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Coach encouragement feedback during circuit training: is it possible to increase the fitness, grit and technical demands of youth sepak takraw athletes?

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ABSTRACT

This study aims to investigate the impact of coach encouragement feedback circuit training (CEFCT) on the level of fitness, grit, and technical performance of youth sepak takraw athletes. A randomised control trial (RCT) design during 8 weeks was adopted. There were 80 young male sepak takraw athletes allocated into two groups: the CEFCT group (n = 40, 17.4 ± 1.22 years) and the control group (CG, n = 40, 17.5 ± 1.24 years). Paired sample t-test showed significant differences in fitness, grit and technical performance in CEFCT (all, $p < .05$) and CG (all, $p < .05$) from pre-test until post-test. In the 2-way ANOVA repeated measures test, we observed a significant time effect on physical fitness (all $p < .05$), along with a group effect ($p < .05$); however, there was no effect on the CMJ parameter ($p > .05$). Moreover, there was an interaction time * group in some parameters ($p < .05$), but it was not found in 10-mST ($p > .05$). At the same time, we found a time effect on grit (all, $p < .05$), but no difference in the group effect (all, $p > .05$). Furthermore, there was a time * group interaction on grit-maintaining interest (MI) ($p < 005$), but it was not found in grit-continuing efforts (CE) ($p > .05$). Finally, we found that there was an effect of time (all, $p < .05$) simultaneously with group (all, $p < .05$), but there was no time * group interaction (all, $p > .05$). The coach must apply encouragement during the circuit to increase the level of physical fitness, grit and technical performance of youth sepak takraw athletes.

KEYWORDS: coach encouragement feedback; circuit training; performance; sepak takraw.

INTRODUCTION

Sepak takraw is a competitive sport that has become popular and has attracted the attention of several coaches in the Asian region (Yudanto et al., 2022). Sepak takraw has the characteristics of a high-intensity sport and requires high levels of energy. Data reported that Malaysian national athletes have a daily energy expenditure of 3,004 ± 298 kcal, while young Thai national athletes have 400.37 ± 44.03 kcal per match (Udomtaku & Konharn, 2020). Thus, this data shows that youth sepak takraw athletes are required to perform at high levels. Based on existing literature, several factors that support the performance of young athletes in competitive sports include fitness (Sabarit et al., 2020; Villaseca-Vicuña, Otero-Saborido et al., 2021), psychological (Ríos Garit et al.,

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2021), and technical (Giatsis et al., 2023). Several previous studies explained that well-developed physical fitness was able to generate great power when kicking (Isnaini et al., 2023), high jumping power (Heynen et al., 2024; Ramirez-Campillo et al., 2020), speed when running, agility when moving, flexibility (Sikora & Linek, 2023), and endurance to compete longer without experiencing excessive fatigue (Papaevangelou et al., 2023). In addition, psychological aspects such as grit have received attention among researchers worldwide (Braun et al., 2024; Sumarsono et al., 2023) because they could influence performance levels (Apró et al., 2024). A similar situation also applied to technical aspects, which have been proven to create a major contribution to support high performance in the competition (Ramírez-López et al., 2022). Thus, basically, these three factors have a positive relationship. High fitness will have a positive impact on technical performance; meanwhile, increasing grit is also important for improving fitness and technical quality (Romdhani et al., 2024). Considering the importance of fitness, grit and technical performance for young athletes, an appropriate and relevant training program, such as providing encouraging feedback from coaches during circuit training (CEFCT), is considered important.

CEFCT is a combination of training that provides encouraging feedback from the coach while the athlete is carrying out the circuit program. Encouraging feedback from the coach can be provided verbally (e.g., "You can do it!", "Keep your enthusiasm!", "Don't give up!" or "Good job!" (Khayati et al., 2024; Sahli et al., 2024; Soylu et al., 2023), and action (e.g., lifting thumbs up, giving applause, demonstrating correct movements). Meanwhile, the circuit is a training course with 1 to 8 stations (Pocaan, 2024), and each station has a training task that must be completed by young athletes (Burhanuddin et al., 2023). Based on information from previous studies, each station has different training tasks, for example, burpees, squats, shuttle runs, plyometrics, planks, and push-ups (Milenković, 2022). Combining the provision of encouraging feedback from a coach with a type of training that was documented in previous studies generated positive benefits; for example, Díaz-García et al. (2021) combined coach encouragement during soccer practice, and the results were proven to increase the mental and physical load of 36 young athletes. Meanwhile, Midgley et al. (2018) state that providing verbal encouragement during exercise has a significant impact on performance and motivation. Other benefits showed that encouraging feedback during repeated agility speed training (RAS) can improve physiology, intensity, mood, and perceived enjoyment in young soccer athletes (Selmi et al., 2023).

Although the benefits of CEFCT had been reported by several previous researchers, according to our best knowledge, based on facts and data, there was limited research that investigated the effects of CEFCT on youth sepak takraw athletes. Apart from that, the novelty presented in this research relates to the implementation of the CEFCT program to improve physical fitness, grit and technical performance. Based on these reasons, our research aims to investigate the impact of the CEFCT program on the level of fitness, grit and technical performance of youth sepak takraw athletes.

METHODS

Ethics

This research has received approval from the local ethics committee of the Indonesian Sepak Takraw Association Organisation, Sukabumi City, Indonesia (Registration number: 0324/PSTI-KAB-SMI/II/2024).

Participants

A priori sample size analysis was calculated with G*Power (v 3.1.9.4, [effect size *f* = 0.30, power 1- β err *prob* = 0.90 and α err *prob* = 0.05]). The results showed the minimum number of participants (sample) was 80 athletes, who were divided into experimental (CEFCT, *n* = 40) and control groups (CG, *n* = 40) using an online research randomiser (Selmi et al., 2024). Therefore, this research involved 80 young male sepak takraw athletes from the Indonesian Sepak Takraw Association Organisation, Sukabumi City (Indonesia). They were selected using the following inclusion criteria: (i) youth sepak takraw athletes with a minimum of 2 years training experience; (ii) minimum 2 years of CEFCT experience; (iii) did not have any injury in the last 2 months and during the intervention program period, (iv) did not take any medication during the intervention period. Meanwhile, the exclusion criteria were: (i) the athletes had an injury in the last 1 month and were sick during the intervention program; (ii) did not obtain parental consent to engage in the intervention program; (iii) athletes aged 23 years and over. All participants received information regarding the procedures, rules, risks, and benefits of this research. After verbally agreeing, the participants and their parents should sign the consent form. All activities in this research are in accordance with and follow the ethical standards for human studies from the Declaration of Helsinki (World Medical Association, 2013). Characteristic information about the participants is presented in Table 1.

Measurements

Physical fitness

The physical fitness level of youth sepak takraw athletes was measured using a fitness test battery, including:

Leg strength dynamometer test

The LSDT (T.K.K. 5402, BACKD, Tokyo, Japan) has been used in many previous studies to measure athletes' back and lower leg muscle strength (Ho et al., 2024). The LSDT was carried out with the following instructions. First, the participant stood on the leg dynamometer. Then, the participant leaned their body forward (30°), looked straight ahead, and both hands held the leg dynamometer handle. After instructions, the participant pulled the handle as hard as possible by straightening his knees until he stood up straight (Isnaini et al., 2023). Each participant got 2 opportunities, and the best result was recorded in kg.

10-m speed test

The 10-mST was chosen to measure the speed level of athletes using a stopwatch (s) (Chuang et al., 2022). The 10-mST was carried out with the following instructions. First, participants stood on the start line. After the whistle sounded, participants ran as fast as possible towards the finish line. The test was carried out in 2 trials, and the fastest time was registered for data analysis.

Hexagon agility test

Based on previous studies, HAT has been proven accurate in measuring agility (Lu et al., 2022). HAT was carried out with the following instructions. First, the participant stood upright in the middle of the hexagon and faced line A with his knees bent more than 45° (Encarnación-Martínez et al., 2023). After the instruction "ready and go", the participant quickly jumped out of line B and jumped in again. Next, he jumped again to numbers C, D, E, and F and finally jumped back to line A. The duration was controlled by a stopwatch. Each participant had 3 times trials, and the best time (s) were recorded (Moseid et al., 2019) (Figure 1).

Counter movement jump

The CMJ was used to measure the power level of the vertical jump (Kurtoğlu et al., 2024). The CMJ was carried out with the following instructions. The participant stood upright, hands on hips and feet shoulder-width apart. After the instruction sounded, the participant bent his knees to 90° and jumped vertically as high as possible (Masel & Maciejczyk, 2024; Michailidis et al., 2024). Participants were given 3 opportunities, and the highest vertical jump (cm) was selected for data analysis.

Sit and reach test

Athletes' back muscle flexibility was measured using SnRT (Bogalho et al., 2022). The test was carried out using the following procedure: (i) participants were required to take off their shoes, (ii) participants sat on the floor with both arms kept on the SnRT table and legs straight forward. After instruction was sounded, participants bent their bodies forward and pushed the measuring ruler as far as possible with both arms (Kumar & Zemková, 2022). This position was held for at least one second while recording the distance that could be reached. Participants got 3 times opportunities, and the furthest distance (cm) was selected and recorded.

Multistage 20-m fitness test

In this M20-mFT, if the "beep" audio sounded, then participants would run back and forth from cone A (star) to cone B at a distance of 20 m (Zaharia et al., 2023). If participants

Table 1. Demographic information of the participant.

Outcomes	CEFCT group	CG
Participants (n)	40	40
Age (years)	17.4 ± 1.22	17.5 ± 1.24
Body height (cm)	161 ± 3.38	162 ± 3.18
Body weight (kg)	58.3 ± 3.06	59.2 ± 3.15
BMI (kg·m−2)	22.0 ± 1.05	22.4 ± .80
Sepak Takraw experience (years)	2.38 ± .43	2.44 ± .45
CEFCT experience (years)	2.16 ± .32	2.26 ± .40

CEFCT: Coach encouragement feedback circuit training; BMI: Body mass index.

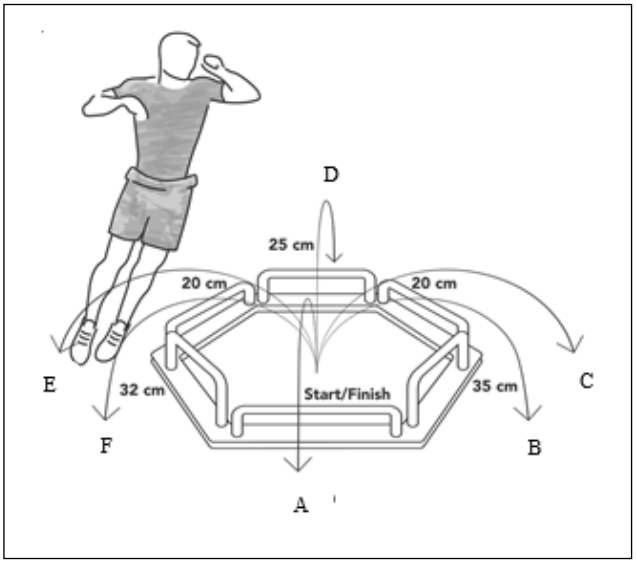

Figure 1. Hexagon Agility Test.

could no longer run or could not follow the "beep" audio, the research team would warn them and expel them after two warnings. This test ended when the participants were discharged. Oxygen consumption VO_2max (mL/kg/min) was recorded for data analysis.

Grit

In this study, the Short Grit Scale (SG-S) was used to measure the grit level of athletes (Mohebi et al., 2022). SG-S consists of 8 question items from 2 dimensions, namely: maintaining interest (MI) with 4 question items (e.g., Setbacks do not discourage me from continuing to practice), and continuing efforts (CE) has 4 question items (e.g., I am an athlete with hardworking character traits). SG-S was assessed on a Likert scale from 1 (does not reflect me at all) to 7 points (extremely reflects me) (Sumarsono et al., 2023).

Technical performance

The level of technical performance of athletes was measured with the following tests:

Sepak Sila test

In this test, the participant stood upright and held the ball. After the instruction "ready and go", the participant performed sepak sila repeatedly for 1 minute, controlled by a stopwatch (Yudanto et al., 2022). If the ball fell, the stopwatch would stop. The total number of kicks in 1 minute was recorded.

Serve tests

This test was carried out to measure the level of accuracy of the athletes' serves (Irawan et al., 2021). Participants stood in the serving area, then after the instruction "ready and go", the participant performed serve, which was directed towards the number grid of the target on the field (e.g., values from 1, 2, 3, 4, 5). Participants got 3 opportunities. The results of 3 serves were added up and recorded.

Smash tests

Based on a previous study, this test was accurate for measuring athletes' smash levels (Aji & Yudhistira, 2023). Participants stood in the smash area, then after the instruction "ready and go", the participant performed a smash directed at the target number grid from values 1, 2, 3 to 4 on the field. Participants were given 3 opportunities. The results of the 3 smashes were added up and recorded for data analysis.

Design and procedures

This research adopted an experimental method with a randomised control trial (RCT) design for 8 weeks (Figure 2). At the initial meeting in the first week, all participants carried out a pre-test, which included physical fitness test (LSDT, 10-mST, HAT, CMJ, SnR, M20-mFT), filling out the grit questionnaire (MI, CE), and technical performance test (sepak sila test, serve tests, smash tests). Pre-test activities were carried out on Wednesdays from 07:00 to 11:00 am. In the second meeting, the experimental group carried out the CEFCT program, while the CG carried out circuit training (CT) without any encouragement from the trainer (CT-non CE). CEFCT and CG activities were carried out for 8 weeks. The final meeting, in week 8, was closed by the implementation of post-test activities, namely: physical fitness test (LSDT, 10-mST, HAT, CMJ, SnR, M20-mFT), grit (MI, CE), and technical performance (sepak sila test, serve tests, smash tests) from 08:00 to 12:00 am.

CEFCT and CG program

The CEFCT program was held in the sports field at the Indonesian Sepak Takraw Association Organisation, Sukabumi City (Indonesia). The CEFCT program was held twice a week, namely on Wednesday and Friday, for 8 weeks (Table 2). Before the intervention program, participants performed a warm-up in the form of Proprioceptive Neuromuscular Facilitation (PNF) for 5 minutes. After the warm-up, participants in the experimental group carried out the CEFCT program. The coach's encouragement was provided in the following form : (i) verbal encouragement such as: "You can do it", "Keep the spirit up", "Don't give up", "good movement", "Do your best", (ii) encouragement of behaviour such as thumbs up, applause, coach demonstrating examples of correct movements. Meanwhile, CG carried out CT without any encouragement from the coach. After the intervention program was completed, all athletes were required to carry out a cool-down (5 min).

Statistical analysis

In this statistical analysis, firstly, several tests were performed, including mean ± standard deviation, normality (Shapiro-Wilk's), and homogeneity (Levene's). Second, a paired sample t-test was conducted to test differences between groups in the pre-test and post-test. Third, the effect size (ES) was calculated using Cohen's (d) with the following cutoff points: very large (> 2.0), large (1.2–1.99), medium (.60–1.19), small (.2–.59) and trivial (< .2). Fourth, a 2-way repeated measures ANOVA was chosen to assess the effects of time, group and interaction in CEFCT and CG on physical fitness (LSDT, 10-mST, HAT, CMJ, SnR, M20-mFT), grit (MI, CE), and technical performance (soccer tests, serve tests, smash tests). Fifth, it was investigated the effects of

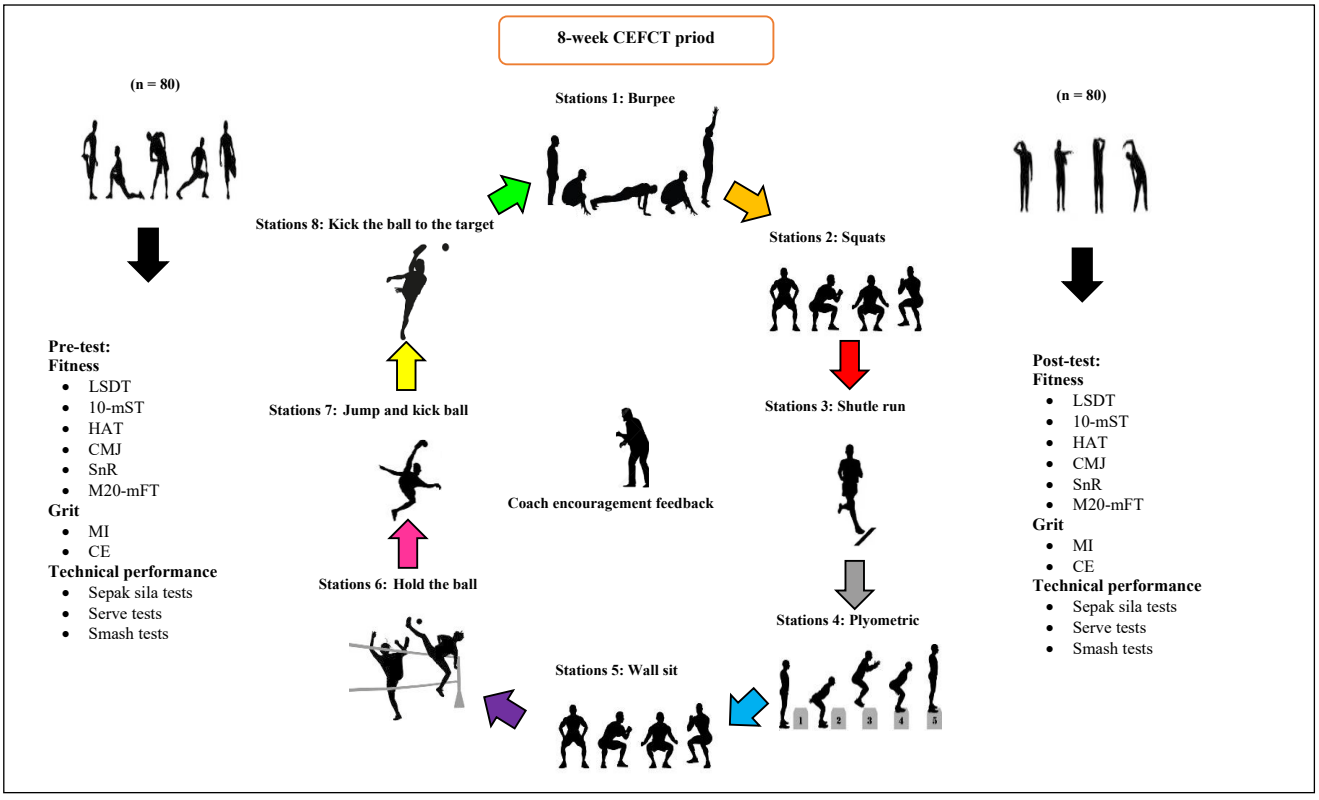

Figure 2. Schematic representation of the experimental design.

Table 2. CEFCT program for 8 weeks.

Week	1 Day (Wednesday)		2 Day (Friday)	
1-4 week	Station 1: Burpee work: 2 rep x 5 sets rest: 3 min	Station 5: Wall sit work: 2 reps x 5 sets rest: 3 min	Station 1: Burpee work: 3 reps x 10 sets rest: 4 min	Station 5: Wall sit work: 3 reps x 10 sets rest: 4 min
	Station 2: Squats work: 2 rep x 5 sets rest: 3 min	Station 6: Hold the ball work: 2 reps x 5 sets rest: 3 min	Station 2: Squats work: 3 reps x 10 sets rest: 4 min	Station 6: Hold the ball work: 3 reps x 10 sets rest: 4 min
	Station 3: Shuttle run work: 2 rep x 5 sets rest: 3 min	Station 7: Jump and kick ball work: 2 reps x 5 sets rest: 3 min	Station 3: Shutle run work: 3 reps x 10 sets rest: 4 min	Station 7: Jump and kick ball work: 3 reps x 10 sets rest: 4 min
	Station 4: Plyometric work: 2 rep x 5 sets rest: 3 min	Station 8: Kick the ball to the target work: 2 reps x 5 sets rest: 3 min	Station 4: Plyometric work: 3 reps x 10 sets rest: 4 min	Station 8: Kick the ball to the target work: 3 reps x 10 sets rest: 4 min
5-8 week	Station 1: Burpee work: 4 reps x 5 sets rest: 3 min	Station 5: Wall sit work: 2 reps x 5 sets rest: 3 min	Station 1: Burpee work: 4 reps x 10 sets rest: 5 min	Station 5: Wall sit work: 4 reps x 10 sets rest: 5 min
	Station 2: Squats work: 4 reps x 5 sets rest: 3 min	Station 6: Hold the ball work: 2 reps x 5 sets rest: 3 min	Station 2: Squats work: 4 reps x 10 sets rest: 5 min	Station 6: Hold the ball work: 4 reps x 10 sets rest: 5 min
	Station 3: Shutle run work: 4 reps x 5 sets rest: 3 min	Station 7: Jump and kick ball work: 2 reps x 5 sets rest: 3 min	Station 3: Shutle run work: 4 reps x 10 sets rest: 5 min	Station 7: Jump and kick ball work: 4 reps x 10 sets rest: 5 min
	Station 4: Plyometric work: 4 reps x 5 sets rest: 3 min	Station 8: Kick the ball to the target work: 2 reps x 5 sets rest: 3 min	Station 4: Plyometric work: 4 reps x 10 sets rest: 5 min	Station 8: Kick the ball to the target work: 4 reps x 10 sets rest: 5 min

time, group and interactions with the η^2_p formula with the following cutoff points: large (.138 >), medium (.059 >) to small (.01 >) (Cohen, 2013). Sixth, the delta percentage value (%Δ) was calculated with Equation 1:

(post-test - pre-test/ pre-test) × 100 (1)

The variable reliability values were tested to find the intra-class correlation coefficient (ICC). Finally, the significance level was set at $p < .05$, and all statistical analyses were performed with Jamovi v. 2.3.28.

RESULTS

Table 3 shows the results of the intra-class correlation coefficient (ICC), Shapiro-Wilk's (SW) and Levene's test (Lt) on the physical fitness, grit and technical performance variables.

Effect of CEFCT and CG on physical fitness

Based on the paired sample t-test results, it was observed pre-test and post-test differences in CEFCT related to physical fitness in all parameters (all, $p < .001$). At the same time, differences in physical fitness in all parameters in the CG were observed (all, $p < .001$) (Table 4).

According to the results of the 2-Way repeated measures ANOVA between CEFCT and CG, it was observed a significant effect of time on physical fitness in the LSDT ($F(1.78) = 230$, $p < .001$, $\eta^2_p = .747$), 10-mST ($F(1.78) = 116.82$, $p < .001$, $\eta^2_p = .600$), HAT ($F(1.78) = 172.5$, $p < .001$, $\eta^2_p = .689$), CMJ ($F(1.78) = 1.468.6$, $p < .001$, $\eta^2_p = .950$), SnR ($F(1.78) = 525.5$, $p < .001$, $\eta^2_p = .871$), M20-mFT ($F(1.78) = 405.40$, $p < .001$, $\eta^2_p = .839$), significant differences were found between groups on parameters LSDT ($F(1.78) = 202$, $p < .001$, $\eta^2_p = .721$), 10-mST ($F(1.78) = 14.1$, $p < .001$, $\eta^2_p = .153$), HAT ($F(1.78) = 34.0$, $p < .001$, $\eta^2_p = .304$), SnR ($F(1.78) = 34.6$, $p < .001$, $\eta^2_p = .307$), M20-mFT ($F(1.78) = 17.3$, $p < .001$, $\eta^2_p = .182$), but there was no difference in CMJ ($F(1.78) = .778$, $p = .381$, $\eta^2_p = .010$). Moreover, there was an interaction effect of time * group on physical fitness on the LSDT parameters ($F(1.78) = 199$, $p < .001$, $\eta^2_p = .719$), HAT ($F(1.78) = 98.8$, $p < .001$, $\eta^2_p = .559$), CMJ ($F(1.78) = 13.6$, $p < .001$, $\eta^2_p = .148$), SnR ($F(1.78) = 28.6$, $p < .001$, $\eta^2_p = .268$), M20-mFT ($F(1.78) = 5.00$, $p = .028$, $\eta^2_p = .060$), but there was no effect on 10-mST ($F(1.78) = 2.16$, $p = .146$, $\eta^2_p = .027$).

Effect of CEFCT and CG on Grit

Based on the results of the Paired sample t-test (Figure 3), we observed that there were pre-tes to post-test differences in CEFCT related to MI ($p < .001$, $d = -3.11$ [very large]), CE ($p < .001$, $d = -4.25$ [very large]), and CG related to MI ($p < .001$, $d = -2.61$ [very large]), CE ($p < .001$, $d = -3.99$ [very large]) on grit parameters.

According to the results of the 2-Way repeated measures ANOVA, it was observed an effect of time on MI ($F(1.78) = 658.0$, $p < .001$, $\eta^2_p = .894$), and CE ($F(1.78) = 1.360.42$, $p < .001$, $\eta^2_p = .946$), but there was no difference in group effects in MI ($F(1.78) = 1.48$, $p = .228$, $\eta^2_p = .019$), and CE ($F(1.78) = 1.31$, $p = .256$, $\eta^2_p = .017$). Moreover, there was a time * group interaction on MI ($F(1.78) = 10.5$, $p = .002$, $\eta^2_p = .118$), but it was not found on CE ($F(1.78) = 2.78$, $p = .099$, $\eta^2_p = .034$).

Effect of CEFCT and CG on technical performance

Based on the results of the Paired sample t-test (Table 5), it was observed differences from pre-test to post-test on CEFCT and CG related to technical performance on the parameters of sepak sila test ($p < .001$), serve tests ($p < .001$), and smash tests ($p < .001$).

According to the results of the 2-Way repeated measures ANOVA between CEFCT and CG, it was observed an effect of time on sepak sila test ($F(1.78) = 228.54$, $p < .001$, $\eta^2_p = .746$), serve tests ($F(1.78) = 229.32$, $p < .001$, $\eta^2_p = .746$) and smash tests ($F(1.78) = 221.54$, $p < .001$, $\eta^2_p = .740$), it was found a group effect on sepak sila test ($F(1.78) = 40.5$, $p < .001$, $\eta^2_p = .342$), serve tests ($F(1.78) = 4.37$, $p = .040$, $\eta^2_p = .053$), and smash tests ($F(1.78) = 12.6$, $p < .000$, $\eta^2_p = .139$). However, no time * group interaction was found on sepak sila test ($F(1.78) = 3.36$, $p = .071$, $\eta^2_p = .041$), serve tests ($F(1.78) = .355$, $p = .553$, $\eta^2_p = .005$), and smash tests ($F(1.78) = 1.16$, $p = .284$, $\eta^2_p = .015$).

DISCUSSION

The current study aims to investigate the impact of the CEFCT program compared with CG on the enhancement level of fitness, grit, and technical performance of youth sepak takraw athletes.

The first finding showed that CEFCT, which had been carried out for 8 weeks, was proven to have a better effect than CG in improving the quality of physical fitness. This finding can be explained by the fact that CEFCT has the advantage of combining the coach's verbal and behavioural encouragement during circuit training. Therefore, it becomes the main factor in physical fitness parameters related to SDT, 10-mST, HAT, CMJ, SnR, and M20-mFT for students. Youth sepak takraw athletes have experienced significant changes. These results are similar to several studies that support our research. For example, Romdhani et al. (2024) applied coach

Table 3. Results of intra-class correlation coefficient (ICC), Shapiro-Wilk (Sw) and Levene test (Lt).

Qutcomes	ICC	95%CI	Sw-CEFCT (pre - post)	Lt-CEFCT (pre - post)	Sw-CG (pre - post)	Lt-CG (pre - post)
Physical fitness						
LSDT (kg)	.95	.92–.97	.066	.123	.059	.190
10-mST (s)	.93	.90–.97	.118	.156	.356	.127
HAT (s)	.88	.84–.92	.695	.187	.236	.269
CMJ (cm)	.82	.72–.88	.161	.243	.328	.312
SnR (cm)	.80	.70–.87	.097	.191	.069	.324
M20-mFT (mL/kg/min)	.89	.84–.93	.637	.264	.066	.277
Grit						
MI (score)	.94	.91–.97	.314	.287	.092	.223
CE (score)	.90	.86–.95	.084	.111	.126	.149
Technical performance						
Sepak sila tests (score)	.83	.73–.89	.084	.139	.077	.182
Serve tests (score)	.81	.71–.87	.075	.255	.071	.163
Smash tests (score)	.87	.83–.91	.695	.252	.061	.184

CEFCT: Coach encouragement feedback circuit training; CG: Control groups; LSDT: Leg strength dynamometer test; 10-mST: 10-m speed test; HAT: Hexagon agility test; CMJ: Counter movement jump; SnR: Sit and reach test; M20-mFT: Multistage 20-m fitness test; MI: Maintaining interest; CE: Continuing effort; ICC: Intra-class correlation coefficient; CI: Confidence interval; SW: Shapiro-wilk; LT: Levene test.

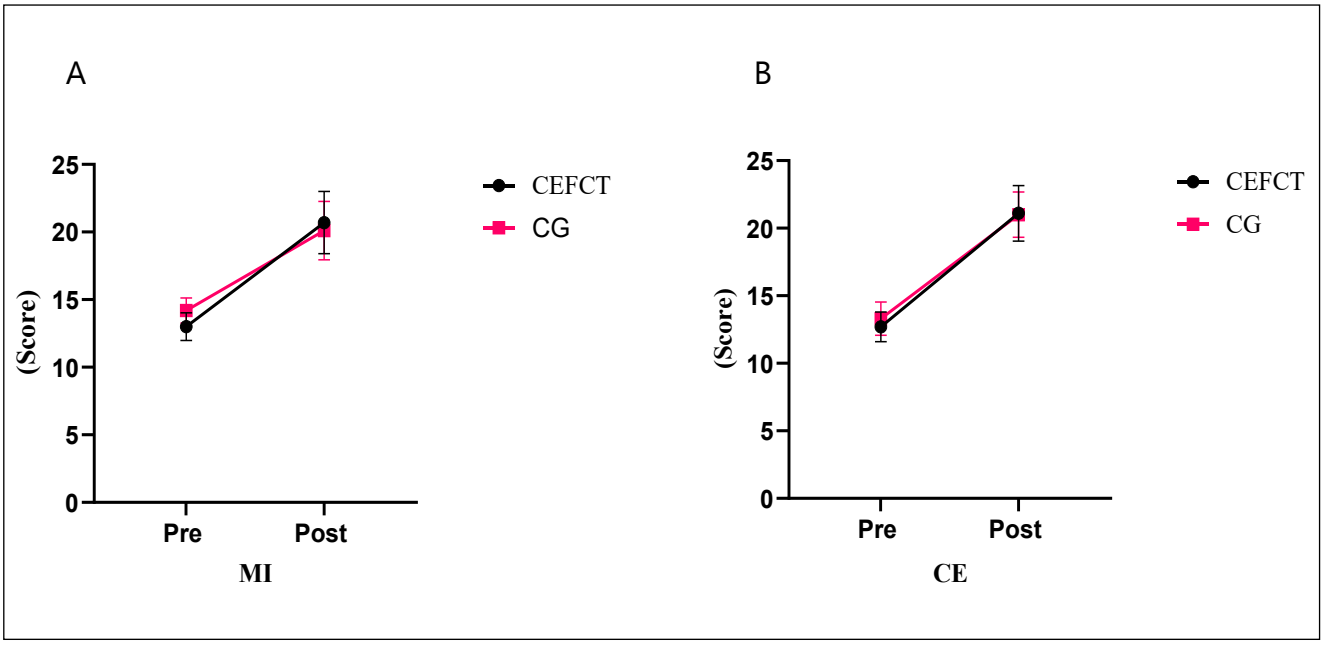

Figure 3. Changes in grit (A [MI], B [CE]) parameters in coach encouragement feedback circuit training (CEFCT) and control group (CG) for pre- and post-test during the 8-week intervention.

Table 4. Physical fitness changes in the coach encouragement feedback circuit training (CEFCT) and control group (CG) for pre- and post-test during the 8-week intervention.

Qutcomes	CEFCT (n = 40)					CG (n = 40)					2-Way Repeated ANOVA		
	Paired Samples T-Test					Paired Samples T-Test							
	Pre	Post	% Δ	p	ES	Pre	Post	% Δ	p	ES	Time	Group	Time * Group
LSDT (kg)	52.1 ± 1.46	82.3 ± 13.21	+58	< .001	-2.32 [very large]	51.2 ± 1.14	52.3 ± 1.07	+2.1	< .001	-2.68 [very large]	$F_{(1.78)} = 230$ $p < .000$ $\eta^2_p = 0.747$	$F_{(1.78)} = 202$ $p < .000$ $\eta^2_p = 0.721$	$F_{(1.78)} = 199$ $p < .000$ $\eta^2_p = 0.719$
10-mST (s)	5.40 ± 0.93	4.35 ± 0.78	-19.4	< .001	1.25 [large]	5.82 ± .65	5.02 ± .58	-13.7	< .001	1.17 [medium]	$F_{(1.78)} = 116.82$ $p < .000$ $\eta^2_p = .600$	$F_{(1.78)} = 14.1$ $p < .000$ $\eta^2_p = .153$	$F_{(1.78)} = 2.16$ $p = 0146$ $\eta^2_p = .027$
HAT (s)	18.6 ±1.19	16.7 ± 0.94	-10.2	< .001	2.05 [very large]	19.0 ± .94	18.7 ± .83	-1.6	.001	0.54 [small]	$F_{(1.78)} = 172.5$ $p < .000$ $\eta^2_p = .689$	$F_{(1.78)} = 34.0$ $p < .000$ $\eta^2_p = .304$	$F_{(1.78)} = 98.8$ $p < .000$ $\eta^2_p = .559$
CMJ (cm)	20.2 ± 1.75	49.3 ± 5.75	+144.1	< .001	-4.56 [very large]	22.2 ± 1.80	46.1 ± 5.74	+107.7	< .001	-3.99 [very large]	$F_{(1.78)} = 1,468.6$ $p < .000$ $\eta^2_p = 0.950$	$F_{(1.78)} = .778$ $p = .381$ $\eta^2_p = 0.010$	$F_{(1.78)} = 13.6$ $p < .000$ $\eta^2_p = 0.148$
SnR (cm)	13.1 ± 1.81	27.3 ± 3.10	+108.4	< .001	-4.00 [very large]	12.7 ± 2.49	21.4 ± 4.89	+68.5	< .001	-1.68 [large]	$F_{(1.78)} = 525.5$ $p < .000$ $\eta^2_p = .871$	$F_{(1.78)} = 34.6$ $p < .000$ $\eta^2_p = .307$	$F_{(1.78)} = 28.6$ $p < .000$ $\eta^2_p = .268$
M20-mFT (mL/kg/min)	36.1 ± 2.98	46.4 ± 2.73	+28.5	< .001	-2.65 [very large]	34.4 ± 3.44	42.5 ± 5.05	+23.5	< .001	-1.90 [large]	$F_{(1.78)} = 405.40$ $p < .000$ $\eta^2_p = .839$	$F_{(1.78)} = 17.3$ $p < .000$ $\eta^2_p = .182$	$F_{(1.78)} = 5.00$ $p = .028$ $\eta^2_p = .060$

CEFCT: Coach encouragement feedback circuit training; CG: Control groups; LSDT: Leg strength dynamometer test; 10-mST: 10-m speed test; HAT: Hexagon agility test; CMJ: Counter movement jump; SnR: Sit and reach test; M20-mFT: Multistage 20-m fitness test; % Δ: Delta percentage. Significant differences were determined at the $p < .05$ level.

Table 5. Changes in technical performance in the coach encouragement feedback circuit training (CEFCT) and control group (CG) for pre- and post-test during the 8-week intervention.

Qutcomes	CEFCT (n = 40)					CG (n = 40)					2-Way Repeated ANOVA		
	Paired Samples T-Test					Paired Samples T-Test							
	Pre	Post	% Δ	p	ES	Pre	Post	% Δ	p	ES	Time	Group	Time * Group
Sepak sila tests (score)	15.6 ± 1.43	21.1 ± 2.33	+35.3	< .001	-2.10 [very large]	13.2 ± 2.15	17.6 ± 3.66	+33.3	< .001	-1.36 [large]	$F_{(1.78)} = 228.54$ $p < .000$ $\eta^2_p = .746$	$F_{(1.78)} = 40.5$ $p < .000$ $\eta^2_p = .342$	$F_{(1.78)} = 3.36$ $p = .071$ $\eta^2_p = .041$
Serve tests (score)	8.65 ± 1.92	11.95 ± 2.14	+38.2	< .001	-1.94 [large]	8.03 ± 1.10	11.07 ± 2.09	+37.9	< .001	-1.50 [large]	$F_{(1.78)} = 229.32$ $p < .000$ $\eta^2_p = .746$	$F_{(1.78)} = 4.37$ $p = .040$ $\eta^2_p = .053$	$F_{(1.78)} = .355$ $p = .553$ $\eta^2_p = .005$
Smash tests (score)	8.20 ± 1.30	10.97 ± 1.10	+33.8	< .001	-1.74 [large]	7.53 ± 1.24	9.93 ± 1.64	+31.9	< .001	-1.58 [large]	$F_{(1.78)} = 221.54$ $p < .000$ $\eta^2_p = .740$	$F_{(1.78)} = 12.6$ $p < .000$ $\eta^2_p = .139$	$F_{(1.78)} = 1.16$ $p = .284$ $\eta^2_p = .015$

CEFCT: Coach encouragement feedback circuit training; CG: Control groups; % Δ: Delta Percentage. Significance is determined at the $p < .05$ level.

encouragement during the training process for 36 sports science student-athletes, and the results of this research showed that the strength and endurance parameters of athletes had increased. Another study reported similar results; verbal encouragement feedback from coaches in training sessions would be a positive tool to improve the quality of physical fitness among soccer athletes (Hammami et al., 2023).

Meanwhile, Sahli et al. (2020) reported that 16 male students participated in a verbal encouragement program during exercise, and their research showed a positive impact on a high physical level. The majority of previous studies support our findings about the changes in physical fitness that occur due to the combination of coaches' encouragement during specific training (Jouira et al., 2024; Puce et al., 2022; Sahli et al., 2022; Selmi et al., 2017), especially in our research through circuit training. For example, previous research highlighted that the impact of coach encouragement integrated into training can improve speed levels (Sahli et al., 2024) and aerobic performance of athletes (Romdhani et al., 2024). Pacholek and Zemková (2022) reported that coach encouragement could be an external stimulus for athletes to achieve high physical fitness performance. In addition, the findings of Aydi et al. (2022) confirmed and supported this research that coach verbal encouragement during the dribbling circuit was a powerful strategy for improving the physical quality of student-athletes.

The second finding showed that CEFCT provided advantages in increasing grit among youth sepak takraw athletes. This finding is due to the encouragement that the coach gave through verbal and behaviour, which was the main trigger for the emergence of grit in young sepak takraw athletes. Recent research also reports encouragement given by coaches to young athletes during the training process to optimise psychological performance towards higher levels (Khayati et al., 2024). Verbal encouragement uttered by a coach, such as: "Come on, come on, you are amazing" or "Do it again", could be used to promote enjoyment and a better mood among athletes (Sahli et al., 2020). Besides that, other studies reported that coach encouragement during soccer training reduced the risk of mental disorders in young athletes (Díaz-García et al., 2021). Similarly, Edwards et al. (2018) suggest integrating coaches' encouragement in exercise because it would enhance motivation levels. Additionally, Selmi et al. (2023) involved 17 male youth soccer players in a program of verbal encouragement from a coach during small-sided game practice, and the results proved that the psychophysiological response, mood, and enjoyment of practice had improved drastically. Furthermore, Aydi et al. (2022) reported a finding that was similar to this study: the coach's verbal encouragement integrated during dribbling circuit training improved an important aspect, namely physiological responses.

The latest findings in our research showed that CEFCT is a positive tool for improving and developing the technical performance quality in youth sepak takraw athletes. The majority of these findings are similar to several previous studies. Research by Rusmana et al. (2023) applied coach encouragement during a tactical game program to 20 young basketball athletes, and the findings showed that tactical game with encouragement (TG+E) was the right solution to improve decision making (DM) and execution skills (SE). Recent research by Jumareng et al. (2024) reported that technical performance among soccer athletes showed positive changes after an experienced coach's verbal encouragement program during small-sided games training. Selmi et al. (2023) also supported this finding that coaches used verbal encouragement during training sessions, which would improve the quality of technical performance in football. Similar results were also described by Hammami et al. (2023), who stated that the improvement in technical performance was caused by a long-term coach verbal encouragement program. A similar finding was also reported by Kilit et al. (2019); young male tennis players who got coach encouragement program sessions during tennis practice showed positive results in improving technical performance in tennis.

This study has several main strengths, namely: (i) creating a program that combines coach encouragement feedback in the form of verbal and behaviour during circuit training, (ii) creating a CEFCT program that is easy to implement on a daily basis by coaches and youth sepak takraw athletes, (iii) This is the first study that used the CEFCT program to increase the level of physical fitness, grit and technical performance in sepak takraw athletes. This study has several limitations that need to be acknowledged: (i) This study involved a small number of participants, who came from one Sepak Takraw Association Organisation from Sukabumi City, Indonesia; (ii) this study only involved male participants. It is recommended that future research overcome the limitations in this research by adding more participants from several Sepak Takraw Association Organisations in Indonesia and also involving young female Sepak Takraw athletes.

CONCLUSIONS

Based on the results of this study, the CEFCT program, which has been implemented for 8 weeks, has proven to be effective in increasing the level of physical fitness, grit and technical performance in youth Sepak Takraw athletes. In addition, this study clearly shows that CEFCT has a greater impact than CG. This research contributes as an innovation

to developing a training program using CEFCT, so it is expected that it can be used by coaches and athletes continuously in the future to generate optimal physical fitness, grit and technical performance, which in the end can enhance the athlete's performance.

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