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RESEARCH ARTICLE

Effects of a Short-term Training Program on the Technical Performance of Shuttlecock Athletes Aged 10-11

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Abstract:

Background:

Shuttlecock has become a popular sport in Vietnam, turning into a strength of the country. It is a sport with diverse techniques and is challenging to practice. To train shuttlecock athletes, coaches need to give the technical training appropriately from the early stage of the training process.

Methods:

The current study evaluated the effectiveness of a short-term skill training program on the technical abilities of young shuttlecock athletes. Seventeen adolescent shuttlecock athletes (10 to 11 years) playing for two shuttlecock teams in Ho Chi Minh City were divided into the experimental group (n=9) and the control group (n=8). The training program included five sessions per week (60 minutes of practicing technical skills each), and it was conducted for three months. Sixteen exercises were chosen to develop the experimental group's technical skills, such as serving, spiking, passing, and slamming for the experimental group. The study also developed a skill-testing battery that was reliable and valid to assess the technical abilities of the participants.

Results:

The results showed that the experimental group's technical performance (W=19.47%) was much better than those of the control group (W=12.85%).

Conclusion:

In conclusion, the short-term training program effectively enhanced the technical performance of the young shuttlecock athletes.

Keywords: Exercises, Technical skills, Technical performance, Shuttlecock athletes, Ho Chi Minh city, Shuttlecock.

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1. INTRODUCTION

The shuttlecock is an Asian game in which the players keep a shuttlecock in the air using their feet but not using their hands. It originated from an ancient game in China about 2000 years ago [1]. It was not popular in the 50s and 60s in Vietnam, but it has been recognized as a national sport since the 70s. It has also been included in the national school physical education curriculum. In recent years, the shuttlecock has been considered the most potent sport in Vietnam. With the highest achievement of the Vietnam shuttlecock team in the 10th Shuttlecock World Championships organized in France in 2019, the shuttlecock gained some recognition from Vietnamese people as well as international fans [2].

The shuttlecock is a competitive sport played on a court with a net in the middle, similar to badminton and volleyball. In the game, due to the swift and fierce movement of the shuttlecock, the players are required to have good physical capability, stable psychology, relevant tactical skills, and high technical skills to score and win the game. According to Martens (2012) [3], technical skills are specific procedures to move one's body to perform an activity. Athletes are routinely

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trained in technical and tactical skills [4]. For example, in basketball, some technical skills are required, such as dribbling, passing, and shooting, which are central in training. No matter how good his physical strength is, an athlete can not perform effectively in a competition without technical skills, especially in a shuttlecock game. Players need to have high dexterity in movement. It is undeniable that the technical skills of shuttlecock athletes play a crucial role in the training program. In the study conducted by Pham (2018) [5], it is found that technical skills in a shuttlecock game were determinants over other factors, such as physical strength, psychology, and anthropometric characteristics. Thus, to achieve high results in competition, shuttlecock athletes need to know how to integrate the technical skills from primary to difficulty, such as kicking, passing, serving, spiking, and catching. To gain success, these athletes need to have comprehensive and complete training. Importantly, to train technical skills, it is necessary to select exercises that are suitable for the physiological and psychological characteristics of the athletes, the actual situation, the availability of facilities, the training stage, and the capability of the athletes.

In the context of Vietnam, because of its novice popularity in the country, few related studies related to technical skill training in shuttlecock have been conducted. Dang (2009) [6] researched two technical skills, including propelling and passing in shuttlecock. The participants of his study were Vietnamese students who were playing shuttlecock for their institution's team. An experimental group with 65 students and a control group with 48 students constituted the study participants. The experimental group was coached by thirty-three exercises to improve the two mentioned skills. The results confirmed the effectiveness of the employed exercises on propelling and passing skills. In a similar vein, Dang (2010) [7] conducted a study aiming to improve the quality of teaching and training some basic technical skills for young shuttlecock athletes in Hanoi city. The study deployed ten exercises without shuttlecock to develop the players' starting position and their movement. Fourteen other exercises with shuttlecock were used to enhance the players' skills, such as serving, catching, passing, and attacking. Similarly, in the study conducted by Hoang (2012), the passing skill of shuttlecock was examined on eight female fifteen to seventeen-year-old shuttlecock players of the Hanoi team. The study indicated the effectiveness and appropriateness of twelve exercises on the participants' passing performance. Le (2017) [8] developed 27 exercises to improve attacking skills for six female shuttlecock players aged 16-17 years old. After receiving six months of training, these six players' attacking skill was examined by ten tests. The results revealed that these exercises could enhance the participants' attacking skill in shuttlecock.

This investigation can be seen as a novel since it aims at examining the effectiveness of sixteen exercises on five technical skills of male 10–11-year-old shuttlecock players. It is hoped that the results of the study will contribute to the rare literature on shuttlecock sport and bring more lessons for the coaching of professional shuttlecock athletes.

2. METHODS

2.1. Participants

The study was conducted in Ho Chi Minh City, Vietnam, from September to December 2020. The study participants included 17 professional shuttlecock athletes playing for two shuttlecock teams in Ho Chi Minh City. They were divided into two groups: an experimental group (EG), including nine athletes playing for the Shuttlecock team of Go Vap district, and a control group consisting of eight athletes playing for the shuttlecock team of district 5. All of them were male, and their age ranged from 10 to 11 years old. They received training from coaches for about one to two years and had a similar competition experience. Thus, it could be concluded that they had a similar background.

2.2. Intervention

The experiment lasted for three months with five training sessions per week, 120 minutes each session in which half of the session was for coaching techniques. At the same time, the control group received the same agenda of training but with different exercises according to the previously prepared training program. To select the exercises employed to train the experimental group, previous materials used for shuttlecock training were carefully reviewed, such as Duong *et al*. (1995) [9], Dang (2003) [6], Physical Education Section (2010) [10], Chau *et al*. (2016) [11] and other related studies. Then, the researchers consulted with some coaches experienced in shuttlecock training and decided to choose sixteen exercises. Table **1** displays the exercises proposed for the experiment.

Table 1. Description of technical exercises given to the shuttlecock athletes in the experimental group.

Purposes	Exercises
To develop the ability to control the shuttlecock in the air by the top of the feet and the knees	Exercise 1: High instep kicking
	Exercise 2: First, practice instep kicking with the dominant leg. Then, instep kicking with the other leg. Finally, practice instep kicking with both legs.
	Exercise 3: First, practice kicking the shuttlecock with the dominant knee. Next, practice kicking the shuttlecock with the other knee. Finally, kicking the shuttlecock with two knees
To increase the attacking technique, the ability to locate the shuttlecock and coordinate with teammates to attack the shuttlecock over the net.	Exercise 4: Continuously kicking without the shuttlecock
	Exercise 5: Kicking the shuttlecock to a shield
	Exercise 6: Receiving a pass near the net and kicking it over the net
	Exercise 7: Catching the shuttlecock with the dominant leg and kicking it over the net with the other leg

(Table 1) contd.....

Purposes	Exercises
To increase the ability to pass the shuttlecock to other teammates	Exercise 8: Hitting the shuttlecock with the dominant knee or with the less dominant knee and then kicking the shuttlecock to the margin of the opponent's court.
	Exercise 9: Catching the shuttlecock and dropping it into the specified square.
	Exercise 10: Catching the shuttlecock and kicking it straightly to the two corners of the opponent's court.
	Exercise 11: Positioning the movement of the shuttlecock, then kicking it into a specified square
To improve the serving technique of the athletes	Exercise 12: High serving to the three specified squares near the net
	Exercise 13: High serving to the three specified squares below the three first squares
	Exercise 14: High serving on the edge of the court lines.
To improve the ability to attack by the dominant leg and by the less dominant leg	Exercise 15: Continuously kicking on a shield that is hung at the top of the net.
	Exercise 16: Highly kicking the shuttlecock and slamming it vertically and diagonally.

As presented in Table **1**, the training program for the experimental group included 16 exercises with five purposes. The experiment program was carried out with the assistance of an experienced shuttlecock coach. All exercises were carefully determined and scheduled to fit the capabilities of the players and the training facilities (see appendix).

2.2.1. Assessments

A shuttlecock skill-testing battery consisting of seven items was developed to evaluate the technical performance of the study participants before and after the training. The researchers also carefully discussed the proposed tests with a board of 11 expert shuttlecock coaches to get feedback on the specificity of the tests and their relevance. After receiving feedback, some minor modifications were made to the test battery. The test-retest reliability was evaluated. Two trials were conducted at a three-day interval and under the same testing conditions. Then, the correlation coefficient (Pearson) (r) of the results of the two trials was calculated. The results showed that all seven tests had $r > 0.85$ and $P<0.05$, ensuring the reliability of the test battery in assessing the technical performance of the participants. The Spearman correlation between the test results and the achievements in previous internal competitions was calculated. The results showed that all seven test items are valid with $r > 0.52$ and $P<0.05$. It means that the test has acceptable validity and high reliability. The seven test items are described in detail in Table **2** below.

As shown in Table **2**, not all the technical skills required in a shuttlecock game are assessed due to the short time of the training program in this study and the young age of the participants.

2.3. Data Analysis

The results of the study were collected at two points of time, before and after the treatment. For the first time, it happened one week right before the experiment. For the second time, it occurred one week after the experiment. All the data were calculated with the assistance of SPSS 22.0. The outcomes included mean (M), standard deviation (SD), mean difference, growth rate, or percent change. Independent Sample t-Test, paired-samples t-Test, and One-way ANOVA test were conducted to see significant differences.

Table 2. Description of shuttlecock skill-testing battery.

Test items	Skills assessed	How to score
Test 1: Instep kicking in one minute (times)	Skill of controlling the shuttlecock in the air by the top foot	The total score is the total number of times that the athlete can kick the shuttlecock by his foot in one minute. Even if he drops the shuttlecock, he can pick it up and continue to perform the activity. The performing times will be counted at the end of the time allotted.
Test 2: Highly kicking the shuttlecock over the net into a specified square ten times (points)	The skill of spiking over the net and performing the action accurately.	There are four squares in the opposite court, two squares are near the net, and the others are at the end of the court. One assistant throws the shuttlecock to the test taker, and he immediately kicks over the net to one of the four boxes. The performance is scored by the total points that the athlete can kick the shuttlecock over the net. If he kicks into one of the squares, he can score one point. When he can not kick into the square but over the net, he scores half of a point.
Test 3: Passing the shuttlecock into a specified square ten times (points)	The skill of catching and passing the shuttlecock is assessed	The athlete gets the shuttlecock from the assistant, then passes over the net into one of the squares in the opposite court. The scoring way is similar to Test 2.
Test 4: Low serving ten times (points)	The skill of serving accurately is assessed	There are six one-meter squares for tests 3 and 4, three of them are near the net, and the others are below. The athlete who serves one of the six squares can score one point. If he does over the net, he can cut half of the point. The total score is calculated by the points that he can perform.
Test 5: High serving in ten times (points)		

(Table 2) contd.....

Test items	Skills assessed	How to score
Test 6: Slamming the shuttlecock over the net by the dominant leg ten times (points)	The skill of slamming the shuttlecock accurately over the net by the dominant leg and the other leg is assessed	Regarding tests 6 and 7, four squares are used like in tests 3 and 4. The assistant throws the shuttlecock to the athlete and slams it into any square in the opposite court. The total score is calculated by the points that he can perform.
Test 7: Slamming the shuttlecock over the net with the less dominant leg ten times (points)		

3. RESULTS

As mentioned earlier, the technical assessment test was performed on the participants before and after the experiment. An Independent Sample t-Test was used to compare the mean scores of the two groups before and after the treatment. Table **3** below shows the comparison's results.

The results shown in Table **3** revealed no significant differences between both groups (sig > 0.05) before the experiment. Thus, it means that both groups had similar technical abilities.

After the experiment, there was a significant difference in the technical test values between the experimental group and the control group (sig < 0.05). All the mean scores of the experimental group were found to be much higher than those of the control group.

As shown in Table **3**, the shuttlecock athletes' technical performance in the experimental group (M=81.44) in terms of the skill of controlling the shuttlecock (test item 1) was slightly better than that of its counterpart (M = 75.25). Regarding the spiking skill (test item 2), the experimental group (M= 6.89) outstripped the control group (M=6.38). Regarding the passing skill (test item 3), the experimental group (M=7.56) also performed better than its counterpart (M=6.88). The experimental group reached M=5.00 and M=5.14, while the control group obtained M=4.65 and M=4.69 in item 4 and item 5, evaluating serving skills. Finally, for the test items 6 and 7, which were employed to assess the slamming skill, the scores of the experimental group (M=6.67 and M=6.22) also improved more than the control group (M=6.13 and M=5.50).

Although the mean scores of the 7 test items of the experimental group were higher than those of the control group, we could not conclude the enhancement of the experimental group. Hence, a calculation of the growth rates of the two groups was conducted. Then, Paired Sample t-test was employed to compare the growth rates of each group before and after the experiment. The results are presented in Table **4** below.

Table 3. Independent sample t-test comparisons for the seven technical assessment items between the control group and experimental group before and after the experiment.

No	Test items	Before experiment			After experiment		
		EG	CG	Sig	EG	CG	Sig
		Mean ± SD	Mean ± SD		Mean ± SD	Mean ± SD	
1	Test 1	71.11±5.28	69.75±6.48	0.64	81.44±5.64	75.25±5.80	0.04
2	Test 2	5.78±0.44	5.50±0.53	0.26	6.89±0.33	6.38±0.52	0.03
3	Test 3	6.22±0.44	6.13±0.35	0.62	7.56±0.53	6.88±0.64	0.03
4	Test 4	4.28±0.33	4.21±0.37	0.71	5.00±0.34	4.65±0.27	0.03
5	Test 5	4.04±0.41	4.01±0.26	0.85	5.14±0.45	4.69±0.40	0.04
6	Test 6	5.33±0.50	5.25±0.46	0.73	6.67±0.50	6.13±0.35	0.02
7	Test 7	4.89±0.60	4.88±0.35	0.95	6.22±0.83	5.50±0.53	0.05

Table 4. Growth rates of the experimental group and the control group after the experiment.

No	Test items	Experimental group					Control group				
		Before experiment	After experiment	W (%)	t-value	Sig	Before experiment	After experiment	W (%)	t-value	Sig
		Mean ± SD	Mean ± SD				Mean ± SD	Mean ± SD			
1	Test 1	71.11±5.28	81.44±5.64	13.56	6.93	0.00	69.75±6.48	75.25±5.80	7.70	5.50	0.00
2	Test 2	5.78±0.44	6.89±0.33	17.69	10.00	0.00	5.50±0.53	6.38±0.52	14.83	3.86	0.01
3	Test 3	6.22±0.44	7.56±0.53	19.32	7.98	0.00	6.13±0.35	6.88±0.64	11.28	4.58	0.00
4	Test 4	4.28±0.33	5.00±0.34	15.61	8.71	0.00	4.21±0.37	4.65±0.27	10.05	3.81	0.01
5	Test 5	4.04±0.41	5.14±0.45	24.00	10.71	0.00	4.01±0.26	4.69±0.40	15.36	3.42	0.01
6	Test 6	5.33±0.50	6.67±0.50	22.3	7.99	0.00	5.25±0.46	6.13±0.35	14.56	7.00	0.00
7	Test 7	4.89±0.60	6.22±0.83	23.82	8.00	0.00	4.88±0.35	5.50±0.53	16.18	3.41	0.01
Mean				19.47					12.85		

Table 5. Comparison of the growth rates between the control group and experimental group after the experiment.

No	Test items	W (%)		F	Sig	Post - hoc (LSD)
		Experimental group	Control group			
1	Test 1	13.56	7.70	5.987	.031	$\mu 1 > \mu 2$
2	Test 2	17.69	14.83	6.070	.026	$\mu 1 > \mu 2$
3	Test 3	19.32	11.28	5.773	.030	$\mu 1 > \mu 2$
4	Test 4	15.61	10.05	5.404	.035	$\mu 1 > \mu 2$
5	Test 5	24.00	15.36	4.822	.044	$\mu 1 > \mu 2$
6	Test 6	22.3	14.56	4.408	.049	$\mu 1 > \mu 2$
7	Test 7	23.82	16.18	4.386	.049	$\mu 1 > \mu 2$

$\mu 1$: Experimental group*; $\mu 2$:* Control group.

The data in Table **4** showed that the technical performance of both groups changed significantly after the three-month training period. The Paired Sample t-Test analysis indicated a significant difference in both groups after treatment (sig ≤ 0.01). However, the percent change of the experimental group was more significant than that of the control group (W=19.47% and W = 12.85%, respectively).

To certify the effectiveness of sixteen exercises, a One-way ANOVA test was applied to compare the growth rates of the two groups after the experiment. The results are shown in Table **5** below.

The results in Table **5** showed a significant difference in all tests between the experimental and control groups (sig < 0.05). Overall, the experimental group was found to be much better than the control group on the seven specific test items. To be specific, the percent changed in the 1st test item evaluating the skill of controlling the shuttlecock, and the experimental group's growth (W = 13.56%) was greater than that of the control group (W = 7.70%). Test item 2, checking the attacking skill of the experimental group (W = 17.69%), increased higher than its counterpart (W = 14.83%). Regarding test item 3, the experimental group (W = 19.32%) obtained a higher growth rate than the control group (W = 11.28%). Observing the two test items which tested the serving skills, the experimental group (W = 15.61% and W = 24.00%) also surpassed the control group (W = 10.05% and W = 15.36%). For the last two test items testing the shuttlecock slamming technique, the experimental group (W = 22.3% and W = 23.82%) also obtained better growth rates than the control group (W = 14.56% and W = 16.18%).

In sum, after comparing the growth rates of the specific test items, it can be seen that the training program significantly improved after the 3-month experiment.

4. DISCUSSION

The current study aimed to examine the effectiveness of short-term technical training with sixteen exercises on the technical performance of shuttlecock athletes aged 10-11 in Ho Chi Minh city. After the experiment, the results revealed that the sixteen exercises employed in the study positively impacted the technical performance of the experimental group. The results from seven tests of the experimental group were found to achieve higher growth in the five technical skills than that of its counterpart. It can be stated that the sixteen exercises in the current study could enhance the five technical skills of the experimental group. The study has shown a significant difference from previous studies. Firstly, it is seen that the current study focuses on developing rather comprehensive technical skills of shuttlecock (five skills); meanwhile, other studies mainly emphasize one or two technical skills. For instance, Dang (2009) [12] only examined the effectiveness of some exercises on high passing technical performance for university students. The study conducted by Hoang (2012) [13] investigated the exercises to enhance the attacking skill of female shuttlecock players aged 15-17. Furthermore, the results of a study conducted by Le (2017) [8] aimed at improving the slamming skill of female shuttlecock athletes aged 16-17 years old. Unfortunately, the findings of Dang (2010) [7] were somehow similar to what was found in the present study. Her study determined the impact of some exercises on six technical skills of young shuttlecock athletes, including two basic and four high-level skills. Secondly, the present study's participants were totally different from other previous studies, including Dang (2009) [12], Hoang (2012) [13], Le (2017) [8]. It can be inferred that these exercises could contribute to the research gap in shuttlecock sport. Thirdly, this study also proposed a reliable test battery, which can be employed to test the technical skills of young shuttlecock athletes. The test items were valid and could be used to evaluate some vital skills, such as serving (test items 4 and 5), controlling the shuttlecock in the air by the top foot (test item 1), catching and passing (test item 3), and slamming (test items 6 and 7).

However, there are some limitations to the present study. The first limitation is the small sample size (17 male professional shuttlecock players were divided into the control group and the experimental group). A larger sample may be generated more convincing results. In addition, the participants were limited to male athletes only. It could bring different results if the sample included mixed-gender groups or only female athletes. Finally, the training program that lasted only three months would bring the uncertainty of the exercises' effects. Nonetheless, it was difficult for the researchers to conduct a longer training program for this aged group (ten-eleven years old) as they are frequently given three-month training.

CONCLUSION

The present study has shown a comprehensive selection of exercises, including sixteen technical exercises. The three-month training resulted in a significant improvement in the technical performance of the adolescent shuttlecock athletes. The results indicated that the experimental group improved all technical skills employed in the training program, such as instep kicking, serving, spiking, passing, and slamming the shuttlecock. It can be concluded that the sixteen technical exercises showed positive effects and fit with the characteristics of the 10-11-year-old shuttlecock athletes. The study also showed that the tests are reliable and valid for evaluating the technical ability of adolescent shuttlecock athletes.

Though some positive findings were identified in this study about the impact of sixteen exercises on technical performance in shuttlecock, more research is recommended to further investigate this area. Since the participants of this study were all male aged ten to eleven years old, other studies can be conducted with another gender group or other age groups. In this particular study, the impact of sixteen exercises on technical performance was investigated with time restriction. However, further research is needed to investigate the impact of some exercises on other factors, for instance, the physical fitness level of the shuttlecock players or their tactical performance.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was approved by the Ethics Committee of Can Tho University, Vietnam, and Ho Chi Minh City University of Physical Education and Sports, Vietnam.

HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All human research procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2013.

CONSENT FOR PUBLICATION

Not applicable.

STANDARDS OF REPORTING

STROBE guidelines and methodologies were followed in this study.

AVAILABILITY OF DATA AND MATERIALS

The datasets analyzed in the current study are available from the corresponding author [V.Q.N] on reasonable request.

FUNDING

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or others.

ACKNOWLEDGEMENTS

Declared none.

APPENDIX

N0	Exercise	Syllabus Structure																											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Exercise 1			x	x				x			x					x	x				x			x					x	x
2	Exercise 2	x				x		x			x		x		x				x		x			x		x		x			
3	Exercise 3		x				x			x				x		x				x			x				x		x		
4	Exercise 4					x													x				x								
5	Exercise 5	x							x													x							x		
6	Exercise 6						x							x													x				
7	Exercise 7							x				x								x					x						
8	Exercise 8		x								x					x								x					x		
9	Exercise 9				x			x					x								x						x				
10	Exercise 10					x				x								x					x								x
11	Exercise 11			x										x			x									x			x		
12	Exercise 12	x								x					x				x									x			
13	Exercise 13						x					x								x					x						
14	Exercise 14			x							x					x								x					x		
15	Exercise 15				x										x			x				x						x			x
16	Exercise 16		x						x				x				x				x					x					

N0	Exercise	Syllabus Structure																												
		31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
1	Exercise 1				x			x					x	x				x			x					x	x				x
2	Exercise 2	x		x			x		x		x				x		x			x		x		x				x		x	
3	Exercise 3		x			x				x		x				x			x				x		x				x		
4	Exercise 4	x													x														x			
5	Exercise 5				x							x						x									x				x
6	Exercise 6									x						x							x						x		
7	Exercise 7		x					x							x						x					x					
8	Exercise 8						x					x								x					x						
9	Exercise 9			x					x								x													x	
10	Exercise 10					x								x					x				x								x
11	Exercise 11				x					x			x									x				x					
12	Exercise 12			x							x							x						x						x	
13	Exercise 13		x					x								x					x								x		
14	Exercise 14						x						x							x					x						
15	Exercise 15					x					x			x					x					x			x				
16	Exercise 16	x							x								x					x						x			

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