Vol. 11, No. 2, 2026, pp. 217-227
DOI: https://doi.org/10.29210/027135jpgi0005

Contents lists available at Journal IICET

JPGI (Jurnal Penelitian Guru Indonesia)
ISSN: 2541-3163(Print) ISSN: 2541-3317 (Electronic)

Journal homepage: https://jurnal.iicet.org/index.php/jpgi

Physical fitness profiling of community-level badminton athletes: a cross-sectional assessment of five performance components and implications for talent development

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Article Info

Article history:

Received Jul 09th, 2026
Revised Jul 10th, 2026
Accepted Jul 11th, 2026

Keywords:
Badminton,
Physical fitness profile,
Muscular endurance,
Flexibility,
Cardiorespiratory endurance

ABSTRACT

Systematic physical-condition profiling underpins evidence-based coaching, yet community-level badminton programmes in Indonesia rarely document the fitness status of their athletes, leaving training prescription to intuition rather than objective baselines. This study aimed to establish the physical fitness profile of registered badminton athletes at the PB Infinity club (Batam, Indonesia) across five performance components and to translate the resulting profile into targeted developmental priorities. A descriptive, cross-sectional design with total sampling was used to assess 14 club athletes. Five field tests were administered: the one-minute push-up test (arm muscular endurance), the 30-m sprint (speed), the sit-and-reach test (flexibility), the vertical jump (leg power), and the 15-minute Balke run (cardiorespiratory endurance). Raw scores were converted to a five-level ordinal scale and expressed as frequencies, percentages, and mean converted scores; a composite fitness index was derived and classified. The composite profile placed the whole cohort (100%) in the poor category (mean index = 4.4). Flexibility was the weakest component, with every athlete rated very poor, followed by arm muscular endurance, leg power, and speed, which were predominantly poor to moderate. Cardiorespiratory endurance was the single strength, with the majority rated good to excellent. The cohort exhibited a markedly uneven profile: a well-developed aerobic base coexisting with deficient flexibility, upper-limb endurance, and lower-limb power, indicating that conditioning has emphasised general endurance at the expense of sport-specific neuromuscular qualities. Coaches should prioritise mobility work, explosive lower-limb training, and upper-limb endurance while maintaining aerobic capacity, and should embed periodic field testing as a monitoring routine.

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Introduction

Badminton is among the most physiologically demanding of the racquet sports, characterised by intermittent high-intensity rallies interspersed with brief recovery intervals, frequent multidirectional lunging, rapid changes of direction, and repeated explosive upper- and lower-limb actions sustained across matches that may exceed an hour (Phomsoupha & Laffaye, 2015). The intermittent structure of play imposes simultaneous demands on the aerobic and anaerobic energy systems, on neuromuscular power, and on joint mobility, so that no single fitness quality is sufficient in isolation. Performance instead emerges from the coordinated expression of speed, muscular endurance, flexibility, explosive power, and cardiorespiratory capacity, each of which supports a distinct facet of match play (Kui et al., 2023; Deng et al., 2024).

Contemporary evidence has increasingly framed physical condition not merely as a prerequisite for technical execution but as a determinant of it. The capacity to reach the shuttle early, to decelerate and re-accelerate through a lunge, and to maintain stroke quality as fatigue accumulates all depend on well-developed neuromuscular and metabolic foundations (Lam et al., 2020; Alvarez-Dacal et al., 2025). Longitudinal and interventional research further shows that these qualities are trainable and specific: plyometric and neuromuscular programmes reliably enhance jump power and change-of-direction ability in badminton and comparable court sports (Ramírez-Campillo et al., 2022; Cao et al., 2024; Zhao et al., 2021), while structured aerobic conditioning raises the maximal oxygen uptake that underwrites between-rally recovery (Srivastava et al., 2024; Jurov & Demšar, 2024). The implication is that a player's profile is a modifiable target, and that profiling is the logical first step in directing that modification.

A recurring theme in the profiling literature is heterogeneity within athletes. Rather than being uniformly strong or weak, players frequently present a jagged profile in which one or two qualities are well developed and others lag conspicuously behind (Cejudo, 2021; Fernández-Fernández et al., 2023). Flexibility in particular has emerged as a component that is often neglected in racquet-sport conditioning yet is consequential for both movement economy and injury risk, since restricted range of motion at the hip, trunk, and shoulder constrains lunge depth and predisposes to musculotendinous strain (Behm et al., 2016; Parpa & Michaelides, 2025). Coordination, agility, and reactive qualities likewise vary substantially with age and training history (Jaworski et al., 2017). This within-athlete variability is precisely what makes component-wise profiling informative: a single composite score can conceal the specific weaknesses that most limit a player.

In the Indonesian context, badminton occupies a position of exceptional cultural and competitive importance, and a substantial body of local research has documented the physical condition of club and regional athletes (Purnomo, 2021; Zhannisa et al., 2018; Ardi & Rosmaneli, 2020; Munandar, 2021). These studies consistently report that many community-level athletes fall short of the fitness standards associated with competitive success, and that conditioning is frequently subordinated to technical and tactical practice (Edmizal et al., 2019; Puja et al., 2021). Yet most of this work is confined to single components or to one sex, and few reports integrate the full spectrum of qualities relevant to the sport within a single cohort. As a result, the practical question that most concerns coaches, namely which components to prioritise for a given group of athletes, often remains unanswered.

This gap is more than academic. At the club level, training decisions are commonly made without any objective baseline, so that programmes are neither individualised nor demonstrably matched to athletes' actual deficits (Himawan & Permadi, 2019; Permadi, 2017). The absence of documented profiles also precludes monitoring: without a baseline, neither progress nor regression can be detected, and the effect of a training block cannot be evaluated. The methodological gap is comparable. Much community-level profiling relies on a narrow instrument set and reports results descriptively without situating them against the component-specific demands of the sport, limiting the interpretive value of the findings (Febrio & Firdaus, 2019; Dwiapta & Yaslindo, 2020).

The present study addresses these gaps by profiling the complete registered roster of a single community badminton club across five field-assessed components, thereby producing an integrated, athlete-level snapshot of physical condition in a setting that has never previously been measured. Its novelty lies less in the individual tests, which are well established, than in the integration: by assessing the whole cohort on the same battery and analysing the profile component by component, the study exposes the internal architecture of the group's fitness, including the dissociation between developed and underdeveloped qualities that a composite score would obscure.

Accordingly, the objective of this study was to determine the physical fitness profile of badminton athletes at the PB Infinity club across arm muscular endurance, speed, flexibility, leg power, and cardiorespiratory endurance, and to translate that profile into prioritised, evidence-based recommendations for coaches, athletes, and the club. We hypothesised, on the basis of the local literature, that the cohort would display an uneven profile in which sport-specific neuromuscular qualities lag behind general endurance.

Method

Research design

A descriptive study with a quantitative approach was adopted. Descriptive quantitative designs are appropriate when the aim is to characterise the state of one or more variables as they exist, without manipulating conditions or testing causal relationships. Because the purpose here was to portray the physical condition of a defined group of athletes at a single point in time, the design was cross-sectional: all measurements were obtained within one assessment period and no follow-up was undertaken.

Participants, setting, and sampling

Participants were the full registered membership of the PB Infinity badminton club in Batam City, Riau Islands Province, Indonesia. Total (census) sampling was used, whereby every member of the population is included as a participant; this technique is suited to small, well-defined populations because it removes sampling error and yields a complete portrait of the group. The resulting sample comprised 14 athletes. Testing was conducted at the Temenggung Abdul Jamal badminton hall (Jl. Ahmad Yani, Muka Kuning, Batam) during April 2026, on the athletes' regular indoor training courts.

Inclusion and exclusion criteria

Athletes were eligible if they were officially registered and active members of the club and were present for the scheduled assessment. Athletes were excluded from a given test if they reported an acute injury or illness that precluded safe maximal effort on that specific measure. No athlete withdrew, and complete data were obtained for all 14 participants across the battery.

Ethical considerations

The study was conducted with the permission of the club's founder and head coach, who authorised access to the athletes and the venue. Participation was voluntary, the testing procedures and their purpose were explained beforehand, and the data were used solely for research purposes and reported in aggregate so that no individual athlete is identifiable. Standardised warm-up and familiarisation preceded maximal-effort tests to protect participant safety.

Instruments and measurement procedures

Physical condition was operationalised through a five-test field battery drawn from an established Indonesian sport-testing manual (Fenanlampir & Faruq, 2015). Field tests were selected in preference to laboratory measures because they are ecologically valid, require only equipment available at the club, and can be administered to a whole squad within a single session, which makes them sustainable for routine monitoring at the community level. Each test targets a component with a clear role in badminton performance, and each was chosen for that specific correspondence.

Physical fitness tests

Arm muscular endurance one-minute push-up test. Athletes performed standard push-ups on a flat surface for 60 s, lowering the chest to the mat and extending the arms fully on each repetition; the number of correctly executed repetitions was recorded. Repetitions were discounted when the chest failed to reach the surface, the arms did not fully extend, or trunk alignment was lost. This test indexes the local muscular endurance of the upper limb, which sustains stroke quality over the course of a match.

Speed 30-m sprint. From a standing start, athletes sprinted 30 m at maximal velocity; time was recorded to the nearest 0.1 s (and to 0.01 s where possible). The 30-m distance captures acceleration and short-distance linear speed, which underpin the rapid court coverage required to reach the shuttle. Flexibility sit-and-reach test. Athletes sat with legs extended and reached forward along a measuring scale; the furthest reach (in inches) was recorded. The test estimates the extensibility of the posterior chain and lower-back mobility, which contribute to lunge depth and movement economy. Leg power vertical jump. Standing reach height was marked, after which athletes performed three maximal countermovement jumps against a wall-mounted scale; leg power was quantified as the difference between jump and reach heights (in inches), the best trial being retained. Vertical jump is a criterion field measure of lower-limb explosive power, the quality behind jumping smashes and rapid directional changes. Cardiorespiratory endurance 15 minutes Balke run. Athletes ran continuously for 15 min and the distance covered was recorded; estimated maximal oxygen uptake (VO_2max) was calculated from the standard Balke equation, $VO_2max = ((\text{distance in m} / 15) - 133) \times 0.172 + 33.3$. The test provides a practical estimate of aerobic capacity, which governs recovery between rallies and resistance to fatigue across sets.

Validity and reliability

The five tests belong to a standardised battery whose protocols, norms, and scoring conventions are documented in the reference manual (Fenanlampir & Faruq, 2015) and have been applied extensively in

Indonesian sport-science research (Zhannisa et al., 2018; Purnomo, 2021). Standardisation of administration, consistent equipment, uniform verbal instruction, and prior familiarisation were used to safeguard measurement consistency across athletes. The field tests selected are widely regarded as valid indicators of their respective components and are reliable when administered under controlled conditions (Cejudo, 2021; Srivastava et al., 2024).

Data collection and statistical analysis

Data were collected through direct observation, field testing, and measurement. Raw performance on each test was interpreted against the criterion norms for the relevant component and converted to a five-level ordinal scale: very poor = 2, poor = 4, moderate = 6, good = 8, and excellent = 10. For each component, the distribution of athletes across categories was expressed as frequencies and percentages ($P = f / N \times 100$), and a mean converted score was computed. A composite physical-condition index was then obtained for each athlete as the mean of the five converted component scores and classified as very poor (2.0–3.9), poor (4.0–5.9), moderate (6.0–7.9), good (8.0–9.5), or excellent (9.6–10). All analyses were descriptive; the converted-score means, standard deviations, minima, and maxima summarise the standardised scores rather than the raw test units.

Results and Discussions

The results are presented in four stages: the characteristics of the cohort and the assessment framework, the descriptive statistics of the converted component scores, the classification of athletes within each component, and the composite profile of the group. Numerical detail is confined to the tables and figures; the surrounding text highlights the patterns that carry interpretive weight rather than restating individual values.

Table 1. Cohort and assessment framework for the physical-condition profile

Component	Field test	Unit assessed	Athlete(n)
Arm muscular endurance	One-minute push-up	Repetitions	14
Speed	30-m sprint	Seconds	14
Flexibility	Sit-and-reach	Inches	14
Leg power	Vertical jump	Inches	14
Cardiorespiratory endurance	15-min Balke run	VO_2max (ml·kg^{-1}·min^{-1})	14

Note N = 14 registered athletes assessed by total sampling at a single time point. All athletes completed every test.

Table 1 summarises the assessment framework. The complete registered roster of 14 athletes was evaluated on all five components, so that the profile that follows reflects the entire population of the club rather than a subsample.

Table 2. Descriptive statistics of the converted component scores (2–10 scale)

Component	M	SD	Min	Max	Category (mean)
Arm muscular endurance	3.29	0.99	2	4	Very poor
Speed	4.14	1.66	2	6	Poor
Flexibility	2.00	0.00	2	2	Very poor
Leg power	4.29	0.73	4	6	Poor
Cardiorespiratory endurance	8.43	1.16	6	10	Good

Note M = mean; SD = standard deviation. Statistics summarise the standardised converted scores (very poor = 2 to excellent = 10), not the raw test units.

The descriptive statistics in Table 2 reveal a steep gradient across components. Cardiorespiratory endurance stands apart as the only quality whose mean reaches the good band, whereas flexibility sits at the floor of the scale with no variation whatsoever, every athlete recording the lowest possible converted score. Speed and leg power occupy the poor band, and arm muscular endurance falls just below it. The near-zero dispersion in flexibility, contrasted with the wider spread in speed, indicates that the flexibility deficit is uniform across the squad rather than driven by a few individuals.

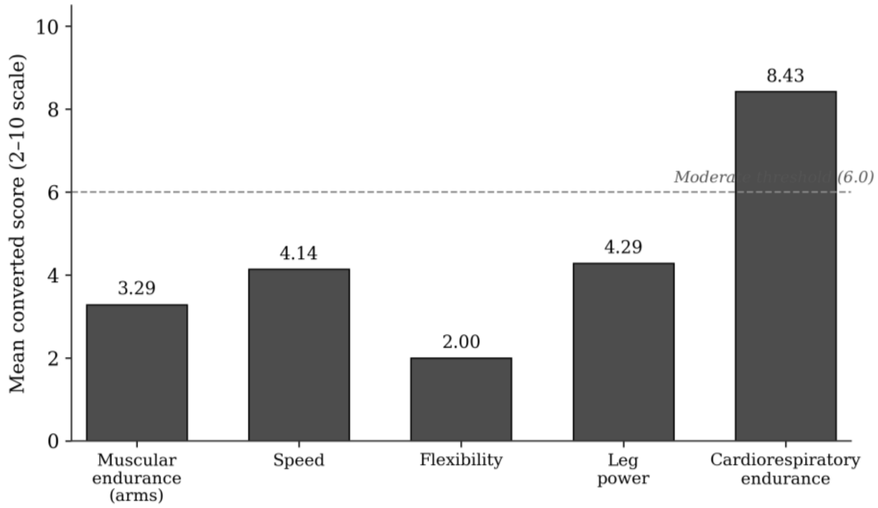

Figure 1. Mean converted scores across the five physical-condition components

Note bars show the mean converted score (2–10 scale) for each component; the dashed line marks the moderate threshold (6.0).

Figure 1 displays these means graphically and makes the dissociation immediate: a single component clears the moderate threshold while the remaining four fall well below it. Considered together with the classification data below, this pattern defines the group's developmental priorities.

Table 3. Classification of athletes by category for each component: frequency (percentage)

Component	Very poor	Poor	Moderate	Good	Excellent
Arm muscular endurance	5 (35.71)	9 (64.28)	0 (0.00)	0 (0.00)	0 (0.00)
Speed	4 (28.57)	5 (35.71)	5 (35.71)	0 (0.00)	0 (0.00)
Flexibility	14 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Leg power	0 (0.00)	12 (85.71)	2 (14.28)	0 (0.00)	0 (0.00)
Cardiorespiratory endurance	0 (0.00)	0 (0.00)	1 (7.14)	9 (64.28)	4 (28.57)

Note values are frequencies with percentages in parentheses; N = 14 per component. Percentages are rounded and may not total 100 exactly.

The classification in Table 3 clarifies where each component sits. Arm muscular endurance is confined entirely to the two lowest bands, and flexibility is absolute in its weakness, capturing the whole cohort in the very poor category. Speed is more dispersed, straddling the very poor, poor, and moderate bands in roughly equal measure, which suggests a group in transition rather than a uniform deficit. Leg power is concentrated in the poor band with a small moderate minority. Cardiorespiratory endurance inverts the pattern seen elsewhere, with the great majority rated good and a substantial minority excellent.

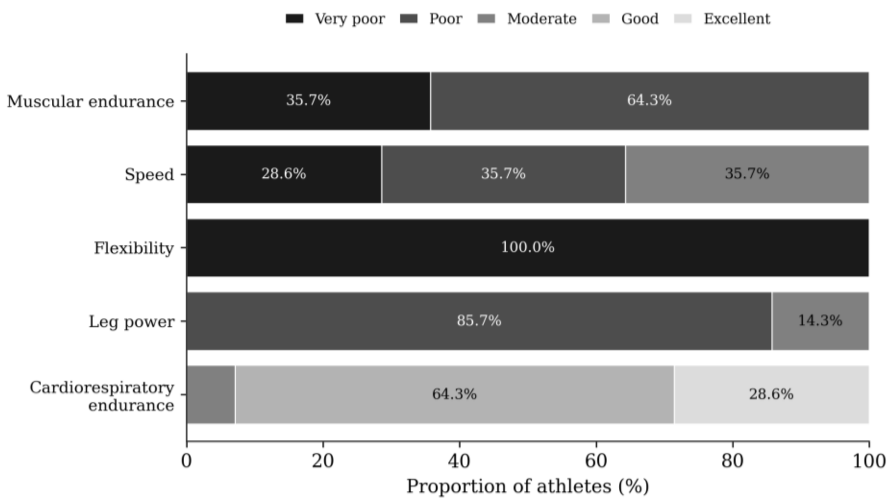

Figure 2. Percentage distribution of athletes across categories, by component

Note horizontal bars show the proportion of athletes in each category per component.

Figure 2 renders the same classification as a distribution, in which the leftward (weaker) concentration of flexibility, arm muscular endurance, and leg power is visually opposed to the rightward (stronger) concentration of cardiorespiratory endurance. Speed alone shows an intermediate, more balanced spread.

Table 4. Overall physical-condition profile of the cohort (composite index)

Score range	Classification	Frequency	Percentage
2.0–3.9	Very poor	0	0.00
4.0–5.9	Poor	14	100.00
6.0–7.9	Moderate	0	0.00
8.0–9.5	Good	0	0.00
9.6–10	Excellent	0	0.00

Note. Composite index = mean of the five converted component scores per athlete. Group mean index = 4.4. The entire cohort classified as poor.

Table 4 presents the composite profile. When the five converted scores are averaged for each athlete, every member of the squad falls within the poor band, and the group mean index is 4.4. Despite the marked variation between components, the composite index masks that structure and returns a single, homogeneous classification. It is the component profile, not the composite, that carries the actionable information.

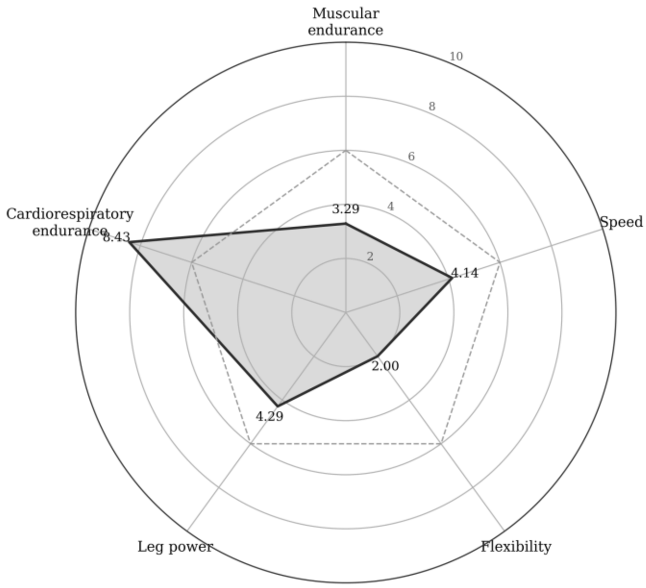

Figure 3. Radar representation of the overall physical-condition profile

Note each axis shows the mean converted score (2–10) for one component; the dashed ring marks the moderate threshold (6.0).

Figure 3 integrates the profile into a single shape, making the group's fitness architecture visible at a glance: a form elongated toward cardiorespiratory endurance and collapsing toward the centre at flexibility, with speed, leg power, and arm muscular endurance forming an intermediate cluster below the moderate ring.

The central finding of this study is not that the cohort scored poorly overall, but that its poverty is unevenly distributed. A well-developed aerobic base coexists with pronounced deficits in flexibility, upper-limb endurance, and lower-limb power. Because badminton performance depends on the coordinated expression of all these qualities, an asymmetric profile of this kind is likely to constrain match play more than the composite index alone would suggest. The following sections interpret each component in turn, situating the findings against recent evidence and drawing out the physiological, biomechanical, and coaching implications.

Arm muscular endurance

Arm muscular endurance was among the weakest components, with every athlete confined to the two lowest bands. In a sport in which stroke production is repeated hundreds of times per match, local endurance of the upper limb is what preserves the velocity and precision of overhead clears and smashes as a rubber wears on.

When this quality is deficient, stroke quality decays late in rallies and late in matches, a decline that is tactical as much as physical because it narrows the shots a fatiguing player can execute reliably.

The physiological basis of this deficit lies in the fatigue resistance of the shoulder-girdle and forearm musculature, which depends on capillary density, oxidative enzyme capacity, and motor-unit recruitment economy. Where training has not developed these adaptations, repeated near-maximal contractions provoke early accumulation of metabolic by-products and a fall in force output. Biomechanically, a fatigued upper limb alters the kinetic chain of the overhead stroke, so that timing at the shoulder, elbow, and wrist degrades and the smash loses the terminal angular velocity that makes it effective (Lam et al., 2020). This corresponds with regional evidence linking upper-limb endurance and power to stroke capability in Indonesian players (Asnaldi, 2019; Nasri et al., 2019).

For training, the implication is that upper-limb conditioning should target endurance rather than maximal strength alone, through moderate-load, high-repetition resistance work and medicine-ball throwing that mimics the overhead pattern. Interventions of this kind have improved skill-related fitness in badminton and comparable populations (Deng et al., 2024). For coaching, the finding argues for integrating stroke-endurance drills into technical practice so that fatigue resistance is trained in the specific pattern of play, and for athletes it underscores that late-rally errors may reflect a conditioning deficit rather than a purely technical fault.

Speed

Speed presented the most balanced distribution of any weak component, spread across the very poor, poor, and moderate bands. Linear acceleration over short distances is the substrate of court coverage: the capacity to close on a drop shot or recover to base after being pushed to a corner depends on rapid acceleration far more than on top speed, given that few badminton actions exceed a handful of metres (Phomsoupha & Laffaye, 2015; Gualtieri et al., 2023).

Physiologically, short-sprint performance is governed by the rate of force development, the proportion and firing frequency of fast-twitch motor units, and intermuscular coordination, all of which are trainable through sprint and plyometric exposure. Biomechanically, acceleration hinges on the ability to produce large horizontal impulses in brief ground contacts, a quality closely related to lower-limb power (Fernández-Fernández et al., 2023). The intermediate and mixed nature of the present speed results, contrasted with the more uniform leg-power deficit, suggests that some athletes already convert available power into acceleration effectively while others do not, pointing to a coordination and technique dimension over and above raw power.

Training should therefore combine short accelerative sprints, resisted starts, and change-of-direction drills that reproduce the stop-start demands of the court. Because speed and power share a neuromuscular basis, programmes that develop explosive strength tend to transfer to acceleration (Ramírez-Campillo et al., 2022; Cao et al., 2024). For coaches, the heterogeneity of the speed data is itself informative, indicating that individualised rather than uniform speed prescriptions are warranted within this squad.

Flexibility

Flexibility was the defining weakness of the cohort: every athlete recorded the lowest possible score, and the component showed no variability at all. Such a uniform floor effect is rarely a coincidence of individual limitation; it typically signals that mobility work has been systematically absent from the training culture. This interpretation aligns with the wider observation that flexibility is the most frequently neglected fitness quality in racquet-sport conditioning (Behm et al., 2016).

The consequences are twofold. Functionally, restricted range of motion at the hip, trunk, and posterior chain limits lunge depth and reach, compromising the movement economy with which a player defends the corners of the court and recovers from a stretched position. Mechanically, the same restriction concentrates load on the musculotendinous structures at the extremes of movement, and reduced extensibility has been associated with elevated injury risk in court and field sports (Cejudo, 2021; Parpa & Michaelides, 2025). A player who cannot lengthen the posterior chain safely is both slower to the shuttle and more exposed to strain when forced beyond a comfortable range. Regional work on trunk and lower-limb flexibility in badminton reaches similar conclusions regarding movement quality and injury exposure (Ahady et al., 2024).

Because flexibility responds readily to training, this deficit is also the most immediately correctable. A structured mobility programme combining regular dynamic stretching within warm-ups and targeted static or proprioceptive stretching during cool-downs can raise range of motion within weeks (Behm et al., 2016). For coaches, the priority is cultural as much as technical: mobility must be scheduled as a non-negotiable element of every session rather than left to individual initiative. For athletes, the uniformity of the deficit means that improvement here offers the single largest and quickest gain available to the group.

Leg power

Leg power clustered in the poor band, with only a small minority reaching the moderate level. Lower-limb explosive power is the engine of the most decisive actions in badminton, the jumping smash, the split-step, and the explosive re-acceleration out of a lunge, and it is tightly coupled to on-court speed and reach. A deficit here therefore propagates: it blunts the smash, slows the first step, and shallows the lunge simultaneously (Kui et al., 2023).

Physiologically, explosive power reflects the capacity to recruit high-threshold motor units rapidly and to exploit the stretch-shortening cycle, whereby elastic energy stored during the countermovement augments the concentric action. Biomechanically, an athlete with limited power generates smaller vertical and horizontal impulses in the brief ground contacts that badminton allows, so that both jump height and acceleration suffer (Moran et al., 2017; Fernández-Fernández et al., 2023). The concentration of the present cohort in the poor band, in the context of adequate aerobic fitness, suggests that conditioning has developed the metabolic base without the neuromuscular one.

The training remedy is well established. Plyometric and integrative neuromuscular programmes reliably improve jump power and change-of-direction ability in badminton and comparable court sports (Ramírez-Campillo et al., 2022; Cao et al., 2024; Zhao et al., 2021), and their effects transfer to sport-specific performance. For coaches, progressive plyometric loading, combined with basic strength work to provide the force platform on which power is built, should feature centrally in the programme; for athletes, gains in leg power are likely to be felt directly in the smash and in court speed. Regional evidence on plyometric and jump training in Indonesian badminton supports the same prescription (Zhannisa et al., 2018).

Cardiorespiratory endurance

Cardiorespiratory endurance was the cohort's clear strength, with the majority rated good and a substantial minority excellent. Aerobic capacity underwrites the between-rally and between-set recovery on which sustained performance depends: a higher maximal oxygen uptake accelerates the replenishment of phosphocreatine and the clearance of metabolic by-products, allowing a player to maintain intensity deep into a match (Srivastava et al., 2024; Jurov & Demšar, 2024).

That this component alone is well developed is revealing. It suggests that the athletes are physically active and that their training has included sufficient continuous or intermittent running to build an aerobic base, even as the more specific neuromuscular qualities have been left underdeveloped. The pattern is consistent with a conditioning approach oriented toward general endurance rather than toward the explosive, mobile qualities that distinguish high-level badminton (Alvarez-Dacal et al., 2025). In physiological terms the cohort has built the metabolic foundation but not the structure that sits on top of it.

The coaching implication is one of maintenance rather than development: the aerobic base should be preserved through periodic higher-intensity interval work so that it does not regress while attention shifts to the deficient components. Crucially, a strong aerobic capacity is an asset for the corrective programme itself, since it allows athletes to tolerate the higher training volumes needed to develop power, mobility, and upper-limb endurance without undue fatigue.

Synthesis against previous studies

Table 5 situates the present profile against a selection of recent studies. The comparison reinforces two themes: that community-level cohorts frequently underperform on sport-specific qualities, and that flexibility and lower-limb power are recurrent weak points amenable to targeted training.

Table 5. Comparison between present findings and previous studies

Author (Year)	Country	Sample	Method	Major findings	Agreement	Implication
Purnomo (2021)	Indonesia	Female club athletes	Descriptive	Mixed readiness several components below target	Agree	Objective baselines needed pre-competition
Zhannisa et al. (2018)	Indonesia	University team	Descriptive	Uneven component profile in club players	Agree	Component-specific conditioning required
Kui et al. (2023)	Malaysia	4 elite juniors	Profile + match analysis	Elite juniors show developed power and speed	Contrast	Gap between community and elite standards
Cejudo (2021)	Spain	Basketball players	Flexibility profiling	Limited ROM linked to injury risk	Agree	Mobility screening should be routine
Fernández-	Spain	Youth	Neuromuscular	Leg power central to	Agree	Prioritise

Author (Year)	Country	Sample	Method	Major findings	Agreement	Implication
Fernández et al. (2023)		tennis	testing	court speed		plyometric development
Deng et al. (2024)	Multi-country	Badminton (meta-analysis)	Systematic review	Structured training improves skill-related fitness	Agree	Deficits are trainable and reversible

Note ROM range of motion. "Agreement" indicates whether the cited study's direction of findings is consistent with the present profile.

Theoretical implications

Theoretically, the findings reinforce a component-specific rather than global conception of physical condition. A composite index classified the entire cohort identically, yet the underlying profile was strongly asymmetric; the composite therefore concealed the very information a coach needs. This argues for treating physical condition as a vector of distinct, differentially trainable qualities, and for reporting and interpreting profiles at the component level (Cejudo, 2021; Fernández-Fernández et al., 2023).

Practical implications and recommendations

Practically, the profile converts directly into an ordered set of priorities: flexibility first, given its uniform floor effect and rapid trainability; leg power and upper-limb endurance next, given their centrality to the smash and to sustained stroke quality; speed thereafter, with individualised prescriptions to match its heterogeneity; and aerobic capacity maintained rather than further developed. Embedding periodic field testing turns this baseline into a monitoring system capable of detecting progress and regression.

For coaches, mobility work should be a fixed element of every session, complemented by progressive plyometric and basic strength training for leg power and moderate-load, high-repetition upper-limb work that mirrors the overhead pattern; aerobic conditioning can shift toward maintenance. For athletes, mobility and explosive-strength work should be treated as complements to technical practice, supported by attention to sleep, nutrition, and recovery from minor injury. For the club, a more varied conditioning provision, adequate equipment, and institutionalised periodic testing would allow athlete development to be guided by data rather than impression.

Study strengths

The principal strengths of the study are its complete coverage of the club's roster through total sampling, which removes sampling error and yields a true population profile, and its integrated, five-component battery, which exposes the internal architecture of the group's fitness rather than a single quality in isolation. The use of ecologically valid field tests also makes the assessment sustainable for routine club use.

Study limitations

Several limitations qualify the findings. The sample was small (N = 14) and drawn from a single club, so generalisation beyond this setting is limited. The cross-sectional design captures a single time point and cannot describe change or the effect of any subsequent training. Potential confounders, including training frequency, sleep, nutrition, recovery from prior injury, and competitive experience, were not controlled, and pre-test physical and psychological state was not standardised, so individual results may have been influenced by day-to-day condition. Finally, the descriptive design precludes any causal or associational inference about the determinants of the observed profile.

Future research directions

Future work should enlarge and diversify the sample across multiple clubs, extend the battery to include agility, coordination, balance, reaction, and accuracy, and adopt longitudinal or intervention designs that track the effect of targeted training on the components identified here as deficient. Examining the determinants of physical condition, such as training load, recovery, and playing experience, would move the field from description toward explanation and yield more actionable guidance for community programmes.

Conclusions

This study established, for the first time, the physical fitness profile of the PB Infinity badminton club and answered its guiding objective: to characterise the cohort across five components and translate that profile into developmental priorities. The profile proved markedly asymmetric. A well-developed aerobic base coexisted with pronounced deficits in flexibility, upper-limb endurance, and lower-limb power, and speed occupied an intermediate, heterogeneous position. The scientific contribution of the work lies in demonstrating, within a complete community cohort, that a uniform composite classification can conceal a strongly structured underlying profile, and that it is this structure that should govern training design. Its practical contribution is a concrete, ordered set of priorities, mobility and explosive qualities first, aerobic capacity maintained, together with the case for embedding routine field testing as a monitoring tool. The novelty of the study is its integrated, whole-roster, component-wise approach in a setting that had never been measured, offering a transferable template for evidence-based conditioning at the community level.

Acknowledgments

The authors thank the founder and head coach of PB Infinity Badminton Club, Batam, for authorising access to the athletes and the training venue, and the athletes for their participation. No external funding was received for this study.

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