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Biomotor Training Mentorship for Bone Table Tennis Athletes Preparing for South Sulawesi PORPROV

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ABSTRACT

This biomotor training mentorship program aimed to improve the physical This community service program aimed to strengthen the physical preparedness of table tennis athletes in Bone Regency through a structured biomotor training mentorship program in preparation for the South Sulawesi Provincial Sports Week (PORPROV). The program was implemented in collaboration with local athletes and coaches, addressing the partner's primary problem, namely the absence of systematic, evidence-based biomotor training. The service activities were conducted through several stages, including needs analysis, program planning, implementation of biomotor training mentorship, and monitoring and evaluation. Biomotor components developed in this program included strength, speed, agility, endurance, and coordination. Program effectiveness was evaluated using pre- and post-activity measurements as supporting data to assess changes in athletes' physical condition. The results showed improvements across all measured biomotor components, indicating positive outcomes of the mentorship-based training program. In addition to improving athletes' physical condition, the program enhanced coaches' capacity in planning, implementing, and evaluating structured biomotor training. Overall, this community service activity contributed to athlete readiness for competition while promoting sustainable capacity building among local coaches through a practical mentorship approach.

INTRODUCTION

Table tennis is a competitive sport that demands fast reaction speed, precise movement coordination, and the ability to change direction rapidly within a short time (Alim et al., 2021). The fast-paced nature of the game, characterized by high-intensity work intervals, makes physical condition a fundamental factor in supporting athlete performance, in addition to mastery of technical and tactical skills. Athletes with suboptimal physical condition tend to experience decreased movement quality, delayed responses, and inconsistent performance during matches.

Several studies indicate that table tennis is categorized as a sport dominated by anaerobic alactic and lactic work combined with high demands for speed and coordination (Pluta et al., 2020; Pradas de la Fuente et al., 2023) . This condition requires athletes to develop balanced biomotor components, particularly strength, speed, agility, endurance, and coordination. These components directly influence stroke effectiveness, footwork, and the ability to maintain game intensity during long rallies.

Muscle strength, especially in the upper and lower extremities, plays an important role in producing fast and stable strokes and in supporting movement efficiency within the playing area. Recent studies show that improvements in functional strength have a positive correlation with ball speed and postural stability in table tennis athletes (Sawali, 2024). In addition, agility and speed are crucial factors because athletes must be able to respond to varying ball directions and speeds in less than one second (Irawan, 2019). Cahyadi & Aziz (2025) emphasized that multidirectional movement training significantly improves agility and reaction time in racket sport athletes.

Endurance also plays an important role, even though table tennis is often considered a short-duration sport (Fahrudin & Hafidz, 2023). In competitive match contexts, athletes must be able to maintain performance quality across several sets with repeated high-intensity work patterns (Atiq et al., 2022). Research by El Hafidh et al. (2025) shows that good aerobic capacity helps athletes maintain movement speed and technical accuracy in the final phases of matches. Thus, aerobic endurance serves as a foundation to support anaerobic performance during competition.

In addition to these physical components, hand–eye coordination is a key characteristic of table tennis (Pratama & Budiman, 2017). Good coordination allows athletes to integrate visual information with motor responses quickly and accurately. A study by Yasa (2025) stated that visual–motor coordination has a direct relationship with stroke accuracy and the effectiveness of game strategies. Athletes with poor coordination tend to experience technical errors and delayed decision-making (Bowo, 2016).

In the context of regional elite sport development, a major challenge often faced is the limited availability of structured, evidence-based physical training programs. Many development programs still focus primarily on technical training, while biomotor aspects have not received proportional attention. In fact, evidence-based training approaches have been proven to increase training effectiveness and minimize injury risk (Bompa & Buzzichelli, 2019).

Recent evidence from a literature review by Ahmad et al. (2024) highlighted that structured and systematic physical training programs significantly improve key biomotor components such as strength and speed. These findings support the implementation of mentorship-based biomotor training programs as an evidence-based strategy to enhance athletes' physical preparedness prior to major competitions.

Bone Regency, as one of the regions actively developing table tennis, requires systematic mentorship strategies ahead of the South Sulawesi Provincial Sports Week (PORPROV). Biomotor training mentorship serves as a strategic step to ensure athletes' physical readiness to compete optimally. Therefore, this community service activity focuses on providing measurable, well-programmed, and regularly evaluated biomotor training mentorship as part of athletes' preparation for provincial-level competition.

The purpose of this activity is to improve the biomotor physical components of table tennis athletes, including strength, agility, speed, endurance, and coordination. In addition, this activity aims to provide evidence-based physical training methods that can be applied by coaches in the athlete development process. This program also seeks to assess athletes'

physical development through quantitative observations conducted before and after the implementation of the training program.

In the context of community service, table tennis athletes in Bone Regency face challenges related to the limited availability of structured and evidence-based biomotor training prior to major competitions such as PORPROV. Therefore, this community service program was designed to address partner needs through a mentorship-based biomotor training approach that emphasizes capacity building and practical implementation.

IMPLEMENTATION METHOD

Needs Analysis of Community Partners

The community partners involved in this program were table tennis athletes and coaches of Bone Regency who were preparing for the South Sulawesi Provincial Sports Week (PORPROV). Based on initial observations and discussions with coaches, it was identified that athletes had not yet been supported by a structured and evidence-based biomotor training program. Physical conditioning activities were still conducted incidentally and focused primarily on technical aspects, while systematic development of biomotor components such as strength, speed, agility, endurance, and coordination had not been optimally implemented. This condition became a key challenge in ensuring athletes' physical readiness ahead of provincial-level competition.

Planning of the Biomotor Training Mentorship Program

Based on the identified partner needs, the service team designed a biomotor training mentorship program tailored to the physical demands of table tennis. The program emphasized five main biomotor components: strength, speed, agility, endurance, and coordination. Training plans were developed using an evidence-based approach and adjusted to athletes' characteristics, competition schedules, and available facilities. Coaches were actively involved in the planning process to ensure that the program could be applied sustainably beyond the duration of the community service activity.

Implementation of the Biomotor Training Mentorship

The biomotor training mentorship was conducted at Lapatau Stadion from October to November 2025 over a total of 12 sessions. A total of 12 table tennis athletes aged 20–22 years participated in the program. Training sessions were implemented through direct assistance and supervision by the service team, with active involvement of coaches at each meeting. The mentoring process emphasized correct movement techniques, appropriate regulation of training intensity, and gradual progression according to athletes' physical responses. This direct mentoring approach allowed for immediate feedback, technique correction, and increased athlete motivation throughout the program.

Figure 1. Biomotor Training Mentorship Implementation

Monitoring and Evaluation of Program Implementation

Monitoring and evaluation were conducted as an integral part of the biomotor training mentorship program. Several physical condition evaluation activities were used as practical tools to monitor athletes' physical development, including assessments of strength, agility, speed, endurance, and coordination. Strength was observed through a push-up activity, with performance indicated by the number of repetitions completed within one minute. Agility was monitored using a shuttle run activity, recorded in seconds. Speed was assessed through a 10-meter sprint activity, while endurance was evaluated using the Cooper run activity, with distance covered serving as the indicator. Hand–eye coordination was observed through coordination drills, with performance scores recorded based on athlete achievement (Sepdanius et al., 2019).

Figure 2. Biomotor Component Evaluation Activities

The evaluation activities were conducted in a structured and consistent manner as part of the program monitoring process. The results of these evaluations served as supporting data to describe changes in athletes' physical condition following participation in the mentorship program, rather than as primary research findings.

Program Evaluation, Reflection, and Sustainability

The final evaluation stage was conducted after the completion of the entire biomotor training mentorship program. This stage involved repeated physical condition evaluation activities as well as reflective discussions between the service team and coaches regarding athlete development and program implementation. Through this evaluation process, coaches gained practical insights into the importance of structured biomotor training, training load regulation, and systematic monitoring of athlete progress.

Figure 3. Program Evaluation and Reflection Activities

To support program sustainability, the service team shared training guidelines and biomotor training structures with coaches as practical references for continued implementation. This follow-up strategy is expected to strengthen evidence-based coaching practices and support long-term athlete development in Bone Regency.

RESULTS AND DISCUSSION

RESULTS

Table 1. Changes in the Average Biomotor Components of Male Table Tennis Athletes

Component	Pre-test Value	Post-test Value	Change (%)
Strength	21,67 rep/menit	29,50 rep/menit	+36,1%
Agility	15,67 detik	14,83 detik	+5,4%
Speed	3,76 detik	3,50 detik	+6,9%
Endurance	1888,33 m	2170,00 m	+14,9%
Coordination	27,50 skor	34,33 skor	+24,9%

Based on Table 1 descriptive analysis results, male table tennis athletes showed improvements across all biomotor components after participating in the mentorship program. Mean strength increased from 21.67 repetitions per minute in the initial test to 29.50 repetitions per minute in the final test, representing a 36.1% improvement. In agility, average completion time improved from 15.67 seconds to 14.83 seconds, an increase of 5.4%. Furthermore, male athletes' sprint speed showed a reduction in time from 3.76 seconds to 3.50 seconds, indicating a 6.9% improvement.

Endurance, measured using the Cooper Test, showed an increase in mean distance covered from 1888.33 meters to 2170.00 meters, representing a 14.9% improvement. Meanwhile, hand–eye coordination scores increased from 27.50 in the pretest to 34.33 in the posttest, reflecting a 24.9% improvement.

Table 2. Changes in the Average Biomotor Components of Female Table Tennis Athletes

Component	Pre-test Value	Post-test Value	Change (%)
Strength	19,17 rep/menit	26,00 rep/menit	+35,6%
Agility	16,28 detik	15,62 detik	+4,1%
Speed	4,05 detik	3,78 detik	+6,7%
Endurance	1780,00 m	2080,00 m	+16,9%
Coordination	24,50 skor	31,33 skor	+27,9%

Based on Table 2, the female athlete group also demonstrated improvements across all measured biomotor components. Mean strength increased from 19.17 repetitions per minute in the initial test to 26.00 repetitions per minute in the final test, representing a 35.6% improvement. Agility performance improved from 16.28 seconds to 15.62 seconds, an increase of 4.1%. Additionally, sprint speed time decreased from 4.05 seconds to 3.78 seconds, indicating a 6.7% improvement.

Endurance measurements showed an increase in mean distance covered from 1780.00 meters in the pretest to 2080.00 meters in the posttest, representing a 16.9% improvement. Coordination scores increased from 24.50 in the pretest to 31.33 in the posttest, reflecting a 27.9% improvement.

Descriptively, both male and female athletes demonstrated increases in mean values across all biomotor components following the mentorship program.

Improvements were observed in strength, endurance, and coordination through increased scores, as well as in speed and agility through reduced completion times in the final tests.

Table 3. Paired Sample t-Test Results

Gender	Variable	*T*	*Df*	*Sig.*	Remarks
Male	**Strength (pre-test) – Strength (post-test)**	-25.489	5	0.000	Significant
	Speed (pre-test) – Speed (post-test)	9.696	5	0.000	Significant
	Endurance (pre-test) – Endurance (post-test)	-32.286	5	0.000	Significant
	Agility (pre-test) – Agility (post-test)	39.528	5	0.000	Significant
	Coordination (pre-test) – Coordination (post-test)	-41.000	5	0.000	Significant
Female	**Strength (pre-test) – Strength (post-test)**	-41.000	5	0.000	Significant
	Speed (pre-test) – Speed (post-test)	29.745	5	0.000	Significant
	Agility (pre-test) – Agility (post-test)	31.623	5	0.000	Significant
	Coordination (pre-test) – Coordination (post-test)	-41.000	5	0.000	Significant

All tested physical condition components in the male group showed Sig. (p-value) = 0.000 < 0.05, indicating that differences between pretest and posttest scores were statistically significant for all variables. Negative t-values for strength, endurance, and coordination indicate that posttest scores were higher (better) than pretest scores, whereas positive t-values for speed and agility indicate lower (faster/better) posttest scores.

Similarly, all physical condition components in the female group showed Sig. = 0.000 < 0.05, meaning that differences between pretest and posttest values were statistically significant. Negative t-values for strength and coordination indicate improved posttest scores compared to pretest, while positive t-values for speed and agility indicate improved performance (faster/better).

Therefore, it can be concluded that all physical condition components—strength, speed, endurance, agility, and coordination experienced statistically significant changes ($p < 0.05$) following the biomotor training mentorship program in both male and female athletes. This demonstrates that the applied training strategies were effective in improving athletes' physical condition in the key aspects targeted in the development program.

DISCUSSION

The results of the study indicate that the biomotor development mentoring program conducted over 12 sessions was able to improve all components of physical condition among table tennis athletes of Bone Regency, both male and female. This improvement reflects positive physiological adaptations resulting from the implementation of a structured, progressive, and evidence-based physical training program. These findings reinforce the view that physical condition is a fundamental foundation for supporting table tennis performance, particularly in the context of preparation for provincial-level competitions such as the Provincial Sports Week (Porprov).

A particularly notable improvement was observed in the strength component in both male and female athletes. This indicates that the strength training provided during the mentoring program was effective in enhancing muscular capacity (Setiawan et al., 2024). In table tennis, muscular strength especially in the upper and lower extremities, plays an important role in producing fast, stable, and powerful strokes, as well as in supporting efficient footwork (Santoso, 2015) . Recent research by Sawali (2024) states that improvements in functional strength have a positive correlation with ball speed and postural stability in table tennis athletes. In addition, (Bompa & Buzzichelli, 2019) emphasize that strength training designed according to the principle of sport specificity can enhance performance without compromising technical quality. Therefore, the strength improvements found in this study indicate that the mentoring program was aligned with the physiological demands of table tennis.

In addition to strength, the agility and speed components also showed consistent improvements in both groups of athletes, as indicated by reduced completion times in the shuttle run and sprint tests. These findings are highly relevant to the characteristics of table tennis, which require athletes to perform rapid changes of direction, acceleration, and quick responses to the opponent's ball within a very short time frame. Cahyadi & Aziz (2025) reported that multidirectional movement training significantly improves agility and reaction time in racket sport athletes. Furthermore, research by Chen et al. (2025) confirmed that improvements in lateral and linear movement speed directly contribute to the effectiveness of athlete responses in fast-paced game situations. Thus, the observed improvements in agility and speed suggest that the training provided met the neuromuscular demands of table tennis athletes.

Improvements in the endurance component indicate that athletes experienced positive adaptations in aerobic capacity. Although table tennis is often categorized as a sport dominated by anaerobic activity, aerobic endurance still plays an important role in supporting repeated high-intensity actions throughout a match. El Hafidh et al. (2025) stated that good aerobic capacity enables athletes to maintain movement speed, concentration, and technical accuracy during the later stages of competition. This is also supported by Nurhidayat et al. (2025) , who emphasized that endurance serves as a metabolic foundation in intermittent sports such as table tennis. Therefore, the endurance improvements found in this study demonstrate that the mentoring program was able to support sustained athlete performance during competition.

The hand–eye coordination component also showed significant improvement in both groups of athletes. Coordination is a key element in table tennis because it determines an

athlete's ability to integrate visual information with motor responses quickly and accurately. Research by Streuber et al. (2012) showed that visual–motor coordination has a strong relationship with stroke accuracy and the effectiveness of playing strategies. In addition, Pradas de la Fuente et al. (2023) stated that high-level table tennis athletes generally have better coordination abilities than novice athletes. With the observed improvements in coordination in this study, it can be concluded that the training provided successfully enhanced fine motor control, which is critically needed in dynamic game situations.

When reviewed by gender, both male and female athletes demonstrated relatively similar patterns of improvement across all biomotor components. This indicates that the applied biomotor development mentoring program was adaptive and could be used effectively for athletes with different physical characteristics. The differences in percentage improvement were more influenced by initial condition and individual variation rather than differences in training response based on gender. These findings are consistent with Pluta et al. (2020), who stated that physical adaptation responses to biomotor training in table tennis athletes are more strongly determined by training load and program consistency than by gender factors.

Overall, the results of this study confirm that a well-measured, systematically programmed, and regularly evaluated biomotor development mentoring approach is effective in improving the physical condition of regional table tennis athletes. This approach not only enhances physical performance but also provides an evidence-based training framework that can be replicated by coaches in the development of competitive sports performance. This is in line with the recommendations of Bompa & Buzzichelli (2019), who emphasize the importance of integrating sports science into long-term athlete development systems.

These findings are consistent with previous community service programs in regional sports development, such as the simulation-based training approach implemented for FORKI Bone karate athletes, which emphasized structured preparation, efficiency, and sustainable coaching capacity to improve athlete readiness for provincial-level competitions (Saputri et al., 2025).

CONCLUSION

The biomotor training mentorship program implemented as a community service activity demonstrated positive outcomes in improving the physical condition of table tennis athletes in Bone Regency, as reflected in supporting evaluation data. More importantly, this program emphasized a mentoring-based approach that actively involved athletes and coaches throughout the stages of needs analysis, training implementation, and evaluation. Beyond physical improvements, the program contributed to strengthening coaches' understanding of structured biomotor training principles, training load management, and performance monitoring, which are essential aspects of community empowerment. The collaboration between the service team and community partners enabled the transfer of practical knowledge and skills that can be sustainably applied after the completion of the program. Therefore, this community service activity not only supported athlete readiness for competition but also fostered long-term capacity development among local coaches to

implement systematic and evidence-based training programs independently.

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