Comparative effects of traditional and contemporary calisthenics on the vertical jump of filipino volleyball athletes

Efectos comparativos de la calistenia tradicional y contemporánea en el salto vertical de voleibolistas filipinos

Authors

Loverette L. Coteng [1]
Keano P. Ananayo [2]
Apple Gay C. Molina [3]
Rex John G. Bawang [4]
Carlos K. Mama-o Jr. [5]
Corina L. Masing [6]

[1] University of Baguio (Philippines)
[2] National University Philippines (Philippines)
[3] Baguio Central University (Philippines)
[4, 5] Benguet State University (Philippines)
[6] Saint Louis University (Philippines)

Corresponding author:
Keano P. Ananayo
keanoananayo451@gmail.com

Received: 05-05-26
Accepted: 29-05-26

How to cite in APA

Coteng, L., Ananayo, K., Molina, A. G., Bawang, R. J., Mama-o, C. J., & Masing, C. (2026). Comparative effects of traditional and contemporary calisthenics on the vertical jump of filipino volleyball athletes. *Retos, 82*, 60-73. https://doi.org/10.47197/retos.v82.119394

Abstract

Introduction: Vertical jump performance is a critical component of volleyball, particularly for effective spiking and blocking actions. Despite the widespread use of bodyweight training, limited evidence compares traditional and contemporary calisthenics approaches in improving sport-specific jumping performance among youth athletes.
Objective: This study sought to examine and compare the effects of traditional and contemporary calisthenics programs on countermovement and running vertical jump performance among Filipino amateur high school volleyball athletes.
Methodology: A quantitative quasi-experimental design with a between-subjects approach was employed. A total of sixty-four (64) athletes were allocated to either the traditional or contemporary calisthenics group. Both groups completed an eight-week training program conducted three times weekly, following structured sessions including warm-up, exercises, and cool-down. Vertical jump performance was measured before and after the intervention using countermovement and running jump tests. Mean, standard deviation, and t-tests were used for analysis at a 0.05 significance level.
Results: Both groups demonstrated significant improvements in countermovement and running jump performance. No significant difference was observed between groups in countermovement jump results, indicating similar improvements in general explosive power. However, the contemporary group showed significantly greater gains in running jump performance.
Discussion: Findings suggest that while both approaches improve vertical power, contemporary calisthenics better enhance sport-specific explosive movements.
Conclusions: Structured calisthenics programs are effective, with contemporary approaches providing greater benefits for volleyball performance in resource-limited training environments.

Keywords

Contemporary calisthenics; countermovement jump; running jump; traditional calisthenics; volleyball;

Resumen

Introducción: El rendimiento del salto vertical es un componente clave en el voleibol, especialmente para el remate y el bloqueo. Existe evidencia limitada que compare enfoques tradicionales y contemporáneos de calistenia en la mejora del rendimiento de salto en jóvenes atletas.
Objetivo: Este estudio tuvo como objetivo comparar los efectos de programas de calistenia tradicional y contemporánea sobre el salto con contramovimiento y en carrera en atletas filipinos de voleibol de secundaria.
Metodología: Se utilizó un diseño cuasi experimental con enfoque entre grupos. Un total de sesenta y cuatro (64) atletas fueron asignados a uno de los dos grupos: el grupo de calistenia tradicional o el grupo de calistenia contemporánea. Ambos realizaron un programa de ocho semanas, tres veces por semana, con sesiones estructuradas. El rendimiento se evaluó antes y después mediante pruebas de salto. Se emplearon media, desviación estándar y pruebas t con significancia de 0.05.
Resultados: Ambos grupos mostraron mejoras significativas en ambos tipos de salto. No hubo diferencias significativas en el salto con contramovimiento. Sin embargo, el grupo contemporáneo obtuvo mayores mejoras en el salto en carrera.
Discusión: Los resultados indican que ambos enfoques mejoran la potencia, pero el contemporáneo favorece el rendimiento específico.
Conclusiones: La calistenia es efectiva, destacando el enfoque contemporáneo para mejorar el rendimiento en voleibol.

Palabras clave

Calistenia contemporánea; salto con contramovimiento; salto en carrera; calistenia tradicional; voleibol.

Introduction

Volleyball is a sport characterized by frequent explosive actions that demand high levels of lower-limb power and neuromuscular efficiency (Ilics, 2024). Among the key physical attributes required for optimal performance, vertical jump ability is particularly critical, as it directly influences essential game skills such as spiking, blocking, and jump serving (Martinez, 2017). Athletes who can achieve greater vertical displacement are able to contact the ball at higher points, produce sharper attack angles, and enhance their defensive reach, thereby gaining a clear competitive advantage during play (Challoumas & Artemiou, 2018). For this reason, vertical jump performance—commonly measured through the countermovement jump and the running or approach jump—has become a widely accepted indicator of lower-body explosive power and overall volleyball performance.

Given its importance, a substantial body of research has focused on training methods aimed at improving vertical jump ability. Among these, plyometric training has consistently been identified as one of the most effective approaches for enhancing explosive performance (Oliveira et al., 2023; Qatami & Kilani, 2026; Silva et al., 2019; Zhang, 2013). Plyometric exercises utilize the stretch–shortening cycle and promote neuromuscular adaptations such as improved motor unit recruitment, enhanced rate of force development, and better intermuscular coordination, all of which contribute to improved jump performance (Hirayama, 2015). Consequently, systematic reviews and experimental studies consistently report moderate to large improvements in vertical jump performance following plyometric interventions, particularly when training is conducted two to three times per week over periods of four to eight weeks or longer (Guimarães et al., 2022; Kurniawan et al., 2025; Oliveira et al., 2023). Despite their effectiveness, many plyometric programs require specialized equipment, structured facilities, and close supervision, which may not always be available in school-based settings, particularly in resource-constrained environments such as those commonly encountered in the Philippines.

In contrast, calisthenics or bodyweight training presents a more accessible and practical alternative. Calisthenics involves the use of an individual's body weight as resistance and emphasizes functional, multi-joint movements that promote strength, stability, coordination, and overall movement efficiency (Chaves et al., 2020). Because these exercises require minimal equipment and can be performed in limited spaces, they are particularly suitable for implementation in schools and community-based sports programs.

Existing evidence suggests that bodyweight exercises such as squats, lunges, single-leg movements, and jumping variations can effectively enhance lower-body strength and power, both of which are essential for vertical jump performance. Furthermore, bodyweight training programs have demonstrated improvements in countermovement and running jump performance through enhanced muscular force production and neuromuscular efficiency (Muhammad et al., 2023; Panihar & Rani, 2022). However, much of the existing research incorporates bodyweight exercises within broader training programs or focuses on general fitness outcomes rather than specifically examining volleyball-related performance variables.

Another notable limitation in the literature is the lack of differentiation within calisthenics approaches. Bodyweight training can generally be categorized into traditional and contemporary forms. Traditional calisthenics consist of foundational strength-oriented exercises such as squats, lunges, step-ups, and calf raises that emphasize muscular control, stability, and progressive strength development (Kotarsky et al., 2017). In contrast, contemporary calisthenics incorporate more advanced, dynamic, and explosive movements such as depth jumps, squat jumps, bounding, and unilateral plyometric exercises that place greater emphasis on reactive strength and rapid force production (Machado et al., 2019).

To date, direct comparative studies examining the relative effectiveness of traditional versus contemporary calisthenics in improving vertical jump performance remain limited. Moreover, existing studies have predominantly focused on stationary jump measures such as the countermovement jump (Pratama et al., 2024; Ramirez-Campillo et al., 2018), while comparatively little attention has been given to the running or approach jump. This represents an important gap because the running jump more closely reflects the dynamic and sport-specific demands of volleyball competition, where athletes must integrate speed, coordination, and explosive power during movement.

The lack of experimental evidence is even more apparent within the Philippine context. Local studies involving volleyball athletes remain scarce, and existing investigations are often descriptive or qualitative rather than intervention-based. Given the resource limitations experienced by many Philippine schools, there is a need for empirically supported, equipment-free training strategies that are both effective and feasible for real-world implementation.

Addressing these gaps is important for advancing both scientific knowledge and practical application in physical education and sports training. Determining whether traditional strength-oriented calisthenics or contemporary explosive calisthenics produce greater improvements in countermovement and running jump performance can provide valuable insights for coaches and physical educators seeking efficient, accessible, and context-specific training methods.

Therefore, the present study aims to examine the effects of traditional and contemporary calisthenics on the countermovement jump and running jump performance of Filipino high school volleyball athletes. By directly comparing these two approaches within a controlled school-based setting, the study seeks to generate context-specific evidence and support the development of affordable, evidence-informed conditioning strategies for youth volleyball. Moreover, the findings are expected to contribute to the understanding of effective training methodologies and inform the implementation of practical, resource-efficient programs in similar educational and athletic contexts.

Method

A quantitative quasi-experimental pretest-posttest between-subjects design was employed to examine the effects of traditional and contemporary calisthenics programs on countermovement jump and running jump performance. This design was considered appropriate because it enabled the investigation of intervention-related changes while maintaining a high degree of ecological validity within a real-world school-based training environment. Unlike highly controlled laboratory experiments, school-based interventions are subject to practical and contextual constraints that limit complete experimental control, thereby making a quasi-experimental approach more suitable.

The incorporation of pre-test and post-test measurements allowed for the assessment of performance changes over time within each intervention group. Participants who met the established inclusion criteria were recruited from the target population and subsequently assigned to either the traditional calisthenics group or the contemporary calisthenics group. Random assignment was implemented to improve baseline comparability between groups and reduce selection bias. However, the study retained its quasi-experimental classification because participants were not randomly selected from the broader population and the intervention was conducted within a natural school setting where complete control of extraneous variables was not feasible. These characteristics are consistent with quasi-experimental designs commonly employed in applied educational and sports science research (Anwer et al., 2021).

The independent variable was the type of calisthenics program (traditional or contemporary), while the dependent variables were countermovement jump and running jump performance. The factorial between-subjects structure facilitated a direct comparison of the two intervention conditions and provided a clearer understanding of how each training modality influenced the outcome variables. Such a design is particularly valuable in applied sports science research, where the objective is not only to determine whether an intervention is effective but also to compare its relative effectiveness against alternative approaches.

Moreover, the use of a between-subjects design offered several methodological advantages. By assigning each participant to only one intervention group, the study minimized the risk of carryover effects that could occur if the same individuals were exposed to multiple training protocols. It also reduced the likelihood of fatigue and learning effects that might confound performance outcomes. Consequently, the observed improvements could be more directly attributed to the specific intervention received by each group (Costa et al., 2016).

Furthermore, this design was particularly appropriate for evaluating conditioning programs intended for school-based implementation. By integrating the interventions into the athletes' regular training routines, the study preserved the natural training environment while maintaining sufficient methodological control to generate valid and meaningful findings. This balance between control and ecological validity is essential for producing evidence that is both scientifically sound and practically applicable.

Overall, the selected research design provided a robust framework for examining the comparative effectiveness of traditional and contemporary calisthenics programs. It enabled meaningful interpretation of performance changes, promoted comparability between groups, and aligned with the practical realities of school-based sports training. As a result, the findings offer valuable insights that can inform evidence-based decision-making among coaches, physical educators, and sports program developers.

Participants

A total of 64 Filipino high school volleyball athletes (32 males and 32 females) participated in the study, providing a balanced representation of both sexes and enhancing the generalizability of the findings within the target population. The inclusion of both male and female athletes also allowed for a more comprehensive examination of training effects across a typical school-based volleyball cohort. Participants were assigned to two intervention groups to ensure comparability and reduce potential selection bias. Group A, composed of 16 males and 16 females, participated in a traditional calisthenics training program, while Group B, likewise consisting of 16 males and 16 females, underwent a contemporary calisthenics training program. This equal distribution of participants by sex and group helped maintain structural balance, thereby strengthening the internal validity of the study and ensuring that any observed differences in outcomes could be more confidently attributed to the intervention rather than demographic disparities.

Baseline characteristics were assessed to determine the initial comparability of the groups prior to the implementation of the training interventions. Group A had a mean age of 17.6 years, an average height of 1.62 meters, and a mean body weight of 59.21 kilograms. In comparison, Group B recorded a mean age of 17.2 years, an average height of 1.66 meters, and a mean body weight of 60.11 kilograms. These values indicate that both groups were relatively homogeneous in terms of key demographic and anthropometric variables. The minimal differences in age suggest that participants were at a similar stage of physical maturation and athletic development, which is particularly important in adolescent populations where growth and developmental factors can influence performance outcomes. Likewise, the comparable height and body weight between groups imply similar body composition profiles and physical characteristics that are relevant to jump performance, such as limb length, muscle mass, and leverage.

Establishing this baseline equivalence is critical in experimental and quasi-experimental research, as it helps ensure that any post-intervention differences are not confounded by pre-existing disparities between groups. The relative similarity in these initial measurements supports the assumption that both groups started from a comparable performance and physiological baseline. Consequently, improvements observed following the intervention can be more reliably attributed to the specific training programs implemented rather than to inherent differences in participant characteristics. Overall, the balanced composition and comparable baseline profiles of the two groups provide a strong foundation for valid and meaningful comparison of the effects of traditional and contemporary calisthenics on vertical jump performance.

Procedure

Before data collection, a formal request to conduct the study and recruit participants was submitted to the concerned administration and coaches. After institutional approval was granted, informed consent and parental consent forms were distributed, as the participants were minors. The forms detailed the study's objectives, procedures, and possible risks and benefits, and clearly stated that participation was voluntary, with participants free to withdraw at any time without consequence. The study followed the ethical standards stated in the Declaration of Helsinki and provided by Benguet State University.

An orientation session was conducted to explain the study procedures, training protocols, safety guidelines, and participant responsibilities. To ensure physical readiness, all participants underwent a medical screening at the school clinic prior to the intervention.

Participants were randomly assigned to either the traditional bodyweight training group (Group A) or the contemporary bodyweight training group (Group B). Baseline measurements of countermovement and running vertical jump were obtained using a fabricated Vertec-like device. Standardized instructions, demonstrations, and practice trials were provided to ensure consistency and measurement reliability.

Both groups then participated in their respective 8-week training programs conducted three times per week. Each training session followed a standardized structure consisting of: (1) a 5-10-minute dynamic warm-up (light jogging, mobility exercises, dynamic stretching, and activation drills); (2) the prescribed bodyweight training protocol specific to the assigned group; and (3) a 5–10-minute cool-down period that included light activity and static stretching to facilitate recovery and reduce the risk of injury. Training sessions were supervised, and attendance, adherence, and any modifications or incidents were documented. Participant feedback regarding their training experience was also recorded.

Following the intervention period, post-test assessments were carried out using the same procedures and equipment employed during the pre-test to determine changes in vertical jump performance.

Instrument

Table 1 shows the 8-week traditional calisthenics program designed to enhance vertical jump performance of the participants. The intervention was conducted three times (3) per week, with each session consisting of eight traditional calisthenics exercises focusing on the primary muscle groups essential for jump performance, such as the quadriceps, hamstrings, gluteal muscles, and plantar flexors. Rest periods of 60–90 seconds were provided to ensure sufficient recovery while sustaining training intensity.

Table 1. 8-Week Traditional Calisthenics Program for Vertical Jump Improvement

Weeks	Focus	Exercises (Sets × Reps/Duration)
1–2	Foundation Strength and Endurance	Squat (3×15); Alternating Lunges (3×12/leg); Wall Sit (3×30s); Double-leg Calf Raises (3×20); Assisted Single-leg Squat (2×8/leg); Glute Bridge (3×15); Step-back Lunges (3×10/leg); Ankle Hops (3×20). Frequency: 3 sessions/week (Monday, Wednesday and Friday) Rest: 60-90 seconds per exercise
3–4	Strength Development	Tempo Squat (4×15); Split Squat (3×10/leg); Wall Sit (3×45s); Single-leg Calf Raises (3×12/leg); Squat Hold (3×20s); Single-leg Glute Bridge (3×10/leg); Forward Lunges (3×12/leg); Squat Pulses (3×15) Frequency: 3 sessions/week (Monday, Wednesday and Friday) Rest: 60-90 seconds per exercise
5–6	Strength–Power Transition	Jump Squat (4×8); Explosive Lunges (3×10/leg); Tuck Jumps (3×8); Single-leg Squat (3×8/leg); Single-leg Calf Raises (3×15/leg); Split Squat Jumps (3×6/leg); Broad Jumps (3×6); Fast Ankle Hops (3×25) Frequency: 3 sessions/week (Monday, Wednesday and Friday) Rest: 60-90 seconds per exercise
7–8	Explosive Power Development	Max Vertical Jumps (5×5); Jump Squats (4×10); Tuck Jumps (4×8); Broad Jumps (4×6); Alternating Split Jumps (3×8/leg); Single-leg Calf Raises (3×20/leg); Reactive Vertical Jumps (3×10); Approach Jumps (4×5) Frequency: 3 sessions/week (Monday, Wednesday and Friday) Rest: 60-90 seconds per exercise

The structure of the program followed a progressive overload principle, gradually transitioning from foundational strength development to explosive power training. During Weeks 1–2, the emphasis was placed on muscular endurance and movement control through fundamental exercises such as squats, lunges, wall sits, and glute bridges. Establishing a strength base is essential for improving force production capacity, which is a prerequisite for effective power generation during jumping tasks.

In weeks 3–4, the program increased training demands through higher volume, longer isometric holds, unilateral movements, and tempo-controlled exercises. These modifications aimed to enhance neuromuscular control, muscular strength, and lower-limb stability. Unilateral exercises such as split squats and single-leg calf raises were included to address potential strength asymmetries and improve balance, which are critical for take-off efficiency and injury prevention in volleyball.

The transition phase in Weeks 5–6 incorporated explosive movements such as jump squats, tuck jumps, and split squat jumps to facilitate the conversion of strength into power. This phase targeted the stretch–shortening cycle (SSC), a key physiological mechanism underlying vertical jump performance. Rapid force production and reduced ground contact time were emphasized to improve rate of force development.

Table 2. 8-Week Contemporary Calisthenics Program for Vertical Jump Improvement

Weeks	Focus	Exercises (Sets × Reps/Duration)
1–2	Movement Preparation & Dynamic Stability	Explosive Squat to Calf Raise (3×12); Reverse Lunge to Knee Drive (3×10/leg); Single-leg Romanian Reach (bodyweight balance) (3×10/leg); Lateral Lunges (3×10/leg); Elevated Hip Thrust (bench-supported) (3×15); Fast Step-Ups on Bench (3×12/leg); Low-Level Pogos (ankle rebounds) (3×25); Lateral Line Hops (3×20) Frequency: 3 sessions/week (Monday, Wednesday and Friday) Rest: 90-120 seconds per exercise
3–4	Unilateral Strength & Reactive Control	Bulgarian Split Squat (3×12/leg); Single-leg Box Squat (bench touch) (3×8/leg); Bench Step-Ups with Drive (3×12/leg); Single-leg Calf Raises on Step (3×15/leg); Isometric Split Squat Hold (3×30s); Lateral Bounds (controlled) (3×8/side); Forward Bounds (3×10); Continuous Pogos (3×30) Frequency: 3 sessions/week (Monday, Wednesday and Friday) Rest: 90-120 seconds per exercise
5–6	Reactive Strength & Plyometric Development	Depth Drops (low box) (3×6); Depth Jumps (3×6); Explosive Box Jumps (4×8); Alternating Jump Lunges (3×10/leg); Single-leg Bounds (3×6/leg); Lateral Power Bounds (3×8/side); Reactive Pogos (minimal ground contact) (3×30); Broad Jump to Stick Landing (3×6) Frequency: 3 sessions/week (Monday, Wednesday and Friday) Rest: 90-120 seconds per exercise
7–8	Maximal Power & Sport-Specific Reactivity	Depth Jump to Vertical Jump (4×5); Repeated Box Jumps (4×8); Single-leg Box Jumps (3×6/leg); Approach Jump with Penultimate Step (4×5); Continuous Bounds (3×20 m or 10 reps); Reactive Tuck Jumps (4×8); Drop Jump to Immediate Broad Jump (3×6); High-Speed Lateral Bounds (3×10/side) Frequency: 3 sessions/week (Monday, Wednesday and Friday) Rest: 90-120 seconds per exercise

Finally, Weeks 7–8 focused on maximal power output through high-intensity plyometric and sport-specific drills, including maximum vertical jumps and approach jumps. These exercises were intended to enhance neuromuscular efficiency, motor unit recruitment, and movement specificity, thereby optimizing transfer to volleyball performance, particularly during blocking and spiking actions.

Table 2 shows the contemporary calisthenics program implemented to enhance the vertical jump performance of the participants through progressive exposure to high-intensity, dynamic, and reactive calisthenics exercises. Contemporary calisthenics differs from traditional bodyweight training by incorporating elevated surfaces, reactive drop mechanics, multidirectional movements, and higher neuromuscular demands. Conducted three times per week for eight weeks, each training session consisted of eight exercises emphasizing unilateral strength, neuromuscular control, and plyometric performance. Rest intervals ranged from 60 to 120 seconds depending on exercise intensity to ensure adequate recovery and optimal power output.

The program also followed a progressive training model beginning with movement preparation and dynamic stability (Weeks 1–2). These initial sessions incorporated controlled explosive movements, low-level plyometrics, and balance-oriented unilateral exercises to establish joint stability, coordination, and landing mechanics. Developing proper force absorption and alignment is essential before introducing higher-intensity plyometric loads.

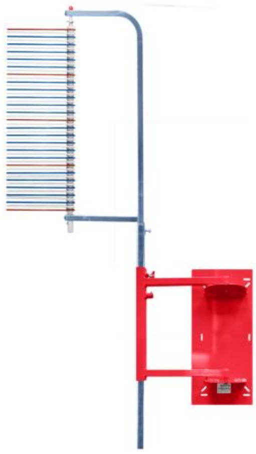
During Weeks 3–4, the focus shifted to unilateral strength and reactive control through exercises such as Bulgarian split squats, single-leg box squats, and bounding drills. Contemporary training approaches emphasize unilateral force production due to its relevance to sport-specific actions and its role in addressing inter-limb asymmetries. Controlled plyometric elements were also introduced to begin stimulating the stretch–shortening cycle (SSC).

The reactive strength phase (Weeks 5–6) incorporated moderate- to high-intensity calisthenic exercises, including depth jumps, box jumps, and reactive ankle work. These exercises were selected to enhance rate of force development, neuromuscular efficiency, and the ability to rapidly transition from eccentric to concentric muscle action. Contemporary calisthenics closely aligns with plyometric training principles, particularly in its emphasis on minimal ground contact time and maximal explosive effort.

The final phase (Weeks 7–8) emphasized maximal power and sport-specific reactivity through advanced drills such as depth jump progressions, repeated explosive efforts, single-leg plyometrics, and volleyball approach jumps. These exercises were intended to maximize neural drive, motor unit recruitment, and movement specificity, thereby improving transfer to performance during blocking and spiking actions.

Figure 1 presents the fabricated Vertec-like device used to measure the vertical jump performance of the participants. The apparatus consists of a steel frame structure equipped with a series of horizontally aligned vanes that rotate upon contact by the participant's hand, allowing the maximum reach height to be recorded. Each vane represents a 1.27 cm (½ inch) increment, enabling precise measurement of jump height. The height of the vane assembly is adjustable from 6 to 12 feet, making the device suitable for both beginner and elite athletes.

Figure 1. Vertec-like device image



Note. Reprinted from Sports Imports, "Vertec Jump Trainer," https://www.sportsimports.com/product-category/training-tools/training-vertec/ (accessed June 2026). Copyright by Sports Imports.

The equipment is designed with a weighted base to ensure stability during repeated and high-intensity testing. Additionally, built-in easy-glide wheels allow for convenient transport and setup across different locations. The device is practical and efficient, as it is portable, easy to operate, and adaptable for use in various training and testing environments, making it appropriate for field-based performance assessment.

Prior to data collection, the device was calibrated using standard measuring procedures, and standardized testing instructions, demonstrations, and practice trials were provided to all participants to enhance measurement consistency. While the device served as a practical and cost-effective alternative for field-based assessment, formal psychometric validation and reliability testing were not conducted and should be considered in future investigations.

Data analysis

Both descriptive and inferential statistical techniques were employed to analyze the data. Descriptive statistics, specifically the mean (M) and standard deviation (SD), were calculated to summarize participants' countermovement jump and running jump performance during the pre-test and post-test phases for each intervention group.

To determine significant changes in performance within each group following the intervention, paired-samples t-tests were conducted. Independent-samples t-tests were subsequently employed to compare post-intervention performance between the traditional and contemporary calisthenics groups. These statistical procedures were selected to address the study objectives of examining within-group improvements and between-group differences in vertical jump performance.

All statistical analyses were performed using a significance level of $\alpha = 0.05$, corresponding to a 95% confidence level. Statistical significance was established when p-values were less than .05.

To supplement statistical significance testing, effect size estimates (Cohen's d) were computed from the reported t-statistics to assess the practical significance of the interventions. Effect sizes were interpreted using conventional benchmarks.

Results

Table 3 presents the pre-test and post-test countermovement jump performance of Group A (traditional calisthenics). Results indicated a significant increase in countermovement jump height following the intervention, t = -4.35, p = .001. The effect size (d = 0.77) suggested a moderate practical effect, indicating meaningful improvements in lower-body explosive power among the volleyball athletes.

Table 3. Comparison of the countermovement jump scores before and after traditional calisthenics program.

GROUP A (Traditional Calisthenics Group) Countermovement Vertical Jump				
	Pre-Test Scores (in cm)	Post Test Scores (in cm)	t-value	p-value
MEAN	60.6875	63.5000	-4.3484**	0.001
Legend:	** - highly significant			

Table 4 presents the pre-test and post-test running jump performance of Group A (traditional calisthenics). Results indicated a significant increase in running jump performance following the intervention, t = 4.18, p = .001. The effect size (d = 0.74) suggested a moderate practical effect, indicating meaningful improvements in approach-based explosive performance among the volleyball athletes.

Table 4. Comparison of the running jump scores before and after the traditional calisthenics program.

GROUP A (Traditional Calisthenics Group) Running Vertical Jump				
	Pre-Test Scores (in cm)	Post Test Scores (in cm)	t-value	p-value
MEAN	66.6250	69.6875	4.178**	0.001
Legend:	** - highly significant			

Table 5 presents the pre-test and post-test countermovement jump performance of Group B (contemporary calisthenics). Results indicated a significant increase in countermovement jump performance following the intervention, *t* = -6.22, *p* < .001. The effect size (*d* = 1.10) suggested a moderate-to-large practical effect, indicating substantial improvements in lower-body explosive power among the volleyball athletes.

Table 5. Comparison of the countermovement jump scores before and after the contemporary calisthenics program.

GROUP B (Contemporary Calisthenics Group) Countermovement Vertical Jump				
	Pre-Test Scores (in cm)	Post Test Scores (in cm)	t-value	p-value
MEAN	61.1250	64.6250	-6.220**	0.000
Legend:	** - highly significant			

Table 6 presents the pre-test and post-test running jump performance of Group B (contemporary calisthenics). Results indicated a significant increase in running jump performance following the intervention, t = -7.38, p < .001. The effect size (d = 1.31) suggested a large practical effect, indicating substantial improvements in approach-based explosive performance among the volleyball athletes.

Table 6. Comparison of the running jump scores before and after the contemporary calisthenics program.

GROUP B (Contemporary Calisthenics Group) Running Vertical Jump				
	Pre-Test Scores (in cm)	Post Test Scores (in cm)	t-value	p-value
MEAN	68.1250	74.4375	-7.383**	0.000
Legend:	** - highly significant			

Table 7 presents the comparison of countermovement jump performance between the traditional and contemporary calisthenics groups after the intervention. The results indicate no significant difference between the two groups, as reflected by a computed t-value of -0.61 and a corresponding p-value of 0.550.

This finding suggests that the post-test countermovement jump scores of the volleyball athletes in both training groups were statistically comparable. The results indicate that traditional and contemporary calisthenic exercise programs produced similar effects on countermovement jump performance among the participants.

Table 7. Comparison between traditional and contemporary countermovement jump scores after the calisthenics programs

GROUP A VS. GROUP B POST-TEST SCORES Countermovement Vertical Jump				
	Pre-Test Scores (in cm)	Post Test Scores (in cm)	t-value	p-value
MEAN	63.5000	64.6250	-0.612^{ns}	0.550
Legend:	ns - not significant			

Table 8 presents the comparison of running jump performance between the traditional and contemporary calisthenics groups after the intervention. The results indicate a significant difference between the two groups, as evidenced by a computed t-value of -4.117 and a corresponding p-value of 0.001.

This finding suggests that the post-test running jump scores of the volleyball athletes differed significantly between the training groups. Further examination of the mean scores indicates that participants in the contemporary calisthenics group achieved higher running jump performance than those in the traditional group. The results therefore, imply that contemporary calisthenic exercises were more effective than traditional bodyweight exercises in enhancing running jump performance among volleyball athletes.

Table 8. Comparison between traditional and contemporary running jump scores after the calisthenics programs

GROUP A VS. GROUP B POST-TEST SCORES Running Vertical Jump				
	Pre-Test Scores (in cm)	Post Test Scores (in cm)	t-value	p-value
MEAN	69.6875	74.4375	-4.117**	0.001
Legend:	** - highly significant			

Discussion

The present study examined the comparative effects of traditional and contemporary calisthenics programs on countermovement jump and running vertical jump performance among Filipino high school volleyball athletes. The findings demonstrated that both training approaches produced statistically significant improvements in lower-body explosive performance. Effect size analysis further revealed moderate effects for the traditional calisthenics program (countermovement jump: $d = 0.77$; running jump: $d = 0.74$) and moderate-to-large to large effects for the contemporary calisthenics program (countermovement jump: $d = 1.10$; running jump: $d = 1.31$). These findings indicate that both interventions produced meaningful practical improvements in vertical jump performance, with contemporary calisthenics yielding comparatively greater effects. However, contemporary calisthenics generated significantly greater improvements in running jump performance, while no significant difference was observed between the two groups in countermovement jump outcomes. These results suggest that although both training modalities are effective for enhancing explosive power, their effectiveness may differ depending on the specific movement demands of the performance task.

The significant improvements observed in the traditional calisthenics group indicate that foundational bodyweight training can effectively enhance lower-body power among adolescent volleyball athletes. Exercises such as squats, lunges, unilateral movements, and controlled jump variations likely contributed to improvements in muscular strength, neuromuscular coordination, and force production capacity.

These adaptations are essential for vertical jump performance because greater force production enables athletes to generate higher impulse during take-off, resulting in increased jump height (Sánchez et al., 2024). The present findings support previous evidence demonstrating that structured bodyweight training can produce meaningful improvements in explosive performance even without specialized equipment or external resistance (Endab, 2024; Guerra et al., 2019). This reinforces the practicality of traditional calisthenics as an accessible and cost-effective training strategy, particularly in school-based and resource-constrained settings.

Similarly, the contemporary calisthenics program produced significant improvements in both countermovement jump and running jump performance. Unlike traditional calisthenics, the contemporary program incorporated more reactive and dynamic bodyweight exercises, including depth jumps, bounding activities, and advanced unilateral movements. These exercises place greater emphasis on rapid force production and utilization of the stretch–shortening cycle, which may enhance neuromuscular efficiency and explosive performance (Panihar & Rani, 2022). Consequently, the larger effect sizes observed in the contemporary group may be attributed to improved motor unit recruitment, intermuscular coordination, and movement efficiency during explosive actions (Willer et al., 2024; Ramirez-Campillo et al., 2021).

It is important, however, to distinguish contemporary calisthenics from plyometric training. Although contemporary calisthenics incorporates plyometric exercises and utilizes similar physiological mechanisms associated with the stretch–shortening cycle, it represents a broader bodyweight-training framework. Contemporary calisthenics also includes unilateral strength exercises, dynamic stability activities, movement-control drills, and sport-specific bodyweight movements. Thus, plyometric exercises constitute only one component of contemporary calisthenics rather than an equivalent training methodology. This distinction is important when interpreting the findings because the observed improvements likely resulted from the combined influence of multiple training elements rather than from plyometric stimuli alone.

Despite the greater intensity and complexity of the contemporary program, no significant difference was observed between the groups in countermovement jump performance. This finding suggests that both traditional and contemporary calisthenics are capable of improving vertical power under relatively stationary conditions. The countermovement jump primarily reflects lower-body force production and concentric power capabilities, qualities that can be effectively developed through both foundational strength-oriented exercises and more reactive training approaches (Wirth et al., 2016). For adolescent athletes whose neuromuscular systems and training experience are still developing, improvements in fundamental strength may be sufficient to generate substantial gains in countermovement jump performance regardless of the specific training modality employed (Gillen et al., 2021; Moran et al., 2016).

In contrast, the contemporary calisthenics group demonstrated significantly greater improvements in running jump performance. The running jump is a more complex and sport-specific movement that requires the integration of horizontal momentum, vertical force production, coordination, timing, and efficient transfer of elastic energy during the approach and take-off phases (Sánchez et al., 2024). The inclusion of approach jumps, bounding drills, and reactive exercises in the contemporary program more closely mirrored the movement demands of volleyball competition. Consistent with the principle of specificity, training adaptations are greatest when exercise characteristics closely resemble the biomechanical and physiological requirements of the target activity. Therefore, the superior improvements observed in running jump performance may be attributed to the greater movement specificity of the contemporary calisthenics exercises (Martínez-Lema & Guede-Rojas, 2023; Pellegrinotti et al., 2015).

These findings have important practical implications for coaches, trainers, and physical educators. Traditional calisthenics may serve as an effective foundation for developing general strength and explosive capabilities, particularly among novice athletes and in settings where equipment and facilities are limited. Conversely, contemporary calisthenics may be more beneficial when the objective is to enhance sport-specific explosive performance and movement efficiency. A progressive training approach that begins with foundational bodyweight exercises and gradually incorporates more reactive and sport-specific movements may therefore represent an optimal strategy for long-term athletic development.

Limitations

Several limitations are acknowledged in the study. Although participants were drawn from a relatively homogeneous population of high school volleyball athletes, factors such as biological maturation, prior training background, and external physical activity outside the intervention were not formally controlled and may have influenced the observed performance changes. Adolescent athletes often exhibit varying rates of growth and neuromuscular development, which may affect responsiveness to training interventions. Similarly, differences in previous training exposure and participation in additional physical activities may have contributed to individual variability in performance outcomes. Furthermore, the study was conducted within a natural school-based environment, which enhanced ecological validity but limited complete control over all potential confounding variables. Finally, while the fabricated Vertec-like device was calibrated and standardized prior to testing, formal psychometric validation and reliability assessment were not conducted. Future studies should consider controlling for maturation status, training history, and external training loads while employing validated measurement instruments and more advanced analytical procedures to further strengthen the evidence base.

Despite these limitations, the present study contributes to the relatively limited body of experimental research on calisthenics-based training interventions within the Philippine context. Given the resource constraints commonly experienced by many schools and athletic programs, the findings provide locally relevant evidence that structured bodyweight training programs can effectively improve explosive performance among volleyball athletes. The results highlight the potential of low-cost, accessible, and evidence-based training interventions to support athletic development in educational and community sport settings, thereby contributing valuable practical insights for school sports training and conditioning programs.

Conclusions

Both traditional and contemporary calisthenics programs significantly improved countermovement and running vertical jump performance among Filipino high school volleyball athletes after eight weeks of training. The findings indicate that structured bodyweight training is an effective and practical method for enhancing lower-body explosive power in school-based settings.

No significant difference was observed between the two approaches in countermovement jump performance, suggesting that both training methods are equally effective for improving general vertical power. However, contemporary calisthenics produced significantly greater improvements in running jump performance, indicating superior effectiveness for enhancing sport-specific explosive ability.

These results suggest that traditional calisthenics may be used to develop foundational strength and general power, while contemporary calisthenics may be more appropriate for improving dynamic, approach-based jumping performance relevant to volleyball. Coaches and physical educators are therefore encouraged to adopt a progressive training approach that integrates both methods to optimize athlete development.

Overall, the study provides evidence-based support for the use of cost-effective, equipment-free calisthenics programs to improve volleyball performance, particularly in resource-constrained school environments.

Acknowledgements

The authors would like to acknowledge all the government employees who participated in this study.

Financing

This study did not receive any funding.

Author Affiliations

Author	Position	Affiliation
Loverette L. Coteng	Faculty Member-Physical Education	University of Baguio (Philippines)
Keano P. Ananayo	Faculty Member-Physical Education	National University Philippines (Philippines)
Apple Gay C. Molina	Faculty Member-Physical Education	Baguio Central University (Philippines)
Rex John G. Bawang	Director- International Relations Office Faculty Member-Physical Education	Benguet State University, (Philippines)
Carlos K. Mama-o Jr.	Faculty Member-Physical Education	Benguet State University (Philippines)
Corina L. Masing	Faculty Member-Physical Education	Saint Louis University (Philippines)

References

Anwer, U., Nuhmani, S., Sharma, S., Bari, M. A., Kachanathu, S. J., & Abualait, T. (2021). Efficacy of speed, agility, and quickness training with and without equipment on athletic performance parameters: A randomized control trial. *Sports and Arts Journal, 9*(2), 194–202. https://doi.org/10.13189/SAJ.2021.090205

Baena-Raya, A., Díez-Fernández, D. M., García-de-Alcaraz, A., Soriano-Maldonado, A., Pérez-Castilla, A., & Rodríguez-Pérez, M. A. (2023). Assessing the maximal mechanical capacities through the load–velocity relationship in elite versus junior male volleyball players. *Sports Health*. https://doi.org/10.1177/19417381231208706

Challoumas, D., & Artemiou, A. (2018). Predictors of attack performance in high-level male volleyball players. *International Journal of Sports Physiology and Performance, 13*(9), 1230–1236. https://doi.org/10.1123/ijspp.2018-0125

Chaves, L. M. da S., Santos, G. V., Teixeira, C. L. S., & Silva-Grigoletto, M. E. D. (2020). Calistenia e exercício com o peso corporal: Conceitos distintos ou sinônimos científicos? *Revista Brasileira de Fisiologia do Exercício, 19*(1), 13–15. https://doi.org/10.33233/RBFE.V19I1.3985

Costa, A. M., Gil, M. H., Sousa, A. C., Ensinas, V., Espada, M. C., & Pereira, A. M. V. M. (2016). Effects of concurrent strength and endurance training sequence order on physical fitness performance in adolescent students. *Journal of Physical Education and Sport, 16*(4), 1202–1208.

Endab, J. P. D. (2024). Effectiveness of squat and countermovement jumps in improving vertical jump performance. *British Journal of Multidisciplinary and Advanced Studies, 5*(3), 69–95. https://doi.org/10.37745/bjmas.2022.04101

Gillen, Z. M., Shoemaker, M. E., Bohannon, N. A., Gibson, S. M., & Cramer, J. T. (2021). Effects of eccentric pre-loading on concentric vertical jump performance in young female athletes. *Sports Medicine—Open, 3*(1), 98–106. https://doi.org/10.1007/S42978-020-00098-7

Guerra, L. A., Santos, L. R. A. D., Pereira, P. E., Lauria, V. T., Lima, C. de, Evangelista, A. L., Rica, R. L., Bocalini, D. S., Messias, C. B., & Teixeira, C. V. L. S. (2019). A low-cost and time-efficient calisthenics strength training program improves fitness performance of children. *Journal of Physical Education and Sport, 19*, 58–64.

Guimarães, M. P., Silva, R. P. da, Santos, I. A. D., Silva, G. P. da, Campos, Y. de A. C., Silva, S. F. da, & Azevedo, P. H. S. M. de. (2022). Effect of four weeks of plyometric training in the pre-competitive period on volleyball athletes' performance. *Biology of Sport, 40*(1), 193–200. https://doi.org/10.5114/biolsport.2023.112971

Hirayama, K. (2015). Jump performance enhancement induced by countermovement. In *Biomechanics in sports* (pp. 187–198). https://doi.org/10.1007/978-4-431-55315-1_16

Ilics, K. B. (2024). The examination of explosive leg strength in volleyball. *Stadium, 7*(2). https://doi.org/10.36439/shjs/2024/2/15398

Kotarsky, C. J., Christensen, B., Miller, J., & Hackney, K. J. (2018). Effect of progressive calisthenic push-up training on muscle strength and thickness. *Journal of Strength and Conditioning Research, 32*(3), 651–659. https://doi.org/10.1519/JSC.0000000000002345

Kurniawan, R., Hendra, J., Saleh, K., Putra, I. M., & Pilitan, R. B. (2025). Strength and explosive power training supports volleyball smash jumps. *Academia Open, 10*(1). https://doi.org/10.21070/acopen.10.2025.12173

Machado, A. F., Baker, J. S., Junior, A. F., & Bocalini, D. S. (2019). High-intensity interval training using whole-body exercises: Training recommendations and methodological overview. *Clinical Physiology and Functional Imaging, 39*(6), 378–383. https://doi.org/10.1111/cpf.12433

Martinez, D. B. (2017). Consideration for power and capacity in volleyball vertical jump performance. *Strength and Conditioning Journal, 39*(4), 36–48. https://doi.org/10.1519/SSC.0000000000000297

Martínez-Lema, D., & Guede-Rojas, F. (2023). Effects of a sprint and plyometric warm-up protocol on vertical jump height and power in adolescent female volleyball players: A randomized crossover study. *Retos: Nuevas Tendencias en Educación Física, Deportes y Recreación, 48*, 304–311. https://doi.org/10.47197/retos.v48.93852

Moran, J., Sandercock, G., Ramirez-Campillo, R., Meylan, C., Collison, J., & Parry, D. (2016). Age-related variation in male youth athletes' countermovement jump after plyometric training: A meta-analysis of controlled trials. *Journal of Strength and Conditioning Research, 31*(2), 552–565. https://doi.org/10.1519/JSC.0000000000001444

Muhammad, M., Kusnanik, N. W., & Pramono, B. (2023). Effect of eight weeks of combined plyometric training on increasing lower and upper body muscle power in student volleyball athletes. *Teoriâ Ta Metodika Fizičnogo Vihovannâ, 23*(3), 333–338. https://doi.org/10.17309/tmfv.2023.3.03

Oliveira, M. C. T., Souza, Á. L. X. de, Mendonça, L. de M., & Silva, J. F. da. (2023). Does plyometric exercise improve jumping performance in volleyball athletes? An overview of systematic reviews. *Retos*. https://doi.org/10.47197/retos.v50.96114

Panihar, U., & Rani, D. (2022). The effect of calisthenics training on physical fitness parameters and sports-specific skills of soccer players: A randomized controlled trial. *Advances in Rehabilitation*. https://doi.org/10.5114/areh.2022.116181

Pellegrinotti, Í. L., Crisp, A. H., Manji, M. A. P., Rocha, G. L. da, & Verlengia, R. (2015). The influence of 16 weeks of periodized resistance training on vertical leap and 20-meter performance tests for volleyball players. *International Journal of Science Culture and Sport, 3*(1), 67–75. https://doi.org/10.14486/IJSCS235

Pratama, H. G., Imandaqurani, D., Candra, A. T., Pratama, I. G., & Santoso, D. A. (2024). Effects of plyometric training of adolescent male volleyball athletes. *Pamukkale Journal of Sport Sciences*. https://doi.org/10.54141/psbd.1458129

Qatami, H., & Kilani, H. A. (2026). The effects of plyometric training on selected physical abilities and kinematic variables in youth female football players. Retos, 81, 293-300. https://doi.org/10.47197/retos.v81.119142

Ramirez-Campillo, R., Álvarez, C., García-Hermoso, A., Ramírez-Vélez, R., Gentil, P., Asadi, A., Chaabene, H., Moran, J., Meylan, C., & García-de-Alcaraz, A. (2018). Methodological characteristics and future directions for plyometric jump training research: A scoping review. *Sports Medicine, 48*(5), 1059–1081. https://doi.org/10.1007/s40279-018-0870-z

Ramirez-Campillo, R., Gentil, P., Negra, Y., Grgic, J., & Girard, O. (2021). Effects of plyometric jump training on repeated sprint ability in athletes: A systematic review and meta-analysis. *Sports Medicine, 51*(10), 2165–2179. https://doi.org/10.1007/s40279-021-01479-w

Sánchez, J. S., Tocino, P., Ramirez-Campillo, R., & Rodríguez-Fernández, A. (2024). Impact of activation through bodyweight vs elastic band exercises on jump capacity and dynamic strength. https://doi.org/10.17398/1885-7019.20.23

Silva, A. F., Clemente, F. M., Lima, R., Nikolaidis, P. T., Rosemann, T., & Knechtle, B. (2019). The effect of plyometric training in volleyball players: A systematic review. *International Journal of Environmental Research and Public Health, 16*(16), 2960. https://doi.org/10.3390/ijerph16162960

Sports Imports. (n.d.). *Vertec jump trainer*. Sports Imports. Retrieved June 18, 2026, from https://www.sportsimports.com/product-category/training-tools/training-vertec/

Willer, J., Allen, S. J., Burden, R., & Folland, J. P. (2024). How humans run faster: The neuromechanical contributions of functional muscle groups to running at different speeds. *Scandinavian Journal of Medicine & Science in Sports, 34*(8). https://doi.org/10.1111/sms.14690

Wirth, K., Keiner, M., Hartmann, H., Sander, A., & Mickel, C. (2016). Effect of eight weeks of free-weight and machine-based strength training on strength and power performance. *Journal of Human Kinetics, 53*(1), 201–210. https://doi.org/10.1515/hukin-2016-0023

Zhang, X. (2013). Research of jumping ability and explosive power based on plyometric training. In *Advances in sports science* (pp. 427–433). https://doi.org/10.1007/978-1-4471-4790-9_55

Authors' and translators' details:

Loverette L. Coteng	logdoloverette.coteng@gmail.com	Author
Keano P. Ananayo	keanoananayo451@gmail.com	Author
Apple Gay C. Molina	applecalaoa14@gmail.com	Author
Rex John G. Bawang	rj.bawang@bsu.edu.ph	Author
Carlos K. Mama-o Jr.	carlosjrmamao.ihk@gmail.com	Author
Corina L. Masing	corinamasing@gmail.com	Author
Johjen D. Mag-atas	jdmagatas@nu-baliwag.edu.ph	Translator