

Analysis of leg muscle power in Madiun City powerlifting athletes in 2026

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ARTICLE INFO	ABSTRACT
Article history: Received: 14 August 2026 Revised: 20 September 2026 Accepted: 07 October 2026	This study described vertical-jump performance in the ten-athlete Madiun City powerlifting contingent assessed in July 2026. A descriptive quantitative survey used total sampling. Each athlete completed three wall-based Sargent jump attempts, and the highest reported jump-and-reach difference was retained. Individual body masses and jump records were checked during revision. Best jump height averaged 51.20 cm (sample SD 18.12; median 59.50; range 7–61). A supplementary height-based energy estimate was calculated as $E = mgh$ using body mass, $g = 9.8 \text{ m/s}^2$, and jump height converted to meters. Mean estimated energy was 379.40 J (sample SD 152.39; median 443.21; range 54.88–484.22). Joules represent energy rather than mechanical power, and wall-reach displacement is only a proxy for center-of-mass rise. The original flight-time-based calculation was not retained as a validated power measurement. The 7-cm best score was preserved as supplied and flagged for verification; an illustrative sensitivity analysis omitting that record raised mean jump height to 56.11 cm. The study documents variation within this contingent but does not establish normative categories, physiological causes, or relationships with lifting performance. Standardized retesting and, where mechanical power is the target, validated force–velocity measurement are needed before making training decisions.
Keywords: Powerlifting Vertical jump Sargent jump test Lower-limb performance Mechanical energy	

I. Introduction

Powerlifting performance centers on maximal-load lifting, whereas a vertical jump assesses a different movement task. Jump tests can provide supplementary information about lower-limb performance, but jumping ability should not be treated as interchangeable with squat or deadlift strength. Research involving powerlifters shows that the association between deadlift one-repetition maximum and jumping performance depends on sport background [1].

Recent work also identifies variation in strength–jump relationships across participant characteristics and sample sizes [2]. Such evidence limits claims that a single jump score can diagnose the determinants of lifting success. The present study collected no competition totals, squat or deadlift results, training-history measures, or repeated longitudinal assessments. Its scope is a descriptive profile of one local contingent.

Measurement terminology is central to interpreting that profile. Contemporary countermovement-jump research distinguishes performance outcomes, such as height, from kinetic variables, such as force and power [3]. In the International System of Units, energy is expressed in Joules and power in Watts [4]. A calculation based only on body mass, gravitational acceleration, and height therefore cannot be labeled directly measured muscle power.

The local contribution is an auditable description of the three-trial jump records for Madiun City powerlifting athletes assessed in 2026, with one clearly defined supplementary energy calculation. It is not a claim that powerlifting jump profiles have never been studied. The objective was to summarize best jump height, describe its distribution and extreme observations, and calculate a transparent height-based energy estimate. No causal or treatment-effect hypothesis was tested.

The original title is retained. Within the manuscript, its leg muscle power terminology denotes the intended performance domain rather than a directly measured mechanical-power variable. The primary recorded outcome is jump-and-reach height; the derived Joule quantity is explicitly labeled estimated energy. This distinction governs the interpretation of all tables and conclusions.

II. Related Work

Schiemann et al. [1] evaluated deadlift strength and jumping across several sports, including powerlifting, and found sport-dependent relationships. Keiner et al. [2] examined a much larger multisport dataset and considered how sample size and participant characteristics affect strength–jump associations. These studies support treating jumping as a task-specific assessment. They do not validate an energy-to-power conversion or supply normative categories for ten Madiun athletes.

Anicic et al. [3] assessed reliability and the information provided by multiple countermovement-jump variables. De Salles et al. [5] evaluated validity and reproducibility of the Sargent jump in adolescent soccer players, including best-of-three attempts. That population differs from powerlifting athletes. A recent review of force-plate monitoring documents inconsistency in metric definitions and calculations [6], reinforcing the need to specify precisely what a local measurement represents.

The present study consequently retains the inexpensive field-test outcome without claiming the kinetic information available from a force plate. Published validity in another cohort does not establish reliability of the assessors, equipment, or procedure used here. The data support a local description and identification of records needing verification, rather than a validated classification of muscle-power capacity.

III. Method

A. Design, setting, and participants

This was a descriptive quantitative survey of the Madiun City powerlifting contingent, conducted at the Madiun City Sports Hall (GOR) in July 2026. The reported population consisted of ten athletes, all included through total sampling. There was no intervention, comparison group, or longitudinal follow-up. The study is interpreted as a profile of this defined contingent rather than a representative estimate for all powerlifters.

The supplied dataset includes athlete identifiers, body mass, and three jump scores. Ages, sex, weight classes, lifting experience, current training exposure, injury status, inclusion/exclusion rules,

recruitment flow, and missing-attempt procedures were not reported. Body mass ranged from 47 to 83 kg. These omissions prevent assessment of demographic comparability or adjustment for training-related factors.

The source described preparation of a research-permission letter and coordination with the coach, and acknowledged local organizational support. It did not document an ethics approval or exemption, informed consent, or confidentiality procedures. If any participants were minors, age-appropriate guardian consent and participant assent require confirmation. This revision does not invent an approval identifier or consent process.

B. Jump measurement

Athletes wore sportswear and completed a reported 10–15-minute warm-up. Standing reach was recorded before jumping; chalked fingertips marked the maximum reach on a wall-mounted measuring board. The athlete jumped from both feet with a countermovement. The recorded outcome was the difference between standing and jumping reach, reported in centimeters. Three attempts were recorded, and the maximum was retained. The dataset contains no missing attempt values.

The board model, measurement resolution and calibration, body-mass scale, standing-reach values, counter-movement depth, arm-swing instructions, footwear, surface, familiarization, interattempt recovery, invalid-attempt criteria, and assessor identity were not supplied. These factors require standardization before repeat testing. The wall-reaching action differs from a force-plate protocol with defined movement phases.

De Salles et al. [5] provide a published Sargent protocol and measurement-property evidence in adolescent soccer players. That protocol used a specified minimum rest between attempts, but no rest interval is imported as fact for the present study. Within-session variation across three attempts is not a test–retest reliability assessment. Any future reliability analysis should specify the model and uncertainty of its estimate [7].

C. Derived quantity and unit correction

The primary measured variable was best jump-and-reach height. For a supplementary arithmetic estimate, gravitational potential energy was calculated as $E = m \times g \times h$, where m is reported body mass in kilograms, $g = 9.8 \text{ m/s}^2$ as stated in the source, and h is the best recorded jump height in meters (centimeters/100). The resulting unit is $\text{kg} \cdot \text{m}^2/\text{s}^2$, equivalent to Joules [4]. For example, DK: $E = 69 \times 9.8 \times 0.61 = 412.482 \text{ J}$, reported as 412.48 J.

This estimate assumes the measured jump-and-reach difference approximates vertical center-of-mass rise. Wall-reach height is not a direct center-of-mass displacement measurement; changes in arm, trunk, and reaching configuration can affect it. The estimate is therefore a height-based energy

proxy rather than a measurement of muscle work, metabolic expenditure, or total mechanical energy generated during push-off. It adds body-mass weighting to the height result.

The original table included hang times of 0.54–0.71 s but no timing instrument or acquisition protocol. Most of its purported Joule values were consistent with dividing mgh by those times, which gives a Watt-like unit rather than energy. Flight time is not the time over which propulsive work is performed, so that division does not establish mean or peak muscle power. The supplied 7-cm wall score and 0.71-s hang time also require reconciliation. No hang-time-derived power outcome is reported here.

Average mechanical power requires a clearly defined work interval, while instantaneous power may be evaluated from force and velocity during a specified movement phase. Modern jump studies distinguish these quantities and their calculation choices [3], [6]. No force–time, velocity–time, or propulsive-duration records were available for a valid direct power analysis in this dataset.

D. Descriptive analysis and data checks

The source named SPSS version 24 for descriptive analysis. During revision, all ten athlete records were independently checked and summaries recalculated. Each best score was confirmed against the maximum of the three recorded attempts. Energy was calculated from individual body mass and best height before summarization. Unrounded estimates were used for calculations, with final energies displayed to two decimals.

Means, sample SDs and variances use all ten cases, with the $n - 1$ denominator for dispersion. Medians and quartiles are provided because of the extreme low scores. Quartiles use linear interpolation at the 25th and 75th percentiles; no significance test or distributional normality assumption is required for these descriptive results. No low, medium, high, or excellent categories are assigned without validated population-specific cutoffs.

The 7-cm best score for CA was flagged as extreme relative to the other records. Its three supplied attempts were 7, 4, and 5 cm, so the issue cannot be resolved by changing only the best-score cell. The main analysis preserves it. A post hoc sensitivity summary omitting CA is shown only to illustrate its influence; this is not an adjudicated exclusion or proof of measurement error. FN's 30-cm score also lies well below the cluster near 57–61 cm and remains in every analysis.

IV. Results and Discussion

A. Individual records and distribution

Table 1 lists the original measurements. Mean body mass was 74.60 kg (sample SD 10.57), with a range of 47–83 kg. The within-athlete difference between the highest and lowest attempts ranged from 3 to 9 cm. Those differences describe this testing session and do not establish stability across days or quantify assessor error.

Table 1. Body mass and three jump trials

ID	Mass ¹	T1 ²	T2 ²	T3 ²	Best ²
DK	69	58	61	57	61
IB	77	53	56	60	60
CA	80	7	4	5	7
FN	47	30	24	25	30
AS	74	52	48	57	57
SK	83	51	57	55	57
AP	81	56	59	61	61
DS	78	56	58	60	60
RM	75	55	57	59	59
WS	82	60	58	56	60

kg; 2 cm. Best is the maximum of the three supplied attempts. Jump height ranged from 7 to 61 cm, with mean 51.20 cm, sample SD 18.12 cm, and variance 328.40 cm². DK and AP had the highest best heights (61 cm); CA had the smallest (7 cm). Median height was 59.50 cm and the interquartile range was 57.00–60.00 cm. The mean lies below this central cluster because of the two smaller scores.

Table 2 summarizes the primary jump measure and supplementary energy proxy. Figure 1 displays the three attempts for each athlete, making both the extreme values and trial differences visible without assigning performance categories.

Table 2. Descriptive results for all ten athletes

Statistic	Best height (cm)	Energy proxy (J)
N	10	10
Mean	51.20	379.40

Statistic	Best height (cm)	Energy proxy (J)
Sample SD	18.12	152.39
Sample variance ¹	328.40	23221.61
Median	59.50	443.21
25th percentile	57.00	412.70
75th percentile	60.00	462.39
Minimum	7.00	54.88
Maximum	61.00	484.22

Variance units are cm^2 and J^2 , respectively. Energy is calculated from individual records, not from the product of group mean mass and group mean height.

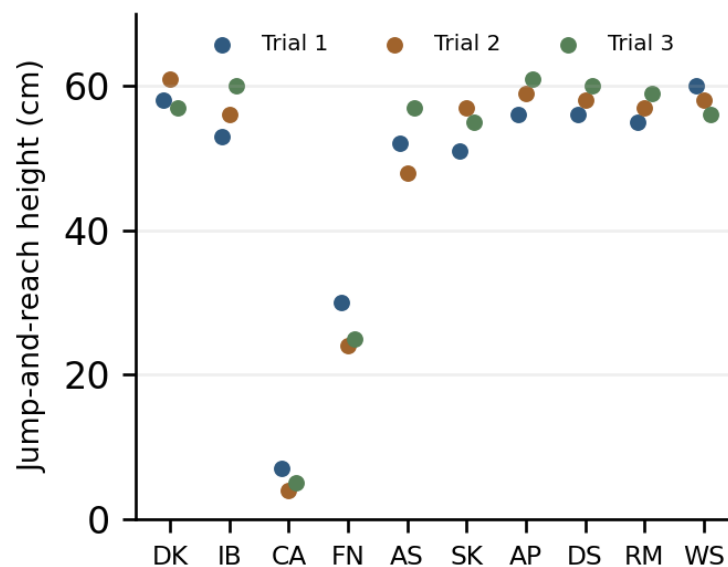


Fig. 1. Three supplied jump attempts for each athlete.

B. Corrected energy estimate and sensitivity

Table 3 provides a single reproducible energy estimate per athlete. The corrected mean is 379.40 J, replacing the original inconsistent means near 589–591 J. AP has the highest proxy value, 484.22

J, while CA has the lowest, 54.88 J. This is a ranking of a mass-weighted height estimate, not measured mechanical power.

Table 3. Corrected $E = mgh$ estimates

ID	Mass (kg)	Best (cm)	E (J)
DK	69	61	412.48
IB	77	60	452.76
CA	80	7	54.88
FN	47	30	138.18
AS	74	57	413.36
SK	83	57	463.64
AP	81	61	484.22
DS	78	60	458.64
RM	75	59	433.65
WS	82	60	482.16

The distinction matters for interpreting rankings. DK and AP both jumped 61 cm, but AP's larger body mass gives the greater energy estimate. WS jumped 60 cm and had a higher energy proxy than lighter athletes with similar heights. Thus, the derived variable combines measured height with body mass by construction; it cannot be interpreted as superior neuromuscular coordination or powerlifting ability.

For the post hoc sensitivity analysis omitting CA only, the remaining nine athletes had mean jump height 56.11 cm (sample SD 9.91; median 60.00; range 30–61) and mean energy proxy 415.45 J (sample SD 107.23; range 138.18–484.22). The main ten-athlete result remains the reported study result. Verification requires original measurement sheets, athlete condition, and standardized retesting; the descriptive influence of a case is not grounds to delete it.

C. Interpretation, limitations, and implications

The data show variation in jump-and-reach performance within this contingent, with eight best scores from 57 to 61 cm and two smaller scores of 30 and 7 cm. The study does not establish that

physiological capacity is uneven in a broader powerlifting population. Body mass enters the energy estimate algebraically, while muscle-fiber composition, neural recruitment, training status, and fatigue were not measured. These cannot be asserted as causes of individual differences.

Powerlifting-specific research indicates that strength–jump associations depend on sport and participant characteristics [1], [2]. The present dataset contains no lifting outcomes, so it cannot test whether a better jump corresponds to greater squat, deadlift, or total performance. No athletes are labeled excellent or deficient on the basis of their position within this small sample.

The key methodological limitation is the difference between a field-test score and mechanical power. A Sargent test can be useful under a defined protocol [5], but modern kinetic assessment separates performance, force, and power measures [3], [6]. The height-based energy estimate remains dependent on an unverified approximation to center-of-mass rise. Missing timing and force–velocity records prevent a defensible direct power estimate.

Other limitations include ten athletes from one contingent, unavailable participant characteristics, incomplete measurement standardization, no reported local reliability, a best-of-three score susceptible to technique and familiarization, and one extreme record requiring verification. Total sampling covers the stated cohort; it does not solve generalizability or measurement validity. A one-session descriptive design cannot establish training effectiveness or changes over time.

The immediate practical use is to organize a baseline testing record and identify scores that need confirmation before individual training decisions. The data do not support prescribing plyometrics, overload, or explosive squats to a particular athlete, because no intervention was tested and lifting demands and injury status were unavailable. Future assessment should standardize the field protocol, record participant and training context, quantify reliability [7], and measure lifting performance alongside a validated kinetic jump protocol when mechanical power is the research target.

V. Conclusion

The ten-athlete Madiun City contingent had a mean best jump-and-reach height of 51.20 cm, with a median of 59.50 cm and range of 7–61 cm. The supplementary $E = mgh$ estimate averaged 379.40 J and represents a height-based energy proxy, not measured muscle power. The extreme low record remains included pending verification. These findings provide a descriptive local baseline, with interpretation limited by the small contingent, missing participant characteristics, and incomplete field-test validation. Standardized retesting and validated force–velocity measurement are needed to evaluate actual mechanical power and its relation to lifting performance.

Acknowledgment

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