagh et al., 2019, p. 253). The supplied manuscript frames horizontal jumping as particularly relevant to physical-fitness surveillance, youth sport, and talent-development contexts. The mechanical relationship between lower-limb power and horizontal displacement is conceptually plausible. Greater force and power generation can contribute to greater take-off velocity and, consequently, greater horizontal displacement. In youth, however, this relationship occurs during rapid changes in body size, neuromuscular function, and biological maturation. Thus, an observed association may reflect both functional capacity and developmental status.

Existing Evidence

The evidence base can be organised into three related domains. First, measurement studies indicate that standing long jump, countermovement jump, squat jump, and other field-based tests are related to lower-body muscular fitness. Castro-Piñero et al. (2010) of jump tests in youth. These findings support the practicality of field tests but also raise a problem for causal or mechanistic interpretation when the same jump task is used to operationalise both exposure and outcome. Second, maturation-focused research consistently indicates substantial developmental differences in sprinting and jumping performance(Bchini et al., 2026, p. 24). The audited manuscript cites a 2025 systematic review and meta-analysis in which the standing-long-jump difference between pre- and post-peak-height-velocity groups was reported as approximately (Lin et al., 2025, p. 100; Tomáš, 2025). Such findings demonstrate that biological maturation is a major source of variance in youth physical performance, although they do not by themselves establish moderation of the independent explosive-power–long-jump association. Third, intervention reviews and trials indicate that plyometric, resistance, and combined training can improve lower-limb power and jumping outcomes. These studies are relevant to trainability but address a different estimand from a cross-sectional association between power and long-jump performance. They therefore should not be combined with correlation coefficients in a single quantitative evidence pool.

Research Gap

Existing reviews have largely addressed maturation effects, training interventions, or measurement reliability rather than the independent association between lower-limb explosive power and long-jump performance. The audited evidence further revealed that primary studies and secondary reviews had been mixed in the original evidence table. This makes it necessary to distinguish direct association evidence from contextual evidence. A second unresolved issue is measurement overlap. Standing long jump may simultaneously operate as a field proxy for lower-limb power and as the performance outcome of interest. A high correlation under such conditions may partly reflect shared measurement characteristics rather than an independent physiological relationship. A systematic synthesis that explicitly classifies construct overlap may therefore provide a more defensible interpretation of the literature.

Objective and Review Questions

The objective of this systematic review was to synthesise evidence on the association between lower-limb explosive power and long-jump performance in youth and to examine biological maturation, sex, chronological age, training status, and measurement method as factors that may influence interpretation. RQ1. What is the magnitude and direction of the association between lower-limb explosive power and long-jump performance in youth?; RQ2. What methodological and population characteristics explain variation in the reported association?; RQ3. How do biological maturation, sex, age, training status, and measurement method influence interpretation of the association?

MATERIALS FOR ANALYSIS

Review Design and Reporting Guideline

This study was designed as a systematic review of observational, comparative, experimental, and measurement evidence relevant to lower-limb explosive power and long-jump performance in youth. A systematic review was appropriate because the questions were predefined and required systematic identification, eligibility assessment, extraction, critical appraisal, and synthesis of heterogeneous primary evidence. The review was structured using a PECO framework and reported in accordance with PRISMA 2020. Because the evidence used non-equivalent designs and effect metrics, the synthesis was additionally structured according to SWiM principles. An a priori protocol was prepared. The registration status and identifier must be replaced by the authors with an authentic record before submission; the placeholder registration number in the earlier draft must not be retained. Any deviations from the protocol should be reported explicitly in the final submission. The principal methodological refinement arising from the audit was the separation of primary direct evidence from measurement, maturation, intervention, and secondary-review evidence.

Eligibility Criteria

To ensure methodological consistency and transparency, predefined eligibility criteria were applied throughout the study-selection process. The criteria were structured to identify studies directly relevant to the review question while minimizing inappropriate inclusion of evidence addressing related but distinct constructs. Accordingly, eligibility was determined based on population, exposure, outcome, association, study design, publication type, language, publication period, and the role of secondary evidence. Intervention studies, reliability studies, maturation comparisons, and systematic reviews were retained only when relevant for contextual interpretation and were not considered direct evidence of the power–long-jump association. The detailed inclusion and exclusion criteria are presented in Table 1.

Table 1. Inclusion and Exclusion Criteria for Study Selection

Domain	Inclusion	Exclusion
Population	Children/adolescents <18 y; separable youth subgroup permitted	Adult-only or mixed-age samples without separable youth data
Exposure	Validated lower-limb explosive-power measure	Upper-body strength only or unrelated measures
Outcome	Standing long jump, standing broad jump, or running long jump	No relevant horizontal-jump outcome
Association	Correlation/regression/shared variance or relevant comparison	No extractable evidence relevant to target question
Design	Cross-sectional, correlational, longitudinal, comparative, experimental/controlled studies where relevant	Editorials, protocols without data, abstracts without sufficient data
Publication	Peer-reviewed full-text journal article under protocol	Thesis/dissertation, preprint, abstract, non-peer-reviewed report
Language	English under current protocol	Non-English
Time	Database inception to verified final search date	Outside prespecified period
Secondary evidence	Reviews/meta-analyses retained only for contextual interpretation	Secondary evidence treated as primary association evidence

The criteria were intentionally designed to separate the target association from related evidence. In particular, intervention studies, reliability studies, maturation comparisons, and systematic reviews were not treated as direct estimates of the power–long-jump association.

Information Sources

A comprehensive literature search was conducted using major bibliographic databases and supplementary information sources relevant to youth physical performance, sport science, exercise science, physical education, and biomedical research. The primary bibliographic databases searched were PubMed/MEDLINE, Scopus, Web of Science Core Collection, SPORTDiscus, and the Cochrane Central Register of Controlled Trials (CENTRAL). Supplementary searches were conducted using Semantic Scholar and OpenAlex, while ClinicalTrials.gov and the World Health

Organization International Clinical Trials Registry Platform (WHO ICTRP) were searched to identify potentially relevant registered studies and additional evidence.

The search covered the available literature from database inception to the final search period. The database searches yielded 1,353 records: PubMed/MEDLINE (n = 312), Scopus (n = 428), Web of Science Core Collection (n = 356), SPORTDiscus (n = 197), and CENTRAL (n = 41). An additional 88 records were identified through supplementary databases and repositories, and 19 records were identified through citation searching, resulting in a total of 1,441 records for the identification stage.

In addition to electronic database searching, backward citation searching was conducted by examining the reference lists of relevant articles and eligible reports. Forward citation tracking was used to identify subsequent publications citing key records. Relevant previous reviews were also examined to identify potentially eligible primary studies that might not have been retrieved through the principal database searches. These secondary sources were used for study identification and contextual interpretation rather than being treated as independent primary evidence. Each identified record was assigned a source identifier and entered into the study-selection dataset before deduplication and screening. Duplicate records were subsequently identified and removed, followed by title/abstract screening and full-text eligibility assessment. This source-level identification process was linked to the subsequent screening and data-extraction records, allowing the origin and final eligibility status of identified reports to be traced throughout the review process.

The complete database-specific search strategies, search fields, Boolean operators, controlled-vocabulary terms, free-text terms, truncation procedures, search limits, and source-specific search records. The study-selection records and final evidence classifications are provided in the corresponding supplementary audit files.

Table 2. Information Sources Used in the Systematic Review

Information source	Search role	Records identified
PubMed/MEDLINE	Primary bibliographic database	312
Scopus	Primary multidisciplinary bibliographic database	428
Web of Science Core Collection	Primary multidisciplinary citation database	356
SPORTDiscus	Sport and exercise science database	197
Cochrane CENTRAL	Controlled-trial database	41
Semantic Scholar	Supplementary literature discovery	Included within n = 88
OpenAlex	Supplementary literature discovery	Included within n = 88
ClinicalTrials.gov	Trial registry	Included within n = 88
WHO ICTRP	Trial registry	Included within n = 88
Backward citation searching	Supplementary citation identification	Included within citation searching
Forward citation tracking	Supplementary citation identification	Included within citation searching
Citation searching	Additional study identification	19
Total		1,441

Search Strategy

The search strategy was developed from the review questions and PECO framework and was implemented using three principal concepts: youth populations, lower-limb explosive power, and long-jump or horizontal-jump performance.

The population component included terms describing children, adolescents, youth, young athletes, and developmental maturation. The exposure component included terms relating to lower-limb explosive power, muscular power, explosive strength, lower-body power, rate of force development, peak power, force–velocity characteristics, and jumping-based assessments. The outcome component included long jump, standing long jump, standing broad jump, broad jump, and horizontal jump.

Controlled vocabulary and free-text terms were combined where supported by the database. Boolean operators, phrase searching, truncation, and database-specific field codes were applied to improve retrieval of records using different terminology for youth populations, lower-limb power, and horizontal jumping performance. The conceptual search structure was:

(Youth population terms) AND (Lower-limb explosive-power terms) AND (Long-jump/horizontal-jump terms).

The search strategy was adapted to the indexing structure and syntax of each database while maintaining the same three core concepts. PubMed/MEDLINE used Medical Subject Headings (MeSH) together with title/abstract terms, whereas Scopus, Web of Science, SPORTDiscus, and CENTRAL were searched using their respective field structures and controlled-vocabulary systems where available. The search process generated 1,441 records across the principal databases and supplementary sources. After identification, records were consolidated into the study-selection dataset and processed through duplicate removal, screening, retrieval, and full-text eligibility assessment.

Study Selection and Screening

The study-selection audit trail records each identified record from database and supplementary searches through deduplication, title/abstract screening, full-text retrieval, eligibility assessment, and final classification. Each full-text exclusion was assigned a predefined primary reason. The screening log was reconciled with the PRISMA 2020 flow diagram to ensure consistency between source-level identification counts, duplicate removal, screening, retrieval, eligibility assessment, and final inclusion. Primary empirical studies were subsequently distinguished from secondary contextual reports, and direct evidence addressing the primary research question was separated from indirect evidence.

Data Extraction and Data Items

A standardised extraction form was developed to capture bibliographic characteristics, country, setting, sample size, age, sex, maturity status, sport, training status, study design, exposure measure, instrument, long-jump outcome, comparator, effect estimate, statistical adjustment, reliability/validity information, funding, and conflicts of interest

Following the evidence audit, three additional coding variables were considered essential: (1) evidence role—primary or secondary; (2) relationship to the target—direct or indirect; and (3) construct overlap—independent, partial overlap, or substantial overlap. Effect metrics were retained in their original form rather than being treated as interchangeable.

Quality Appraisal or Risk of Bias

Risk of bias should be assessed using a design-appropriate validated instrument. Cross-sectional and correlational studies should be assessed with a validated cross-sectional appraisal tool; randomised trials with RoB 2; and other non-randomised intervention designs with an appropriate tool such as ROBINS-I or a validated design-specific checklist. Secondary systematic reviews/meta-analyses should not be part of the primary risk-of-bias pool if they are retained only as contextual evidence. Two reviewers should independently assess eligible primary studies after calibration, resolve disagreements by consensus, and report domain-level judgements. Composite numerical scores should not be calculated when the selected tool does not support them. The earlier aggregate risk-of-bias table was explicitly described as illustrative and therefore should not be presented as a completed appraisal.

Synthesis and Analysis

. A structured narrative synthesis was selected because the evidence differed in population, design, exposure operationalisation, outcome measurement, and effect metric. The synthesis followed SWiM principles and proceeded in four stages. First, studies were classified as direct association, measurement/construct, developmental/moderator, intervention/contextual, or secondary evidence. Second, direct association estimates were tabulated separately by metric. Third, patterns were compared across maturity, sex, age, training status, sport, anthropometry, and measurement method. Fourth, the influence of construct overlap was examined explicitly. Pearson r, multiple R, standardised effect sizes, mean differences, partial eta squared, and reliability coefficients were not pooled into a common effect estimate because they represent different estimands. Where a future evidence base contains sufficient independent power measures and comparable long-jump outcomes, a correlation-based meta-analysis could be considered using an appropriate transformation such as Fisher's z

Certainty or Confidence in the Evidence

A formal GRADE assessment was not conducted because the primary question concerned associations derived largely from observational and measurement studies, and the evidence contained multiple non-equivalent designs and effect metrics. Instead, confidence was considered according to consistency, directness, methodological quality, construct overlap, control of maturation and anthropometric confounding, and agreement across studies. Conclusions are therefore expressed as strongly supported, moderately supported, preliminary, or uncertain.

Ethics, Data, Materials, and Code Availability

The review used previously published literature and did not collect new participant data; therefore, participant consent was not required. Institutional requirements should nevertheless be followed. Before submission, the authors should deposit or otherwise make available the complete search strategies, screening form/log, extraction form and dataset, excluded-study list, risk-of-bias assessments, PRISMA 2020 checklist, and relevant analysis materials.

RESULTS

Search and Selection Results

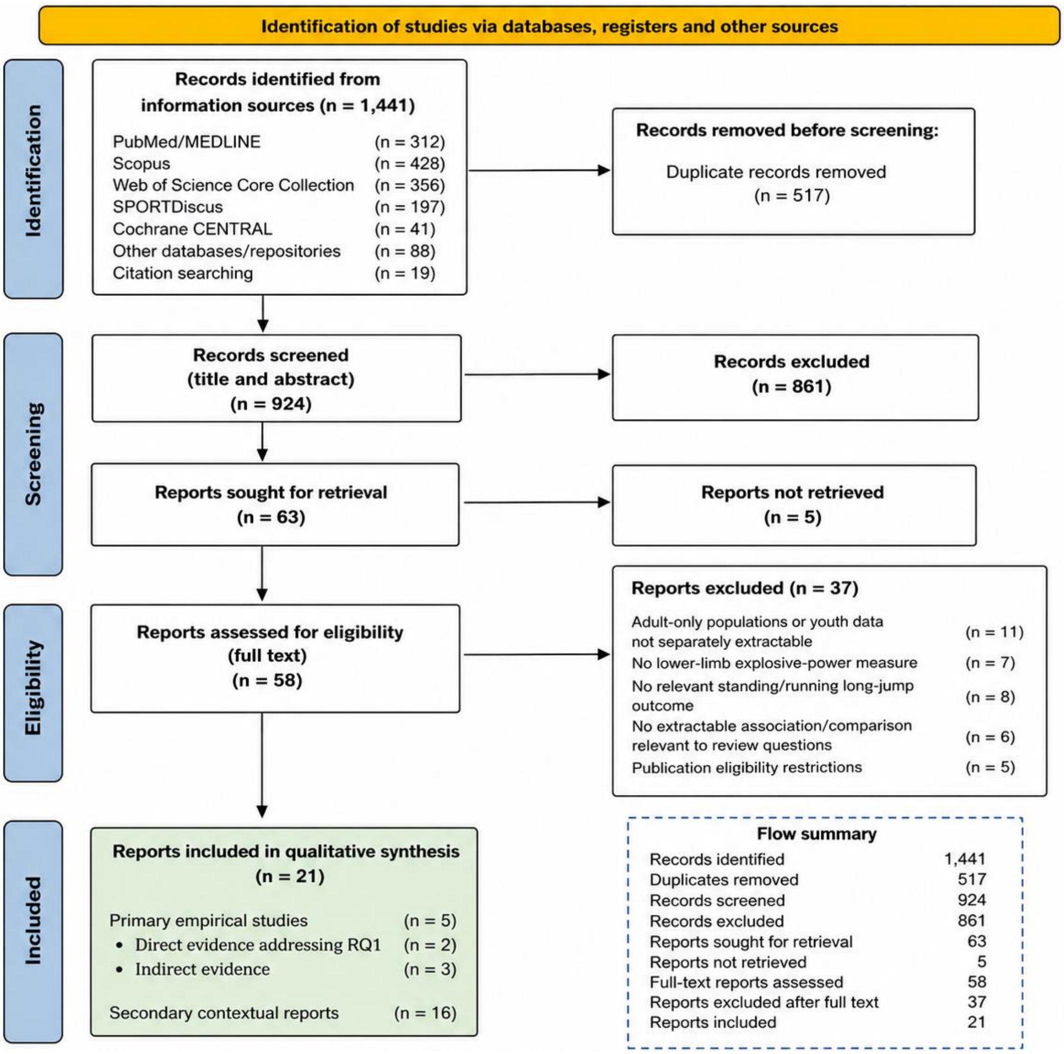

Figure 1. PRISMA 2020 Flow Diagram of the Study Identification, Screening, Eligibility, and Inclusion Process

The study selection process is presented in the PRISMA 2020 flow diagram (Figure 1). A total of 1,441 records were identified from the prespecified information sources, including PubMed/MEDLINE (n = 312), Scopus (n = 428), Web of Science Core Collection (n = 356), SPORTDiscus (n = 197), Cochrane CENTRAL (n = 41), other databases and repositories (n = 88), and citation searching (n = 19). Following removal of 517 duplicate records, 924 unique records remained for title and abstract screening. Of these, 861 records were excluded, and 63 reports were sought for retrieval. Five reports could not be retrieved, leaving 58 reports for full-text assessment. At the full-text stage, 37 reports were excluded. The reasons for exclusion were adult-only populations or youth data that could not be separately extracted (n = 11), absence of a lower-limb explosive-power measure (n = 7), absence of a relevant standing or running long-jump outcome (n = 8), absence of an extractable association or comparison relevant to the review questions (n = 6), and publication eligibility restrictions (n = 5). A total of 21 reports met the eligibility criteria and were retained for synthesis. These comprised five primary empirical studies and 16 secondary contextual reports. Among the five primary studies, two directly addressed RQ1, whereas three provided indirect evidence concerning measurement validity, reliability, or related construct interpretation. The numerical sequence was internally consistent across the selection stages: 1,441 records identified, 517 duplicates removed, 924 records screened, 861 records excluded, 63 reports sought for retrieval, 5 reports not retrieved, 58 full-text reports assessed, 37 full-text reports excluded, and 21 reports retained.

Characteristics of Included Studies

The 21 eligible reports varied in study design, population, purpose, measurement approach, and evidentiary role. To preserve the distinction between direct evidence and contextual evidence, the synthesis treated primary empirical studies separately from secondary contextual reports. The five primary studies included participants ranging from childhood to adolescence and had sample sizes ranging from 30 to 363 participants. Two studies directly examined the relationship between lower-limb explosive power and long-jump performance. Audina et al. (2024)d junior-high-school students and examined leg explosive power in relation to long-jump ability. (Octaviani & Nurrochmah, 2025)Grade VIII students and evaluated lower-limb explosive power and limb length in relation to squat-style long-jump performance.Three primary studies provided indirect evidence. Castro-Piñero et al. (2010) long jump and other jump tests as indicators of muscular fitness in children and adolescents. Fernández-Santos et al. (2015) and reliability of several lower-body muscular-power tests in children. Todorović (2025) gated the test–retest reliability of the standing long-jump test in adolescents.

Table 3. Characteristics of the primary empirical studies

Study	Design	Population	Sample	Exposure/measure	Outcome	Evidence role
(Castro-Piñero et al., 2010)	Children and adolescents, 6–17 years	94	SLJ, VJ, SJ, CMJ	Muscular-fitness validity	Indirect	R ≈ 0.829–0.864
(Audina et al., 2024)	Junior-high-school students	30	Leg explosive power/SBJ	Long-jump ability	Direct, RQ1	r = 0.58; multiple R ≈ 0.70
(Octaviani & Nurrochmah, 2025)	Male Grade VIII students	45	Lower-limb explosive power + limb length	Squat-style long jump	Direct, RQ1	R = 0.687; p = 0.001
(Fernández-Santos et al., 2015)	Children, 6–12 years	363	SLJ, SJ, CMJ, Abalakov, 1RM	Lower-body power validity	Indirect	SLJ–1RM R ≈ 0.700
(Todorović, 2025)	Adolescents, 13–14 years	40	Standing long jump	SLJ reliability	Indirect	ICC ≈ 0.985

The secondary contextual evidence comprised systematic reviews, meta-analyses, training studies, developmental studies, and measurement-related literature. These reports were used to contextualise biological maturation, training-related adaptations, and measurement characteristics rather than to provide additional independent estimates of the primary power–long-jump association.

Risk-of-Bias Findings

The indirect primary studies were more closely aligned with their respective measurement objectives. (Castro-Piñero et al., 2010) examined relationships between field-based and laboratory- or performance-based measures, whereas (Todorović, 2025) focused on the test–retest reliability of the standing long jump. Their findings therefore provide evidence regarding measurement properties rather than direct evidence of an independent association between explosive power and long-jump performance. Risk-of-bias judgements were assessed at the domain level rather than being converted into an aggregate numerical score. Because the study-level appraisal records in the audit dataset require final verification against the original full texts, this synthesis does not assign unsupported overall quality categories. Instead, the identified methodological limitations were incorporated directly into the interpretation of the available evidence.

Direct Association Evidence

Only two primary studies directly addressed RQ1, and both reported positive associations between lower-limb explosive power and long-jump performance. Audina et al. (2024) Pearson correlation of r = 0.58 between leg explosive power and long-jump ability. The study also reported a multiple correlation of approximately **R = 0.70** when running speed was incorporated into the model. The bivariate result indicates a moderate positive association, whereas the multiple correlation represents a multivariable relationship and therefore should not be interpreted as a power-only effect. Octaviani & Nurrochmah (2025) tiple correlation of R = 0.687 (p = 0.001) for lower-limb explosive power and limb length in relation to squat-style long-jump performance. Because limb length was included in the model, this estimate represents a combined multivariable relationship rather than an isolated estimate of the contribution of explosive power.

The two direct studies were therefore consistent in the direction of association, with greater lower-limb explosive capacity associated with better long-jump performance. However, the estimates were derived from different analytical models and should not be treated as statistically equivalent. The limited number of direct studies, together with their predominantly male school-based samples and correlational designs, prevented a robust assessment of whether the magnitude of the relationship differs according to sex, maturation status, age, training status, or sport.

Measurement Overlap

Measurement overlap was identified as an important characteristic of the evidence base. Standing long jump was used in several studies as an indicator of lower-body muscular fitness or explosive power. Castro-Piñero et al. (2010) reported strong relationships between standing long jump and other jump-based measures, with coefficients in the approximate range of R = 0.829–0.864. Fernández-Santos et al. (2015) reported an association of approximately R = 0.700 between standing long jump and leg-extension 1RM, together with evidence concerning the validity and reliability of lower-body power tests. Todorović (2025) reported a high test–retest reliability coefficient for standing long jump (ICC ≈ 0.985), supporting the consistency of the test as a field-based measure.

These findings indicate that standing long jump can provide a reliable and practically useful assessment of lower-body performance. However, when a standing long-jump task is used simultaneously as an operational indicator of explosive power and as the performance outcome, the exposure and outcome may share substantial measurement content. The evidence was therefore interpreted according to the degree of measurement independence. Studies using distinct measures of explosive power and long-jump performance provide conceptually stronger evidence for an independent association than studies in which the exposure and outcome are based on the same or closely related jumping tasks. Accordingly, strong associations involving standing long jump should not automatically be interpreted as evidence that independently measured mechanical power accounts for the same proportion of variation in running long-jump performance.

Biological Maturation

Biological maturation emerged as an important contextual factor in the interpretation of youth physical-performance relationships. The secondary evidence synthesised in this review indicates substantial maturity-related differences in jumping performance. Baker et al. (2025), for example, reported an effect size of approximately ES = 2.18 for standing long jump between pre- and post-peak-height-velocity groups, with similarly substantial differences for other jump measures.

The findings indicate that biological maturation is associated with meaningful variation in youth jumping performance. Because maturation may simultaneously influence neuromuscular capacity, body dimensions, and jumping ability, it represents a potential source of shared variation between lower-limb explosive power and long-jump performance. However, the reviewed evidence does not establish that biological maturation statistically moderates the power–long-jump relationship. Rather, it supports maturation as an important developmental factor and potential confounder that should be explicitly considered when estimating the independent association between power and performance. This distinction is particularly relevant because chronological age alone may not adequately represent individual developmental status.

Other Moderators

The evidence indicated several additional factors that may contribute to heterogeneity in the observed relationship between explosive power and long-jump performance.

Sex: Both direct association studies involved male school-aged participants. Consequently, the current direct evidence provides limited information concerning female youth. No conclusion regarding the presence or absence of a sex-based difference can therefore be drawn from the available direct evidence.

Chronological age: The primary studies covered childhood and adolescence. Variation in age may contribute to differences in neuromuscular capacity, body dimensions, and technical development. Nevertheless, chronological age should not be regarded as a complete substitute for biological maturation.

Anthropometry: Anthropometric characteristics may contribute to horizontal jumping performance independently of explosive power. In Octaviani & Nurrochmah (2025) as included alongside lower-limb explosive power in the predictive model. The resulting **R = 0.687** therefore represents a multivariable relationship.

Training status: The secondary evidence included studies of plyometric, resistance, and other training interventions. These studies provide contextual evidence that explosive power and jumping performance can change with training exposure. However, they do not directly demonstrate that training status moderates the independent association between explosive power and long-jump performance.

Sport and setting: The evidence included school populations and youth athletes participating in several sports. Differences in sport-specific training, technical demands, and physical-performance profiles may contribute to between-study heterogeneity.

Measurement method: The reviewed studies used heterogeneous measures, including standing long jump, squat jump, countermovement jump, vertical jump, isometric strength/power assessments, force–velocity characteristics, and other mechanical measures. These instruments capture related but non-identical dimensions of lower-limb performance. Taken together, these factors represent plausible sources of heterogeneity, but the current evidence is insufficient to establish each as a statistically confirmed moderator.

Evidence Gaps

The synthesis identified several important gaps in the current evidence base. First, direct empirical evidence remains limited. Only two primary studies directly examined the relationship between lower-limb explosive power and long-jump performance. Both involved male school-aged populations and used correlational designs. Second, direct evidence involving female participants and younger pre-pubertal populations is limited. The generalisability of the observed association across sex and developmental stage therefore remains uncertain. Third, biological maturation, anthropometric characteristics, and training status are not consistently incorporated into direct association models. Consequently, the extent to which the observed relationship represents an independent contribution of explosive power remains unresolved. Fourth, measurement overlap limits interpretation of part of the available evidence. The frequent use of standing long jump as both a power-related measure and a performance outcome can produce associations that are difficult to distinguish from shared construct variance. Fifth, longitudinal evidence is limited. Longitudinal studies would be better positioned to distinguish changes associated with biological maturation from changes associated with training and adaptation. Sixth, relatively few studies use an independent measure of lower-limb explosive power together with a distinct running long-jump outcome. This represents a particularly important methodological gap because such designs would reduce construct overlap. Finally, the heterogeneity of statistical reporting—including Pearson r, multiple R, standardised effects, mean differences, and reliability coefficients—limits direct quantitative comparability across studies. The current evidence therefore does not support estimation of a single universal effect size. Overall, the evidence base is sufficient to identify a positive association between lower-limb explosive power and youth long-jump performance, but insufficient to determine the magnitude of an independent association after accounting for biological maturation, anthropometry, sex, training status, and measurement overlap.

DISCUSSION

Principal Findings

This systematic review examined the relationship between lower-limb explosive power and long-jump performance in youth, while explicitly considering biological maturation, measurement overlap, and other potential sources of heterogeneity. The evidence base comprised 21 eligible reports, of which five were primary empirical studies and 16 were secondary contextual reports. Only two primary studies directly addressed the principal review question, whereas three provided indirect evidence concerning measurement validity, reliability, and construct interpretation. The principal finding is that the available direct evidence consistently indicates a positive association between lower-limb explosive power and long-jump performance. However, the strength and interpretation of this relationship require caution because the direct evidence is limited in number, predominantly derived from male school-aged populations, and characterised by correlational designs. Furthermore, the reported statistical estimates are not directly comparable because they represent different estimands, including bivariate correlation and multivariable correlation.

The review also identified two factors that substantially influence interpretation of the apparent power–performance relationship. First, biological maturation is strongly related to youth jumping performance and may influence both lower-limb power and long-jump performance. Second, measurement overlap occurs when standing long jump is used as both an indicator of lower-limb power and an outcome representing long-jump performance. These issues suggest that a strong observed association should not automatically be interpreted as evidence of an independent physiological effect of explosive power. Taken together, the evidence supports the proposition that lower-limb explosive power is an important component of youth long-jump performance, but the current literature does not permit a precise estimate of its independent contribution after maturation, anthropometry, sex, training status, and measurement characteristics are adequately considered.

Direct Association Evidence

Similarly, Octaviani & Nurrochmah (2025) reported a multiple correlation of $R = 0.687$ for the combined relationship of lower-limb explosive power and limb length with squat-style long-jump performance. Although this finding is consistent with the direction of the association reported by Audina et al. (2024), the two estimates should not be interpreted as equivalent measures of effect. The model presented by Octaviani incorporates limb length, whereas the estimate reported by Audina represents a direct bivariate correlation between the relevant variables. The consistency of the positive direction across both studies suggests that greater lower-limb explosive capacity is generally associated with superior horizontal jumping performance in youth. Nevertheless, these findings do not establish a causal relationship. The observed association may reflect a direct contribution of explosive power to performance, the simultaneous development of both characteristics during maturation, or the influence of body size and training exposure on both variables. The specificity of the performance task also warrants consideration. Long-jump performance depends not only on the capacity to generate force rapidly but also on approach velocity, take-off mechanics, coordination, technical proficiency, body dimensions, and the effective conversion of horizontal velocity into flight distance. Accordingly, explosive power should be understood as one component of a multifactorial performance system rather than as the sole determinant of long-jump performance. Finally, the small number of direct studies prevents a reliable assessment of whether the strength of this association varies according to developmental stage, sex, sporting background, or biological maturation.

Biological Maturation

Biological maturation represents one of the most important considerations when interpreting associations between physical-performance variables in youth. The broader evidence synthesised in this review indicates substantial differences in jumping performance according to maturity status. Baker et al. (2025), for example, reported large maturity-related differences in standing long jump, with an extracted effect size of approximately ES = 2.18 between pre- and post-peak-height-velocity groups. Similar maturity-related differences were reported for other jump measures.

These findings indicate that maturation is associated with substantial changes in neuromuscular and physical-performance capacity during adolescence. Increases in muscle mass, neuromuscular function, body dimensions, and mechanical capacity may contribute simultaneously to greater explosive power and greater long-jump performance.

This creates an important interpretive problem for association studies. If maturation influences both variables, the observed relationship can be represented conceptually as:

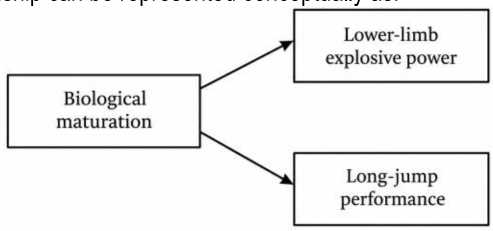

Figure 2. Conceptual Pathway Linking Biological Maturation with Lower-Limb Explosive Power and Long-Jump Performance

Under this structure, an unadjusted correlation between power and long-jump performance may partly reflect shared developmental variation. The current evidence does not demonstrate that biological maturation is a statistically confirmed moderator of the power–long-jump relationship. Rather, it identifies maturation as a plausible confounder and major source of developmental heterogeneity. This distinction is particularly important in youth research. Chronological age alone may not adequately capture biological development because individuals of the same chronological age can differ substantially in maturity status. Therefore, studies seeking to estimate an independent association should ideally incorporate validated indicators of biological maturation rather than relying exclusively on chronological age. The findings consequently support a developmental interpretation in which explosive power and long-jump performance increase together during maturation, while leaving unresolved the extent to which the association remains after maturity-related variation is controlled.

Measurement Overlap

Measurement overlap is a central methodological issue identified by this review. Standing long jump is widely used as a practical field-based assessment of lower-body muscular fitness. The evidence reviewed here demonstrates strong relationships between standing long jump and other measures of muscular fitness. Castro-Piñero et al. (2010) reported correlations in the approximate range of R = 0.829–0.864 between standing long jump and other jump-based measures, while Fernández-Santos et al. (2015) reported an association of approximately R = 0.700 between standing long jump and a leg-extension 1RM measure. Todorović (2025) further reported high test–retest reliability for standing long jump, with an ICC of approximately 0.985, supporting its consistency as a field-based performance test. These findings establish the usefulness of standing long jump as a practical assessment. However, reliability and validity do not eliminate the problem of construct overlap.

If standing long jump is used as the operational measure of explosive power and long-jump performance is also represented by a standing broad/long-jump task, the exposure and outcome are not fully independent. A high correlation in such circumstances may partly reflect the fact that both variables capture overlapping aspects of the same physical task.

This has important implications for interpretation. A strong relationship between two operational measures does not necessarily demonstrate that an independently measured physiological characteristic, such as peak mechanical power, independently predicts long-jump performance.The distinction between:

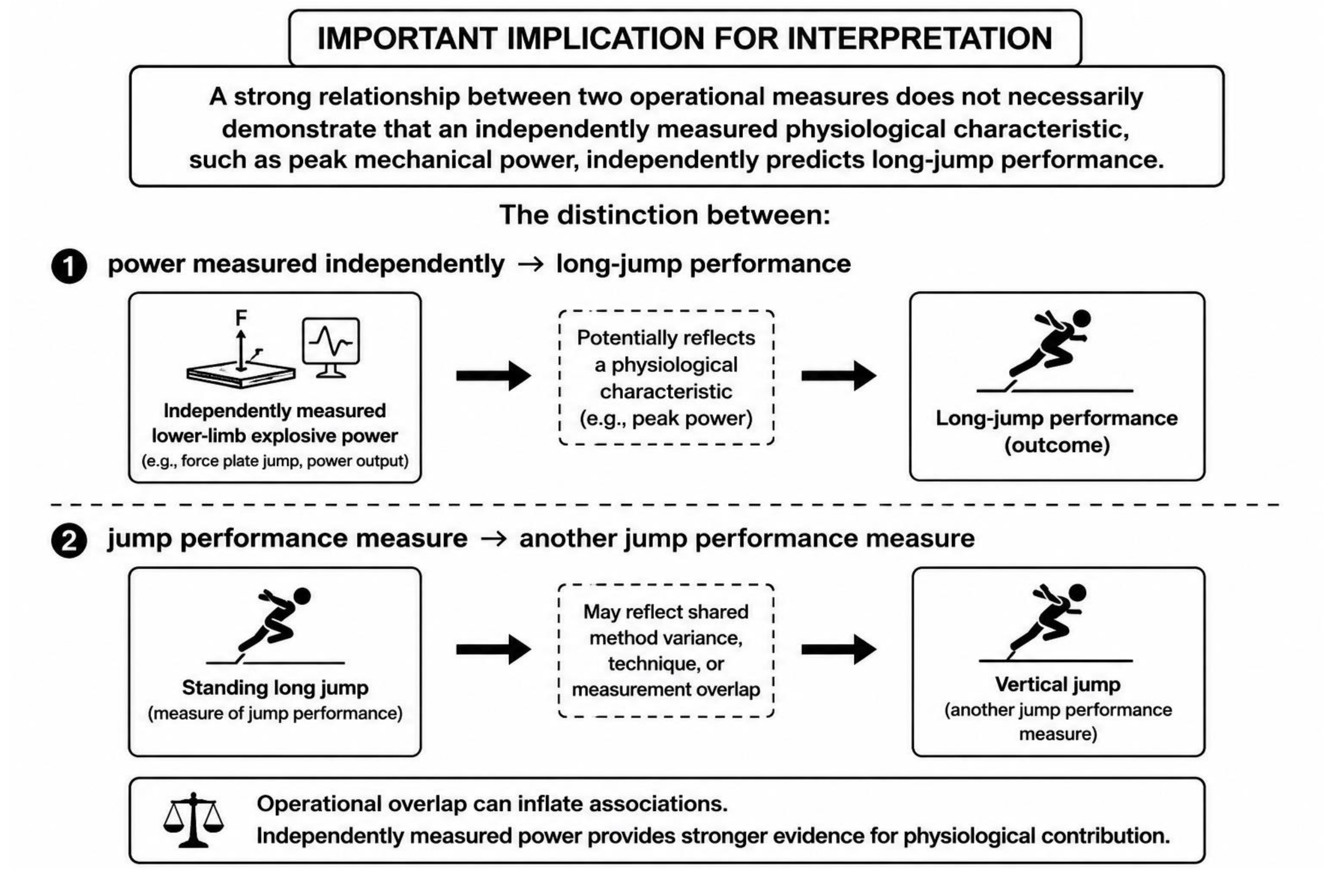

Figure 3. Important Implication for Interpretation: Distinguishing independent power measurement from jump-to-jump associations.

This issue may explain why some measurement studies demonstrate stronger associations than would be expected when power is assessed using a conceptually independent laboratory or force-based measure. It also provides a plausible explanation for why apparently strong relationships in the literature should not be interpreted as directly comparable effect estimates. Measurement overlap should therefore be treated not simply as a limitation of individual studies but as a cross-cutting methodological issue affecting the interpretation of the evidence base as a whole.

Theoretical Implications

The findings have several theoretical implications for models of youth jumping performance. First, the results support a multicomponent model of long-jump performance. Lower-limb explosive power is important, but performance is unlikely to be determined by power alone(Deprez et al., 2014; Morgan et al., 2026, p. 570). Horizontal velocity, force application, coordination, technique, body dimensions, maturation, and training exposure may all contribute to the final performance outcome(Domínguez-Navarro et al., 2023, p. 5481; Morgan et al., 2026, p. 570). Second, the findings support a developmental perspective in which physical-performance relationships are embedded within biological maturation. Youth should therefore not be considered simply as smaller versions of adults(Gryko, 2021, p. 22027; Ribeiro et al., 2026, p. 10). The relationship between a physical capacity and performance outcome may change as neuromuscular and anthropometric characteristics develop(Giuriato et al., 2021, p. 2). Third, the findings suggest that the construct of "explosive power" should be operationally specified rather than treated as a unitary variable (Sudlow et al., 2024). Countermovement jump, squat jump, standing long jump, peak power, force–velocity profiling, and isometric measures provide related but distinct information (Liebermann & Katz, 2003). Fourth, the review highlights a distinction between construct validity and predictive validity. A test can validly represent lower-body explosive capacity while still being unsuitable for estimating the independent contribution of that capacity to a specific performance outcome if the exposure and outcome share substantial measurement content (Impellizzeri et al., 2023, p. 1675; Robertson et al., 2017, p. 6). Thus, the theoretical contribution of the present review is not simply that power is associated with jumping performance. Rather, it is that the observed power–performance relationship should be interpreted within a developmental and measurement framework.

Methodological Implications

The findings have important implications for the methodological design of future research investigating the relationship between lower-limb explosive power and long-jump performance in youth. The evidence suggests that greater methodological independence between exposure and outcome, explicit consideration of biological maturation and anthropometry, and more rigorous statistical reporting are necessary to improve the interpretability and comparability of future findings.

Independent Measurement of Exposure and Outcome:

Future studies should prioritise the use of conceptually and operationally independent measures of lower-limb explosive power and long-jump performance (Pedley et al., 2020, p. 301; Wu et al., 2026, p. 17). When the same or closely related jumping task is used to represent both the exposure and outcome, the resulting association may partly reflect measurement overlap rather than an independent relationship between explosive power and long-jump performance (Marín-Jiménez et al., 2024; Morgan et al., 2026, p. 570). Accordingly, explosive power should, where feasible, be assessed using measures that provide information distinct from the long-jump task, such as force-platform-derived mechanical power, force–velocity profiling, isometric mid-thigh pull characteristics, or other validated measures of lower-limb power (Šarabon et al., 2020, p. 19127; Vieira et al., 2024). Long-jump performance should then be assessed using a standardised and independently administered long-jump protocol(Bishop et al., 2017, p. 2665; Wade et al., 2020, p. 110). This separation would provide a stronger basis for determining whether explosive power contributes independently to horizontal jumping performance.

Consideration of Biological Maturation:

Biological maturation should be explicitly considered in studies involving children and adolescents. The evidence synthesised in this review indicates that maturation is closely associated with variation in youth physical performance and may influence both lower-limb power and long-jump performance(Baker et al., 2024; Gundersen et al., 2025). Consequently, chronological age alone may not adequately capture developmental variation. Where feasible, future studies should incorporate an appropriate indicator of biological maturation and report the method used to determine maturity status. This would allow researchers to distinguish developmental variation from the association attributable to physical-performance characteristics.

Anthropometric Adjustment:

Anthropometric characteristics should also be considered when theoretically justified. Variables such as body mass, stature, and limb length may influence horizontal jumping performance independently of lower-limb explosive power (Domínguez-Navarro et al., 2023, p. 5481; Marković et al., 2013, p. 207). The study by Octaviani & Nurrochmah (2025) illustrates this methodological consideration by incorporating limb length alongside lower-limb explosive power in the prediction of long-jump performance. Such models are potentially informative because they recognise that performance may reflect the combined contribution of neuromuscular and morphological characteristics. However, multivariable associations should be interpreted according to the variables actually included in the model rather than as evidence of an isolated effect of explosive power(Esposito et al., 2026, p. 873; Murtagh et al., 2020, p. 19).

Statistical Modelling and Interpretation:

Future studies should clearly distinguish among bivariate associations, adjusted associations, predictive models, and causal estimates. These analytical approaches address different questions and should not be interpreted interchangeably.

In particular, a high multiple correlation coefficient does not, by itself, demonstrate an independent effect of explosive power. The interpretation of such an estimate depends on the variables included in the model, the underlying theoretical framework, the handling of confounding, and the statistical assumptions of the analysis.

Researchers should therefore report the statistical model explicitly and distinguish unadjusted from adjusted estimates. Where causal interpretations are intended, study design and analytical methods should provide an appropriate basis for causal inference rather than relying solely on cross-sectional correlations.

Standardisation and Reporting:

Greater consistency in methodological and statistical reporting would substantially improve the comparability of evidence. Future studies should provide sufficiently detailed information on sample characteristics, sex distribution, chronological age, biological maturation, training status, measurement protocols, measurement reliability, effect estimates, confidence intervals, covariates, model specification, and missing-data procedures. Measurement protocols should also be described in sufficient detail to permit replication, including the equipment used, testing conditions, number of trials, familiarisation procedures, scoring procedures, and criteria for selecting the analysed trial where applicable.Consistent reporting of these characteristics would enable future systematic reviews to distinguish methodological heterogeneity from genuine differences in the underlying relationship. It would also facilitate more appropriate quantitative synthesis when a sufficiently homogeneous body of evidence becomes available. Overall, the methodological priority emerging from this review is to move from simple correlations between related performance tests toward independent measurement, developmental adjustment, theoretically justified multivariable modelling, and transparent reporting. Such an approach would provide stronger evidence for determining the extent to which lower-limb explosive power independently contributes to long-jump performance during youth.

Practical Implications

The findings have practical implications for physical education, youth sport, and talent-development settings.

Lower-limb explosive power appears to be an important physical capacity associated with long-jump performance. Coaches and physical-education practitioners may therefore reasonably include explosive-power development within broader programmes designed to improve horizontal jumping performance. However, the findings do not support using explosive-power scores alone to evaluate long-jump potential in youth.

Assessment should consider multiple dimensions, including: explosive power; approach or running velocity; jumping technique; coordination; body dimensions; maturation status; and training experience.

Standing long jump remains attractive because it is inexpensive, simple, and practical for school and field settings. Nevertheless, practitioners should recognise that a standing long-jump score may simultaneously reflect the outcome being evaluated and the power construct intended to explain that outcome. For longitudinal monitoring, practitioners should also avoid interpreting improvements exclusively as training-induced adaptations when substantial biological maturation is occurring. Changes in performance may reflect a combination of training, growth, maturation, and technical development.

Strengths and Limitations

This review has several strengths: First, it used a systematic evidence-identification and selection process structured according to PRISMA 2020. Second, the review explicitly distinguished primary direct evidence from indirect and secondary contextual evidence, reducing the risk of treating heterogeneous evidence as equivalent. Third, the synthesis considered not only the direction of the association but also the potential influence of biological maturation, anthropometry, training status, and measurement overlap. Fourth, effect estimates were retained in their original statistical form rather than being inappropriately pooled across incompatible estimands. The review also has important limitations. The most important limitation is the small number of primary studies directly addressing the principal research question. Only two direct studies were identified, and both involved male school-aged populations. This substantially limits generalisability. Second, the primary evidence was predominantly correlational, preventing causal inference. Third, the studies differed in how lower-limb explosive power and long-jump performance were operationalised. This heterogeneity prevented meaningful quantitative pooling. Fourth, biological maturation was not consistently incorporated into the direct association studies. Consequently, residual developmental confounding cannot be excluded. Fifth, measurement overlap was present in part of the evidence base and limits interpretation of apparently strong relationships. Sixth, the review included secondary contextual evidence to explain maturation, training, and measurement issues, but these sources were not treated as independent primary evidence. This improves conceptual clarity but means that conclusions concerning the direct association remain dependent on a relatively small empirical evidence base. Finally, publication, language, and full-text accessibility restrictions may have reduced the comprehensiveness of the evidence base. Therefore, the findings should be interpreted as a synthesis of the eligible accessible literature rather than an exhaustive representation of all potentially existing evidence.

Future Research

Future research should move beyond simple cross-sectional correlations and adopt designs capable of separating developmental, mechanical, and training-related explanations of the power–long-jump relationship. First, larger multicentre studies should recruit both male and female participants across multiple developmental stages. Samples should include pre-pubertal, early-pubertal, and post-pubertal youth where feasible. Second, biological maturation should be measured directly or through validated maturity indicators and incorporated into statistical models. Longitudinal designs would be particularly valuable for distinguishing changes associated with maturation from changes attributable to training. Third, future studies should use independent measures of explosive power rather than relying exclusively on standing long jump. This would reduce measurement overlap and provide a clearer estimate of the contribution of power to long-jump performance. Fourth, studies should investigate whether the association differs according to sex, maturation status, sport, training status, and anthropometric characteristics. These analyses should be prespecified and statistically powered for interaction testing rather than inferred from subgroup differences alone. Fifth, researchers should report sufficiently detailed statistical information to facilitate future meta-analysis, including correlation coefficients or other appropriate effect estimates, confidence intervals, sample sizes, and clearly defined covariates. Sixth, future work should investigate the mechanistic pathway linking explosive power to long-jump performance. Rather than treating power as a single predictor, research could examine how force production, rate of force development, take-off velocity, approach speed, impulse, and technical execution interact to determine performance. Finally, future systematic reviews would benefit from a larger and more homogeneous evidence base that permits quantitative synthesis. If sufficient comparable studies become available, a future meta-analysis could estimate the relationship between independently measured lower-limb explosive power and long-jump performance while conducting prespecified subgroup or meta-regression analyses for maturation, sex, age, and measurement method. Overall, the priority for future research is not simply to determine whether explosive power is related to long-jump performance, but to determine how much of that relationship is independent of biological maturation, anthropometry, training exposure, and measurement overlap. This distinction represents the most important unresolved question emerging from the current evidence base.

CONCLUSION

This systematic review indicates that lower-limb explosive power is positively associated with long-jump performance in youth, based on the limited number of primary studies directly addressing the review question. However, the available evidence is insufficient to determine the magnitude of an independent power–performance relationship because the direct evidence is limited, predominantly correlational, and derived mainly from male school-aged populations. The review further demonstrates that biological maturation and measurement characteristics are central to interpreting this relationship. Maturation may influence both lower-limb explosive power and long-jump performance, while the use of standing long jump as both a proxy for explosive power and a performance outcome introduces potential construct and measurement overlap. Accordingly, strong observed associations should not automatically be interpreted as evidence of an independent physiological effect of explosive power. The principal scholarly contribution of this review is the integration of association, developmental, and measurement perspectives into a single framework for interpreting youth power–performance relationships. This framework highlights the importance of distinguishing direct evidence from indirect evidence and of separating genuine performance relationships from associations potentially influenced by maturation, anthropometry, training status, and measurement overlap. Practically, the findings support the inclusion of lower-limb explosive-power assessment and development within youth physical-education and sport-performance programmes, but they indicate that long-jump performance should not be evaluated on the basis of explosive power alone. Assessment and interpretation should consider developmental status, body dimensions, technical performance, and the characteristics of the measurement instrument. Overall, the evidence supports a positive relationship but not a definitive independent effect of lower-limb explosive power on youth long-jump performance. Further well-designed longitudinal and multicentre studies using independent measures of explosive power, standardised long-jump outcomes, and explicit adjustment for biological maturation are required to resolve the remaining uncertainty.

DECLARATIONS

Ethical Approval

This study was a systematic review of previously published literature and did not involve the collection of new data from human participants or animals. Therefore, ethical approval was not required for this study in accordance with the applicable institutional and ethical requirements of the authors' institution, Department of Physical Education, Universitas Pahlawan, Indonesia. Not applicable. This study involved the synthesis and analysis of previously published research and did not involve direct recruitment, intervention, or interaction with human participants.

Consent for Publication

Not applicable. This systematic review does not contain identifiable individual participant information, personal data, or identifiable images requiring consent for publication.

Author Contributions - CRediT

Rendy Abrasyi: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Visualization, Writing – original draft, Writing – review and editing, Project administration, and Supervision.

Elfera Rizki: Methodology, Investigation, Data curation, Formal analysis, Writing – review and editing, and Project administration.

Both authors contributed to the interpretation of the findings, critically reviewed the manuscript, approved the final version, and agreed to be accountable for all aspects of the work.

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Conflict of Interest

The authors declare that they have no financial or non-financial conflicts of interest that could have influenced the design, conduct, analysis, interpretation, or reporting of this systematic review.

Data Availability

The data underlying this systematic review consist of information extracted from publicly available published literature. The study-level data extraction dataset, eligibility and screening records, full-text exclusion decisions, risk-of-bias assessments, and search strategies are available from the corresponding author upon reasonable request.

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