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POLISH JOURNAL OF PHYSIOTHERAPY

OFICJALNE PISMO POLSKIEGO TOWARZYSTWA FIZJOTERAPII

THE OFFICIAL JOURNAL OF THE POLISH SOCIETY OF PHYSIOTHERAPY

NR 5/2023 (23) KWARTALNIK ISSN 1642-0136



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Young athletes' physical fitness increases the impact of traditional sport intervention: 11 weeks of movement experience

Poprawa sprawności fizycznej młodych sportowców poprzez tradycyjne interwencje sportowe: 11 tygodni doświadczenia ruchowego

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Abstract

This study aims to investigate the effect of traditional sports in order to improve physical fitness of young athletes. Researchers adopted an 11-week randomized controlled trial design. Participants included young athletes from Sultan Ageng Tirtayasa University (Indonesia) who were allocated to TSG (n = 20) and CG (n = 20). Analysis of Students' t-tests for paired samples used to test differences in physical fitness among males and females in two groups at the pre-test and post-test stages. The effect size test (Cohen's d) was used in this research. The first findings showed that male participants in TSG had differences in physical fitness in the pre-test and post-test stages related to Multi-stage ($p < 0.001$, $d = -2.17$), Shuttle run: 4×10 meters ($p < 0.001$, $d = 2.43$), 30 meter run test ($p < 0.001$, $d = 1.85$) and sit and reach test ($p = 0.002$, $d = -1.41$), while male participants in CG had differences in physical fitness in terms of Shuttle run: 4 ×10 meters ($p < 0.001$, $d = 1.69$), Run test 30 meters ($p < 0.001$, $d = 1.64$), but no differences were found for other components. The second finding showed that female participants in TSG had differences in physical fitness in the pre-test and post-test stages related to Multi-stage ($p < 0.001$, $d = -1.53$), Shuttle run: 4×10 meters ($p < 0.001$, $d = 2.76$), 30 meter Run test ($p < 0.001$, $d = 2.02$) and Sit and reach test ($p < 0.001$, $d = -1.72$), while the female participants in CG had differences in physical fitness in the 30 meter Run test ($p < 0.001$, $d = 2.87$), but no differences were found for the other components. In conclusion, this research proves that traditional sport for 11 weeks can improve the physical fitness of young athletes.

Keywords

traditional sport, physical fitness, young athletes

Streszczenie

Celem tego badania jest zbadanie wpływu tradycyjnych sportów na poprawę sprawności fizycznej młodych sportowców. Badacze przyjęli projekt badania kontrolowanego z randomizacją trwającego 11 tygodni. Uczestnikami byli młodzi sportowcy z Uniwersytetu Sultana Agenga Tirtayasa (Indonezja), którzy zostali przydzieleni do grupy TSG (n = 20) i grupy kontrolnej CG (n = 20). Analiza testów t Studenta dla prób sparowanych została użyta do zbadania różnic w sprawności fizycznej między mężczyznami i kobietami w dwóch grupach na etapie przedtestowym i potestowym. W badaniu użyto testu wielkości efektu (d Cohena). Pierwsze wyniki wykazały, że mężczyźni w grupie TSG mieli różnice w sprawności fizycznej na etapie przedtestowym i potestowym związane z testem wieloetapowym ($p < 0.001$, $d = -2.17$), biegiem wahadłowym: 4×10 metrów ($p < 0.001$, $d = 2.43$), testem biegu na 30 metrów ($p < 0.001$, $d = 1.85$) oraz testem siadu z wysięgiem ($p = 0.002$, $d = -1.41$), podczas gdy mężczyźni w grupie CG mieli różnice w sprawności fizycznej w zakresie biegu wahadłowego: 4 ×10 metrów ($p < 0.001$, $d = 1.69$), testu biegu na 30 metrów ($p < 0.001$, $d = 1.64$), ale nie stwierdzono różnic w innych komponentach. Badanie pokazało, że kobiety w grupie TSG miały różnice w sprawności fizycznej na etapie przedtestowym i potestowym związane z testem wieloetapowym ($p < 0.001$, $d = -1.53$), biegiem wahadłowym: 4×10 metrów ($p < 0.001$, $d = 2.76$), testem biegu na 30 metrów ($p < 0.001$, $d = 2.02$) oraz testem siadu z wysięgiem ($p < 0.001$, $d = -1.72$), podczas gdy kobiety w grupie CG miały różnice w sprawności fizycznej w teście biegu na 30 metrów ($p < 0.001$, $d = 2.87$), ale nie stwierdzono różnic w innych komponentach. Podsumowując, to badanie dowodzi, że tradycyjny sport uprawiany przez 11 tygodni może poprawić sprawność fizyczną młodych sportowców.

Słowa kluczowe

tradycyjny sport, sprawność fizyczna, młodzi sportowcy

Introduction

Over the last two decades, physical fitness has still got attention among coaches in all types of sports [1, 2]. Data shows that after the COVID-19 pandemic crisis, physical fitness among young athletes has not yet increased significantly [3]. Basically, physical fitness is an important element for young athletes in carrying out sports activities [4, 5], because physical fitness can be a predictor for success in sporting achievements [6]. According to Gani et al [3], those with a good level of physical fitness will have a greater chance of winning the match, but on the other hand, a low level of physical fitness can result in defeat and reduced performance. Young athletes with a well-developed level of physical fitness could not get tired easily, have good physical skills [7], and have optimal motor movements [8], so they will not experience fatal injuries [2]. Previous research results report that physical fitness is one of the determining factors for athletes to achieve the highest performance in competition [9, 10]. Briefly, a young athlete must develop and improve biomotor abilities related to endurance, agility, speed, reaction and flexibility to a much higher level [11]. Apart from that, good physical fitness can prevent various chronic diseases [12]. Considering the importance of physical fitness for young athletes, effective efforts are needed to maintain and improve physical fitness through traditional sports.

Traditional sports are closely related to the cultural traditions which are passed down from generation to generation and has been recognized by UNICEF as the cultural identity of a country [13]. Data records that there are several world-famous traditional sports such as tai chi, dragon boat, lion dance which are originated from China [14]. Indonesia has various types of traditional sports, for example Hadang, Sondah, Engrang, Gatrik or Bentengan [15, 16]. The popularity of traditional sports is currently increasing and competing with soccer, handball or other sports. Even now, traditional sports have been competed in national sports event in Indonesia. Basically, the characteristic of traditional sports provides a movement experience through a fun game [17, 18], with a high competition among athletes. Based on previous study data, it is proven that traditional sports have several benefits, for example Mujriah et al [16], applied traditional sports to elementary school children and the results were proven to improve fundamental movement skills and social attitudes. In addition, traditional sports are believed to have a positive effect on psychological and physical development [19]. According to a previous study, it was reported that traditional sports not only have benefits for developing physical conditions in normal children but also in children with disabilities [20]. However, currently the popularity of traditional sports shows decline due to the emergence of advanced technology such as smartphones, YouTube [21]. However, several studies on traditional sports have been well documented [22-29], but it was still limited research on traditional sports to improve athletes' physical fitness through an 11-week randomized controlled trial. In this study we presented novelty in terms of investigating the effects of traditional sports on physical fitness through an 11-week randomized controlled trial and analyzing physical

fitness data using the Jamovi application. It is hoped that this research can contribute as information to coaches, teachers and practitioners in the field of sports about the importance of using traditional sports activities for aspects of physical fitness. Therefore, this study aims to investigate the effects of traditional sports on physical fitness in young athletes through an 11-week randomized controlled trial.

Material and methods

Ethical Considerations

All participants had read all rules in this study and agreed to be involved in this research by signing a consent letter to become participants and be actively involved in the intervention program. In addition, this research was carried out in accordance with Helsinki guidelines and the protocol was approved by the Ethics Committee of Sultan Ageng Tirtayasa University (Indonesia) with number: 706/LPPM-Untirta/2023).

Participants

Participants were athletes in traditional game sports, male ($n = 25$) and female ($n = 20$) from Sultan Ageng Tirtayasa University (Indonesia). Participants were selected based on the inclusion criteria, namely: (i) not sick, (ii) not experiencing fatal injuries, (iii) not taking part in a sporting event. Of the 45 athletes, only 40 were selected based on the inclusion criteria (See CONSORT Fig. 1). Researchers calculated a priori the power statistics using G*Power (v. 3.1.9.7). A sample size of at least 20 participants was required to have sufficient power (> 0.80) based on a chosen alpha of 0.05. Then athletes were allocated into the traditional sport group (TSG, $n = 20$) and the control group (CG, $n = 20$) with the help of random analysis (<https://www.randomizer.org/>). The information of age, height, weight and body mass index (BMI) is presented in Table 1.

Measure

Physical fitness among athletes were measured using several test items from previous research [2]. The test consists of:

Multi-stage (ml/kg/min)

This instrument was used to measure an athlete's VO_{2max} endurance level. In this test participants ran back and forth for 20 meters. First, the participant stood at cone A after the audio bleep sounded, then the participant ran towards cone B. This back and forth running activity was carried out continuously until the participant could no longer run or could not follow the bleep sound. The score was calculated from athlete's VO_{2max} when stopping at running level. This test has Inter class correlation (ICC) = 0.82.

Shuttle Run: 4×10 meters (s)

This instrument was used to measure the agility. First, the participant stood at cone A after the instruction "Go", then the participant ran as fast as possible towards cone B. The back and forth running activity was carried out 4 times for 10 meters. The score was calculated from the total duration of 4 times ran back and forth. This test has an ICC = 0.80.

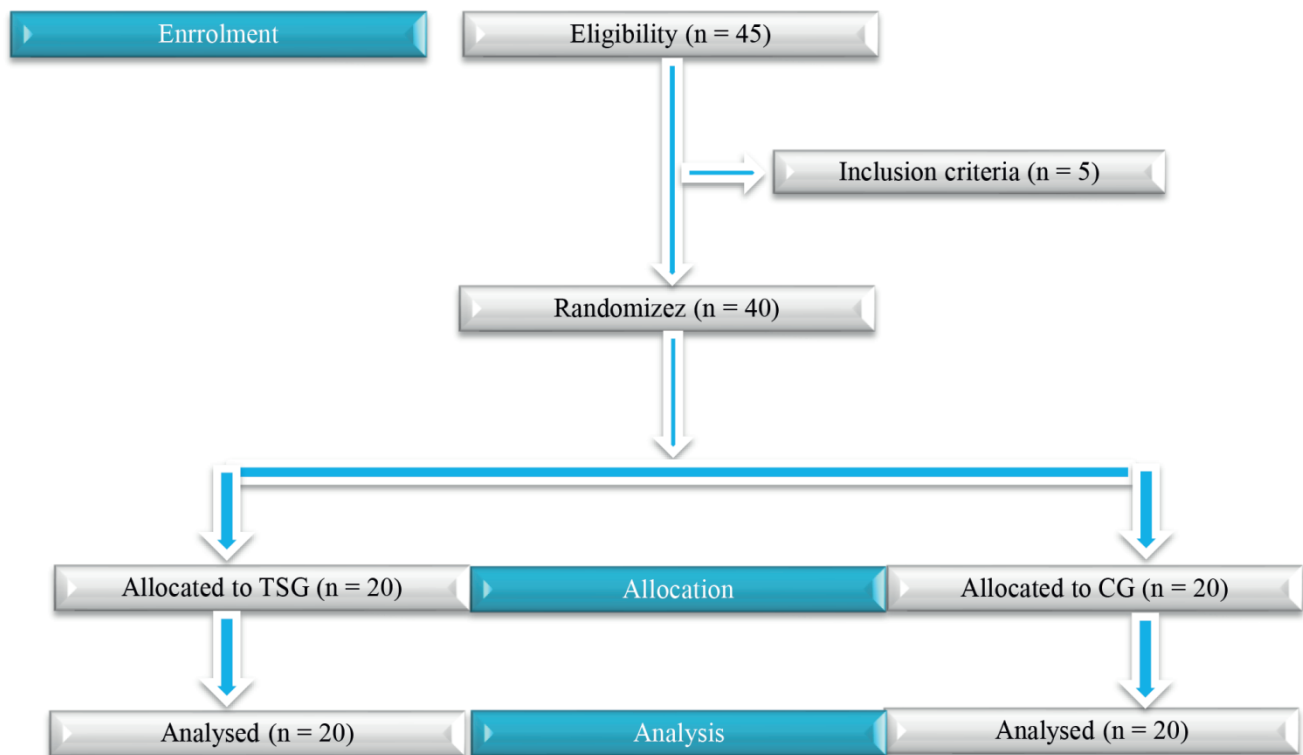


Figure 1. CONSORT diagram

Table 1. Mean \pm SD from the two groups

Group	Gender	n	Age (year)		High (cm)		Weight (kg)		BMI	
			Mean	SD	Mean	SD	Mean	SD	Mean	SD
TSG	Males	10	17.7	0.94	158.1	4.17	57.0	1.41	21.9	0.99
	Females	10	18.2	0.63	154.7	2.94	53.8	3.19	21.0	1.24
CG	Males	10	18.6	0.84	156.5	4.22	58.3	2.83	22.8	1.68
	Females	10	19.30	0.94	159.2	2.89	55.9	3.03	20.7	0.67

Run test 30 meter (s)

This instrument can be used to measure running speed for 10 meters. First, participants stood on the start line and after the "Go" instruction, participants ran as fast as possible towards the finish line. The score was calculated from the total running duration. This test has an ICC = 0.88.

Sit and Reach Test (cm)

According to Isnaini et al [2], this instrument was used to measure the level of flexibility of an athlete's body. Participants sat on the floor, removed their shoes and straightened their legs until reach the table surface. Then the participant slowly bent the body and push the object forward using both arms along the measuring line as far as possible. The score was calculated by measuring the furthest distance. This test has an ICC = 0.84.

Design and procedure

This true experimental research with an 11-week randomized controlled trial design was carried out from September–November 2023. This research was carried out 3 times a week, namely on Wednesday, Friday and Sunday in the sport fields of Sultan Ageng Tirtayasa University (Indonesia). The first meeting was held in the first week on September 6 2023, all participants carried out a pre-test, namely physical fitness, from 08.10–10.10 a.m. The second meeting was held on September 8 2023, the experimental group carried out a traditional sports program and the control group only carried out ladder drill exercises. The program for both groups was carried out until November 17 2023. The last meeting was on November 19 2023, all participants carried out a post-test physical fitness from 09.00–11.00.

Traditional sports program

The traditional sports intervention program was carried out at 08.00-09.00 a.m., at the Sultan Ageng Tirtayasa University field. Before the program started, all participants were required to wear sports clothes and shoes and had been checked for health condition. Apart from that, all participants were required to do a warm-up. Then the participants played a traditional sport, namely Hadang, which consists of two teams with five people in each team. This sport was played by following this instruction. First, the

defense team occupied their own line with both feet on the line, while the opponent team entered. The game started after the referee blows the whistle. The opponent team crossed the front line and should avoid being caught or touched by the defense team. The defense team tried to touch the body of opponent team with their hands while their both feet resting on the line. When the game has been running for 20 minutes, the referee sounded the whistle for a break and the the position was changed. This game was played 2 x 20 minutes with a 5 minute break.

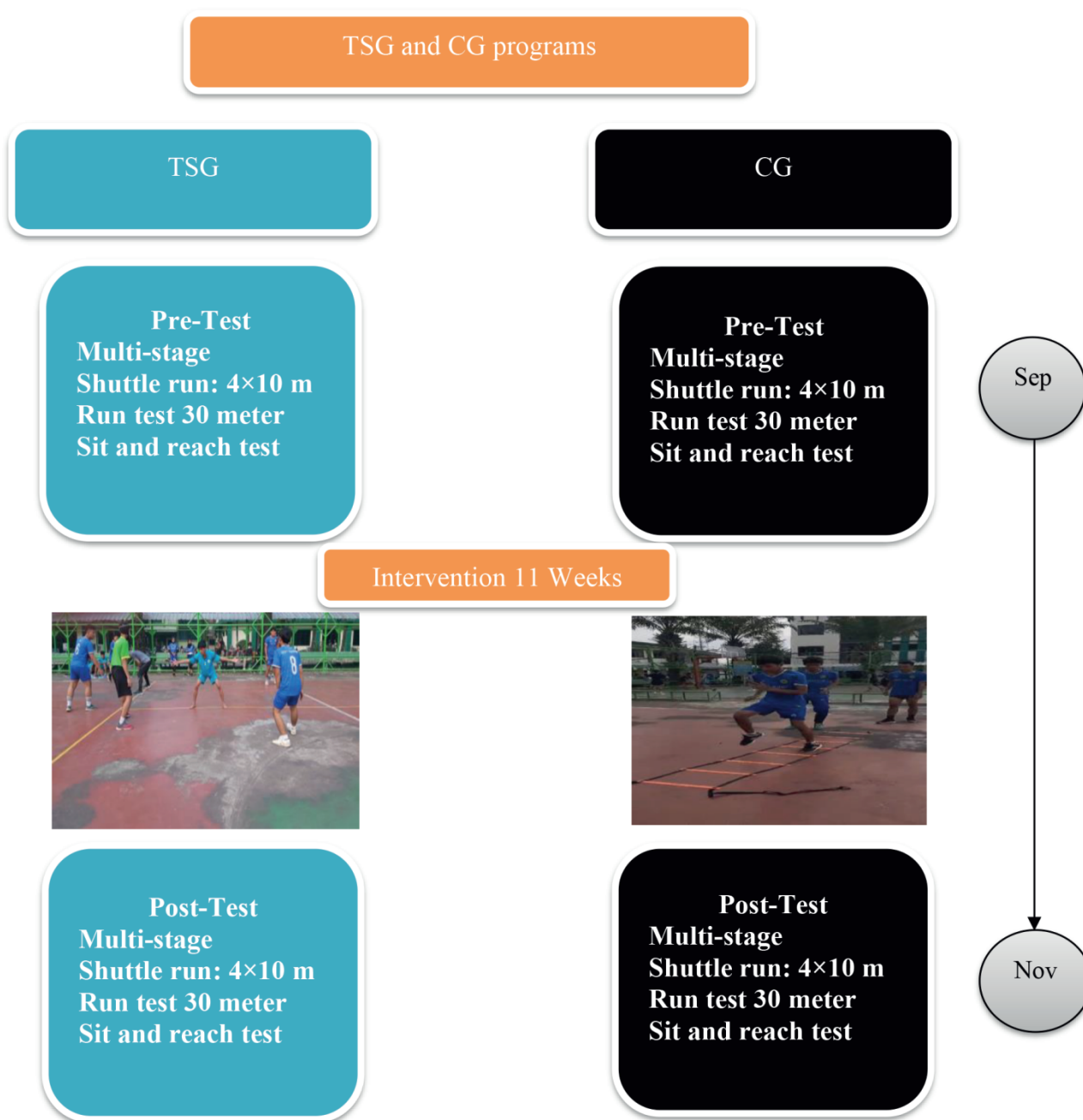


Figure 2. TSG and CG programs

Statistical Analysis

Descriptive statistics include the mean \pm standard deviation tested in this study. The normality test via Shapiro-Wilk was assumed to be normally distributed. Students' t-test for paired samples analysis was used [24], to test differences in physical fitness between the TSG and CG groups in male and female athletes at the pre-test and post-test stages. The effect size test (Cohen's d) was used in this research with the formula: trivial: 0.00-0.19, small effect: 0.20-0.49, moderate effect: 0.50-0.79, large effect: 0.80 > [25]. All data were analyzed using the Jamovi v.2.3 tool with a significance level of $p < 0.05$.

Results

Based on Table 2, it is proven that all variables have a normal distribution ($p > 0.05$). Male participants in TSG have differences in physical fitness in the pre-test and post-test stages related to Multi-stage ($p < 0.001$, $d = -2.17$), Shuttle run: 4 \times 10 meters ($p < 0.001$, $d = 2.43$), 30 meter run test ($p < 0.001$, $d = 1.85$) and sit and reach test ($p = 0.002$, $d = -1.41$) are shown in Table 2.

Meanwhile, for the male participants in CG, there are differences in physical fitness in the pre-test and post-test stages in terms of Shuttle run: 4 \times 10 meters ($p < 0.001$, $d = 1.69$), Run test 30 meters ($p < 0.001$, $d = 1.64$) but there was no difference for other components.

Table 2. Differences in physical fitness between TSG and CG for males at the pre-test and post-test stages

Physical fitness component	Group	n	Pre-Test Mean \pm SD	Post-Test Mean \pm SD	NT	t	p	Cohen's d
Multi-stage (ml/kg/min)	TSG	10	32.7 \pm 1.25	39.2 \pm 3.46	0.363	-6.87	< 0.001	-2.17
	CG	10	32.7 \pm 1.25	33.3 \pm 4.19	0.091	-0.547	0.598	-0.17
Shuttle run: 4 \times 10 meters (s)	TSG	10	68.2 \pm 4.39	58.3 \pm 2.54	0.959	7.70	< 0.001	2.43
	CG	10	69.7 \pm 4.47	62.4 \pm 2.46	0.173	5.34	< 0.001	1.69
Run test 30 meter (s)	TSG	10	5.75 \pm 0.92	3.66 \pm 0.57	0.349	5.84	< 0.001	1.85
	CG	10	6.34 \pm 0.97	4.68 \pm 0.89	0.176	5.19	< 0.001	1.64
Sit and reach test (cm)	TSG	10	4.30 \pm 0.67	9.00 \pm 3.16	0.168	-4.46	0.002	-1.41
	CG	10	6.00 \pm 1.05	6.20 \pm 1.48	0.525	-0.375	0.716	-0.11

Note: TSG-Traditional sport group, CG- Control group, SD-Standar deviasi, NT-Normality test, Significance level at $p < 0.05$

Based on Table 3, the female participants in TSG have differences in physical fitness in the pre-test and post-test stages related to Multi-stage ($p < 0.001$, $d = -1.53$), Shuttle run: 4 \times 10 meters ($p < 0.001$, $d = 2.76$), 30 meter run test ($p < 0.001$, $d = 2.02$) and sit and reach test ($p < 0.001$, $d = -1.72$).

Meanwhile, for the female participants in CG, There are differences in physical fitness in the pre-test and post-test stages related to the 30 meter run test ($p < 0.001$, $d = 2.87$) but there is no difference for the other components.

Table 3. Differences in physical fitness between TSG and CG for girls in the pre-test and post-test stages

Physical fitness component	Group	n	Pre-Test Mean \pm SD	Post-Test Mean \pm SD	NT	t	p	Cohen's d
Multi-stage (ml/kg/min)	TSG	10	31.7 \pm 1.64	37.9 \pm 4.61	0.106	-4.84	< 0.001	-1.53
	CG	10	31.4 \pm 1.43	31.5 \pm 1.08	0.441	-0.198	0.847	-0.06
Shuttle run: 4 \times 10 meters (s)	TSG	10	69.3 \pm 4.11	64.6 \pm 3.24	0.111	8.73	< 0.001	2.76
	CG	10	70.4 \pm 3.98	65.8 \pm 5.45	0.600	1.85	0.097	0.58
Run test 30 meter (s)	TSG	10	6.74 \pm 0.56	5.08 \pm 0.81	0.907	6.40	< 0.001	2.02
	CG	10	7.25 \pm 0.74	5.25 \pm 0.77	0.441	9.06	< 0.001	2.87
Sit and reach test (cm)	TSG	10	4.10 \pm 0.87	6.40 \pm 1.17	0.067	-5.44	< 0.001	-1.72
	CG	10	6.90 \pm 1.20	7.30 \pm 1.89	0.198	-0.937	0.373	-0.29

Note: TSG-Traditional sport group, CG- Control group, SD-Standar deviasi, NT-Normality test, Significance level at $p < 0.05$

Discussion

This study aims to investigate the effects of traditional sports on physical fitness through an 11-week randomized controlled trial.

First, we found that physical fitness in TSG increased positively from pre-test to post-test in both males and females athletes. Meanwhile, male participants in CG only showed an increase in the Shuttle run component: 4×10 meters, 30 meter Run test and female participants only experienced an increase in the 30 meter Run test. This means that TSG has much better effect than CG in improving physical fitness components. This is because Hadang as a traditional sport have an attractive concept of fun and challenging games [26], so athletes were enthusiastic to be actively involved [16] in developing their physical fitness [27]. This is in line with previous research which reported that the advantages of traditional sports can increase overall potential, especially those related to the physical component [20]. Apart from that, the traditional sport of Hadang promoted games with the characteristics of chasing and catching/touching other players, which encouraged athletes to run and turn around to follow movement of opposing team. This activity cause athletes who has low physical fitness component (endurance, speed, agility and flexibility) increased to a higher level. This is also inline with other results of Saputra et al [28], that traditional sport was a powerful event for improving physical condition to be better than before. On the other hand, a previous study acknowledged that traditional sports can increase the level of active physical activity, so that this has the potential to influence the quality of physical fitness [23]. Bhinder et al [29], reported that if an activity has an attractive element for athletes, it must be elevate physical fitness to achieve an optimal ccondition. In the other hand, if the activity is unattractive, the athletes will feel boring in exercising which

is associated with adverse outcomes for physical fitness [24]. Finally, we emphasize that the results of this research remain consistent with previous studies conducted in Indonesia and other countries, which show that traditional sports are an effective method used by coaches or teachers to improve poor physical fitness [20, 21, 22, 30, 31].

The uniqueness and novelty of our findings is that traditional sports with Hadang activities have been proven to be effective in improving the quality of physical fitness among young athletes through an 11-week randomized controlled trial. However, the main limitation in this research that should be acknowledged is this study only involved participants (athletes) from the sports department at one university in Indonesia. Therefore, it is recommended that future research needs to be carried out by adding the quantity of participants from several universities in Indonesia or from other countries as comparisons.

Conclusions

Based on the results, it can be firmly concluded that traditional sports programs can be an alternative in training that can be used to improve and develop the quality of physical fitness among young athletes, both males and females. This research contributes as an innovation in the training process to improve physical fitness at the level of young athletes and as important information for coaches and practitioners in the competitive sports.

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