



LEVEL OF BASIC SPORT-CLIMBING SKILLS AMONG YOUNG ATHLETES FROM FIVE CLIMBING CLUBS IN INDONESIA

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ABSTRACT

Basic sport-climbing skills are essential for supporting safe, efficient, and technically appropriate movement among young climbers. This study aimed to describe the level of basic sport-climbing skills among young athletes from five selected climbing clubs in Indonesia. A quantitative descriptive design with a survey method was employed. The participants comprised 107 climbers aged 10 to 15 years who were selected through purposive sampling. Data were collected through a practical sport-climbing test using a study-specific structured observation rubric covering equipment inspection, harness fitting and use, correct figure-eight knot tying, belayer safety checks, climbing communication, basic movement techniques, route observation and movement planning, and route completion. Formal psychometric validation and inter-rater reliability coefficients were not available for the present dataset; therefore, the scores are interpreted descriptively within the participating clubs. Performance scores were converted into percentages and analysed using descriptive statistics. The participants achieved an overall mean score of 68%, classified as moderate. Higher achievement was recorded in harness fitting and use (74%), equipment inspection (72%), and basic movement techniques (70%), whereas lower achievement was observed in route observation and movement planning (63%), route completion (64%), and belayer safety checks (65%). The findings provide preliminary information for coaches in the participating clubs and should not be generalized beyond comparable settings. Further studies involving broader samples and validated assessment procedures are needed.

Keywords: *basic sport-climbing skills; skill assessment; sport climbing; young athletes; youth development.*

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INTRODUCTION

Sport climbing has developed rapidly as both a competitive sport and a structured youth-development activity. Children and adolescents increasingly participate through climbing clubs, extracurricular programmes, and athlete-development pathways. In this context, climbing clubs have an important role in introducing fundamental techniques, establishing safe climbing habits, and preparing young athletes for more advanced training. Studies conducted in Indonesia indicate that the quality of climbing development is influenced by coaching competence, training programmes, organisational management, facilities, funding, and athlete-development systems (Abadi, 2016; Nasugian & Suripto, 2021; Putri & Khamidi, 2021).

The increasing participation of young climbers requires training that reflects their developmental characteristics. Interest and motivation can encourage young athletes to participate regularly, but participation alone does not ensure adequate technical competence. Azhari and Susanto (2021) reported strong interest and motivation among students participating in climbing activities. For young climbers, training should therefore develop not only physical capacity but also correct movement patterns, equipment handling, communication, route awareness, and safe climbing procedures.

Basic sport-climbing skills involve several interconnected competencies required to perform climbing activities effectively and safely. These include inspecting equipment, fitting and using a harness correctly, tying appropriate knots, conducting partner safety checks, communicating during climbing, using handholds and footholds effectively, maintaining balance and body position, observing the route, planning movement sequences, and completing a route with

controlled movement. In the present study, these competencies are treated as practical components of basic sport-climbing performance rather than as measures of physiological capacity alone.

Movement quality represents an important component of climbing performance. Climbers must coordinate hand and foot placement, maintain balance, control body position, and adapt their movements to route characteristics. Saul et al. (2019) identified movement skill, postural stability, concentration, strength, endurance, and movement efficiency as relevant determinants of climbing performance. However, physical characteristics and movement performance should be distinguished conceptually. Physical capacities may support climbing performance, but they do not directly demonstrate whether a young climber can apply equipment procedures, execute basic techniques, communicate effectively, or follow safety routines.

Structured observation can provide a practical approach to assessing technical movement. Taylor et al. (2020) developed the Climber's Movement Performance Assessment Tool to evaluate climbing movement using observable indicators related to body control, limb use, movement fluency, and efficiency. Their findings demonstrated that climbing performance can be assessed systematically rather than relying solely on route completion or ascent time. This approach is particularly relevant for youth coaching because successful route completion does not necessarily indicate that movements were technically efficient or that safety procedures were applied correctly.

Route observation and movement planning are also important elements of basic climbing performance. Before beginning an ascent, climbers need to identify potential handholds and footholds, body orientations, resting



positions, difficult sections, and possible movement sequences. **Seifert et al. (2017)** found that route-previewing strategies were associated with climbing fluency and exploratory movement. Poor route planning may increase unnecessary pauses, repeated movements, and inefficient use of available holds. For this reason, route-reading ability should be considered together with movement execution when evaluating the basic skill profile of young climbers.

Safety competence is particularly important among participants aged 10 to 15 years. Equipment inspection, correct harness use, knot execution, belayer safety checks, and climbing communication represent routine procedures that should be established from the early stages of training. This concern is supported by evidence that climbing injuries among adolescents frequently affect the upper extremities, particularly the fingers (**Schöffl et al., 2025**). Although the present study does not assess injury incidence, evaluating basic safety-related procedures can help identify areas in which young climbers may require additional supervision and instruction.

Previous climbing research has frequently focused on physiological and performance determinants such as finger strength, forearm endurance, maximal strength, and climbing-specific endurance (**Berta et al., 2025; Langer et al., 2023; Michailov et al., 2018; Philippe et al., 2012; Stien et al., 2022**). These variables are important for advanced climbing performance, but they do not fully represent the practical skills required during youth training. Moreover, substantial variation exists in climbing tests, assessment procedures, route characteristics, and measurement quality (**Langer et al., 2023**). This variation highlights the need for clearly defined and reproducible approaches when assessing young climbers.

Empirical information describing the basic skill profiles of young climbers across multiple clubs in Indonesia remains limited. Existing Indonesian studies have primarily examined athlete development systems or specific physical training methods, while fewer studies have examined a broader combination of technical movement, equipment handling, route planning, communication, and safety procedures among young athletes. A multi-component descriptive assessment can therefore provide useful preliminary information for coaches to identify areas of relative strength and areas requiring further development.

Accordingly, this study aimed to describe the level of basic sport-climbing skills among 107 young athletes aged 10 to 15 years from five selected climbing clubs in Indonesia. The assessment covered equipment inspection, harness fitting and use, correct figure-eight knot tying, belayer safety checks, climbing communication, basic movement techniques, route observation and movement planning, and route completion. The study was intended to provide a descriptive profile of these skills within the participating clubs rather than to represent all young climbers in Indonesia or to evaluate the effectiveness of a specific training programme.

METHOD

Research Design

This study employed a quantitative descriptive design using a survey method. The design was selected because the study aimed to describe the existing level of basic sport-climbing skills among young athletes without manipulating variables, providing an intervention, or examining causal relationships. The primary outcome was the participants' basic sport-



climbing skill score, which was obtained through direct practical assessment and summarized using descriptive statistics.

Participants

The study involved 107 young climbers aged 10 to 15 years from five selected climbing clubs in Indonesia. To maintain institutional confidentiality, the clubs were identified as Club A, Club B, Club C, Club D, and Club E. The participant distribution consisted of 22 climbers from Club A, 20 from Club B, 23 from Club C, 21 from Club D, and 21 from Club E.

Participants were selected using purposive sampling. The five clubs constituted the participating study sites; no probability-based club sampling was used. The inclusion criteria required participants to be active members of one of the participating clubs, regularly attend training sessions, be in good health at the time of assessment, complete all stages of the practical test, and obtain permission from a parent or guardian. Because the sample was drawn from five selected clubs rather than through probability sampling, the findings were interpreted as a description of the participating athletes and were not intended to represent all young climbers in Indonesia. Sex distribution, training age or experience, training frequency, and climbing discipline were not available as analytic variables in the study records and therefore could not be used for subgroup description.

Basic Sport-Climbing Skill Assessment

Data were collected through a practical sport-climbing test using a structured observation rubric. The assessment focused on eight components of basic sport-climbing skills: equipment inspection; harness fitting and use; correct figure-eight knot tying; belayer safety checks; climbing communication; basic

movement techniques; route observation and movement planning; and route completion.

The assessment combined technical movement, equipment-handling, route-planning, communication, and safety-related competencies because these elements represent practical skills required during basic climbing activities. The movement-related indicators were informed by the principles of structured climbing-performance assessment described by [Taylor et al. \(2020\)](#), particularly the use of observable criteria to evaluate movement quality rather than relying solely on route completion or ascent time.

The structured rubric was applied as a study-specific observational instrument. Formal content-validity indices, internal-consistency coefficients, and inter-rater reliability statistics were not available for the present dataset. Accordingly, the resulting scores should be interpreted as descriptive measures within this study rather than as externally validated normative scores. Each indicator was scored using a five-point rating scale. A score of 1 indicated that the participant was unable to perform the required skill correctly or demonstrated an unsafe action. A score of 5 indicated that the participant performed the skill accurately, safely, fluently, and independently. Intermediate scores represented progressively higher levels of skill execution between these two anchors.

The total score obtained by each participant was converted into a percentage score to facilitate interpretation across the assessment components. The overall percentage score was calculated as (sum of obtained ratings / sum of maximum possible ratings) × 100. Component percentages were calculated using the same principle: (sum of obtained ratings within the component / sum of maximum possible ratings within the component) × 100. The resulting scores were classified into five descriptive



categories: very good (86–100), good (71–85), moderate (56–70), poor (41–55), and very poor (≤ 40). These cut-offs were used as operational descriptive thresholds for the present study and should not be interpreted as externally validated normative standards.

Testing Procedures

The practical assessment was conducted using a top-rope climbing system under the supervision of coaches and trained assessors. The top-rope system was selected to reduce the possibility of uncontrolled falls during the assessment of young participants. The available study documentation did not retain the number, individual qualifications, or detailed training records of the assessors required for fuller reporting, and no formal inter-rater reliability coefficient was available. This limitation should be considered when interpreting the reproducibility of the observational scores.

Testing procedures were standardized across the five participating clubs, including route characteristics, wall inclination, instructions, observation time, and scoring procedures. Participants were assessed on their ability to prepare for climbing, apply basic safety procedures, execute fundamental movements, observe and plan the route, and complete the climbing task. The study records available for analysis did not provide sufficiently detailed values for route grade, wall height, hold configuration, warm-up and rest intervals, or the number of attempts. These details therefore could not be reported retrospectively and constitute a limitation for exact replication.

Before beginning the assessment, participants received instructions regarding the testing procedure and safety requirements. Participant identities were recorded using identification codes to protect confidentiality. Participants were allowed to discontinue the assessment if

they experienced pain, excessive fatigue, fear, discomfort, or any condition considered likely to compromise their safety.

Data Analysis

Data were analysed using descriptive statistics. The analysis included mean scores, standard deviations, minimum and maximum scores, frequencies, percentages, and predefined skill-level categories. Descriptive summaries were produced for the overall sample, each participating club, and each basic skill component.

Club-level results were used only to describe the observed distribution of scores across the five participating clubs. No inferential analysis was conducted to test statistical differences between clubs. Therefore, differences in club mean scores were interpreted descriptively and were not treated as evidence of differences in coaching effectiveness or training quality.

Ethical Considerations

All participants were minors between 10 and 15 years of age. Participation required parental or guardian consent. Participant identities and club identities were protected during data recording and reporting. The participating clubs were anonymized as Club A to Club E, while individual participants were identified through research codes. Safety considerations were incorporated throughout the practical assessment, including the use of a top-rope system, direct supervision, and the participants' right to stop the assessment when they experienced physical or psychological discomfort. A formal ethics-committee approval number was not available in the study documentation used for this manuscript; therefore, the ethical procedures reported here are limited to the participant-protection measures that could be verified from the study records.



RESULT

Overall Level of Basic Sport-Climbing Skills

A total of 107 young climbers aged 10 to 15 years from five participating sport-climbing clubs completed the assessment. The participants' basic sport-climbing skill scores ranged from 47 to 89. The overall mean score was 68.00 with a standard deviation of 8.60. Based on the predetermined classification criteria, the overall level of basic sport-climbing skills was categorized as moderate.

Table 1. Descriptive Statistics of Basic Sport-Climbing Skills

N	Min	Max	Mean	SD	Category
107	47	89	68.00	8.60	Moderate

The distribution of skill-level categories showed that more than half of the participants were classified at the moderate level. A total of 56 participants (52.34%) were categorized as moderate, while 32 participants (29.91%) were categorized as good. Fifteen participants (14.02%) were classified as poor, and four participants (3.74%) reached the very good category. No participant was classified as very poor.

Table 2. Distribution of Basic Sport-Climbing Skill Levels

Score Range	Category	Frequency	Percentage
86–100	Very Good	4	3.74%
71–85	Good	32	29.91%
56–70	Moderate	56	52.34%
41–55	Poor	15	14.02%
≤40	Very Poor	0	0.00%
Total		107	100.00%

Overall, 86.00% of the participants were classified between the moderate and very good categories. However, only 33.65% reached the good or very good categories. These findings indicate that most participants demonstrated an intermediate level of basic sport-climbing skill, while relatively few showed consistently high achievement across the assessed components.

Skill Scores across Participating Clubs

Descriptive analysis was also conducted for each participating club. Club C recorded the highest mean score at 69.60, followed by Club B at 68.80, Club E at 67.70, Club A at 67.10, and Club D at 66.90. The difference between the highest and lowest club mean scores was 2.70 points. Despite this variation, the mean scores of all five clubs remained within the moderate category.

Table 3. Basic Sport-Climbing Skill Scores by Club

Club	Number of Participants	Mean Score	Category
Club A	22	67.10	Moderate
Club B	20	68.80	Moderate
Club C	23	69.60	Moderate
Club D	21	66.90	Moderate
Club E	21	67.70	Moderate
Overall	107	68.00	Moderate

These club-level results were interpreted descriptively. No inferential statistical analysis was conducted to test differences among the five clubs. Therefore, the observed differences in mean scores should not be interpreted as evidence of differences in coaching effectiveness, training quality, or athlete-development systems.



Achievement by Basic Skill Component

Component-level analysis revealed variation across the eight assessed areas. Harness fitting and use showed the highest achievement score at 74%, followed by equipment inspection at 72%. Basic movement techniques reached 70%. These three components represented the strongest areas within the observed skill profile.

Route observation and movement planning showed the lowest achievement at 63%. Route completion reached 64%, while belayer safety checks reached 65%. Correct figure-eight knot tying achieved 67%, and climbing communication reached 69%.

Table 4. *Achievement by Basic Sport-Climbing Skill Component*

No.	Skill Component	Score	Category
1	Equipment Inspection	72%	Good
2	Harness Fitting and Use	74%	Good
3	Correct Figure-Eight Knot Tying	67%	Moderate
4	Belayer Safety Checks	65%	Moderate
5	Climbing Communication	69%	Moderate
6	Basic Movement Techniques	70%	Moderate
7	Route Observation and Movement Planning	63%	Moderate
8	Route Completion	64%	Moderate
Overall Mean		68%	Moderate

The component profile indicates that the participating young climbers performed

relatively better in equipment handling and basic movement than in route-planning and selected safety-related skills. In particular, route observation and movement planning, route completion, and belayer safety checks emerged as the three lowest-scoring components. These results identify areas that require closer interpretation in relation to the technical and developmental characteristics of young climbers.

DISCUSSION

The present study identified an overall mean basic sport-climbing skill score of 68%, placing the participating young climbers in the moderate category. This finding indicates that the participants were generally able to demonstrate several fundamental climbing procedures and movements, but their performance was not consistently at a high level across all assessed components. The result should be interpreted as a descriptive profile of the participating athletes rather than as evidence of the overall skill level of young climbers in Indonesia.

The moderate overall score also shows the importance of evaluating climbing performance through multiple observable components rather than relying solely on route completion. **Taylor et al. (2020)** emphasized that climbing movement can be assessed through structured indicators related to body control, limb use, movement fluency, and efficiency. In the present study, the inclusion of equipment handling, safety procedures, movement execution, route planning, and route completion provides a broader description of practical climbing competence. A participant may complete a route while still showing weaknesses in route planning, safety checks, or movement efficiency. Therefore, route completion alone may not adequately



represent the quality of basic climbing performance.

Stronger Performance in Equipment Handling and Basic Movement

Harness fitting and use recorded the highest component score at 74%, followed by equipment inspection at 72% and basic movement techniques at 70%. These results suggest that the participating young climbers were relatively more familiar with routine equipment preparation and fundamental movement execution than with several more complex planning and safety-related tasks.

The relatively higher scores in equipment inspection and harness use may reflect the repetitive nature of these activities during regular climbing sessions. Equipment preparation generally occurs before each climbing attempt, allowing young climbers repeated opportunities to practice these procedures. However, the present study did not directly examine training frequency or coaching practices. Therefore, this explanation should be considered a plausible interpretation rather than a tested causal relationship.

Basic movement techniques also produced a comparatively higher score. Effective climbing requires coordinated use of handholds and footholds, control of body position, balance, and adaptation to the characteristics of the route. **Saul et al. (2019)** identified movement skill, postural stability, strength, endurance, concentration, and movement efficiency as important components of climbing performance. The present findings suggest that the participants had developed a functional foundation in basic movement, although the moderate score indicates that further improvement in consistency and efficiency remained possible.

Physical capacities such as finger strength and forearm endurance may support technical climbing performance. Previous research has demonstrated associations between climbing ability and finger-flexor strength, grip capacity, and climbing-specific endurance (**Berta et al., 2025; MacLeod et al., 2007; Michailov et al., 2018; Philippe et al., 2012**). However, these physical attributes were not measured in the present study. They therefore should not be used to explain the observed skill scores directly. For young climbers, technical execution and safe movement remain important training priorities alongside the gradual development of physical capacity.

Lower Performance in Route Planning and Safety-Related Components

Route observation and movement planning recorded the lowest achievement score at 63%. This result indicates that anticipating movement sequences represented one of the more challenging components for the participating young climbers. Route reading requires climbers to identify possible handholds and footholds, estimate reaching distances, recognize difficult sections, anticipate body positions, and organize movement before beginning an ascent.

Seifert et al. (2017) showed that route-previewing strategies were associated with climbing fluency and exploratory movements. Climbers who develop more effective route-previewing strategies may reduce unnecessary movement changes and pauses during an ascent. The relatively low route-planning score in the present study therefore highlights an area that deserves greater attention in youth climbing instruction. Coaches may use structured route observation, verbal movement planning, and post-climb reflection as practical activities to develop this skill. These strategies represent practical implications derived from



the observed weakness and should be evaluated empirically in future intervention studies.

Route completion was the second-lowest component at 64%. This finding should not be interpreted solely as an indicator of physical capacity because successful route completion can depend on several interacting factors, including movement selection, balance, route reading, technical efficiency, and physical demands. The relatively similar scores for route planning and route completion suggest that these two components may be practically related. However, the descriptive design of the present study does not allow a statistical or causal relationship between them to be established.

Belayer safety checks also received a relatively low score of 65%. This result deserves attention because partner checking represents an important routine safety procedure in climbing. Equipment inspection showed a higher score than belayer checking, suggesting that participants performed individual equipment-related procedures more consistently than some partner-based safety procedures. The present data do not establish why this difference occurred. Nevertheless, regular reinforcement of partner checks, knot verification, harness inspection, and climbing communication is appropriate within youth training because these procedures form part of basic climbing safety practice.

Climbing communication and correct figure-eight knot tying also remained within the moderate category. These skills require not only procedural knowledge but also consistent execution. For young athletes, routine repetition under supervision may help reinforce correct procedures. Safety-related training is particularly relevant in youth climbing because adolescent climbers may be exposed to injury risks during participation. **Schöffl et al. (2025)**

reported that injuries among adolescent climbers frequently involved the upper extremities and fingers. The current study did not measure injury incidence, so the findings cannot demonstrate that particular safety procedures reduce injury risk. Instead, they identify specific procedural skills that require continued attention during training.

Interpretation of Club-Level Findings

Mean scores across the five participating clubs ranged from 66.90 to 69.60. All clubs remained within the moderate category, and the difference between the highest and lowest mean scores was only 2.70 points. These values indicate relatively similar descriptive profiles across the participating clubs.

Previous Indonesian studies have highlighted the importance of coaching programmes, coach competence, facilities, organisational management, and athlete-development systems in climbing development (**Abadi, 2016; Nasugian & Suropto, 2021; Putri & Khamidi, 2021**). However, the present study did not measure these organisational variables and did not perform inferential comparisons among clubs. Therefore, the observed club-level scores should not be interpreted as evidence that one club had better coaching, management, or athlete-development practices than another. Further research would be required to examine whether specific club characteristics are associated with differences in young athletes' climbing skills.

Practical Implications

The component-level profile provides practical information for the participating clubs. Training can continue to reinforce equipment inspection, harness fitting, and basic movement while placing additional attention on route observation, movement planning, route



completion, belayer safety checks, knot execution, and climbing communication.

Progressive training is important in sport climbing because exercise demands should reflect age, experience, technical competence, and developmental level. **Stien et al. (2023)** reported that climbing-specific and resistance training can improve climbing-related performance, although available intervention studies use varied methods and outcome measures. For athletes aged 10 to 15 years, training priorities should therefore remain balanced between technical development, movement quality, safe procedures, and appropriately supervised physical preparation.

Periodic assessment may also help coaches identify changes in individual skill profiles over time. However, repeated assessment requires consistent procedures and adequately documented instruments. **Langer et al. (2023)** identified considerable variation in climbing performance tests, while **Stien et al. (2022)** highlighted limitations in the reporting and standardization of several climbing-specific assessment procedures. Future development of youth climbing assessment should therefore prioritize clear scoring indicators, standardized testing conditions, and evidence of validity and reliability.

Study Limitations

Several limitations should be considered when interpreting the findings. First, participants were selected purposively from five climbing clubs. The sample therefore does not represent all young sport climbers in Indonesia, and the findings should be generalized cautiously.

Second, the study used a descriptive design. It identifies the observed level and distribution of basic sport-climbing skills but cannot determine the causes of differences among participants, skill components, or clubs.

Variables such as training experience, training frequency, coaching methods, physical condition, and climbing discipline were not analysed in the present study.

Third, the interpretation of the findings depends on the structured observation rubric and testing procedures used in this study. Formal psychometric validation and inter-rater reliability statistics were not available for the dataset, and detailed information on assessor characteristics and several route-specific testing parameters was not retained. These constraints limit the reproducibility and external interpretation of the scores. Future research should establish content validity, inter-rater reliability, and standardized administration procedures before the instrument is used across broader populations.

Fourth, participant characteristics such as sex, training age, training frequency, and climbing discipline were not available for subgroup analysis, which limits interpretation of possible variation within the sample. In addition, a formal ethics-committee approval number was not available in the study documentation used for this manuscript. Finally, the study did not examine relationships between skill scores and competitive performance, physical capacity, or injury occurrence. Future research can extend the present descriptive findings by examining these relationships, validating standardized youth climbing assessment instruments, and including broader samples from different regions and training environments.

CONCLUSION

This study found that the basic sport-climbing skills of 107 young athletes aged 10 to 15 years from five selected climbing clubs in Indonesia reached an overall mean score of 68%, which was classified as moderate. The participants showed relatively stronger performance in



harness fitting and use, equipment inspection, and basic movement techniques. In contrast, route observation and movement planning, route completion, and belayer safety checks represented the lowest-scoring components.

These findings indicate that the participating young climbers had developed a functional foundation of basic sport-climbing skills, although performance remained uneven across the assessed components. The results provide practical information for coaches in the participating clubs to identify areas that require greater attention, particularly route-reading, movement planning, partner safety checks, knot execution, and climbing communication.

The findings should be interpreted within the descriptive scope of the study. Because participants were purposively selected from five clubs, the results do not represent all young climbers in Indonesia. Future research should involve broader samples and strengthen the validity, reliability, and standardization of youth sport-climbing skill assessment. Further studies may also examine relationships between basic skill profiles, training characteristics, physical capacity, competitive performance, and injury-related outcomes.

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DECLARATIONS

Author Contribution Statement

All authors contributed to the conceptualization and design of the study, data collection, data analysis and interpretation, and preparation of the manuscript. All authors critically reviewed the manuscript, approved the final version for publication, and agreed to be accountable for the accuracy and integrity of the work.

AI Disclosure Statement

The authors used ChatGPT (OpenAI) during the revision of the manuscript to assist with language editing, organization, and clarity of presentation. The AI tool was not used to generate, alter, or analyze the research data. All AI-assisted content was critically reviewed and edited by the authors. The authors take full responsibility for the accuracy, originality, integrity, and final content of the manuscript.

Conflicts of Interest

The authors declare that they have no financial, institutional, professional, or personal conflicts of interest that could have influenced the conduct, analysis, interpretation, or reporting of this study.

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