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Building up the evaluation tests to access the efficient footwork for talented female table tennis athletes aged 14-15 in Ho Chi Minh City

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Abstract
The purpose of this study was to build up evaluation tests to assess the efficiency of footwork for talented female table tennis athletes aged 14-15 in Ho Chi Minh City. By using the general research methods in sports, our study identified the six tests to evaluate the effectiveness of the footwork for talented female table tennis athletes aged 14-15 in Ho Chi Minh City, consistent with their characteristics, in line with high sufficient science and reliability. The six tests were 60m sprints (s), 8x8m shuttle run (s), 3m for picking up 21 balls (s), smashing the ball on left and right in 1 minute (times), moving 2/3 the table for hitting in 1 minute (times), and skipping in 2 minutes (times).

Keywords: the 6-test, the efficiency footwork, female table tennis athletes, aged 14-15, Ho Chi Minh City

Introduction

Table tennis, or ping-pong, is a well-known sport with diverse playing skills, its feature lies in three major skill sets, typically, serving-receiving a ball, foot movements, and attack-defense (Amelin, 1985) [1]. Besides, depending on the moment that a ball hits a bat, athletes with different playing st might generate extrapolated skills beyond the basic techniques to respond to the changed ball spin, and types of ping-pong rackets (Yuza *et al*., 1992) [13]. Notably, because this sport's feature is to deal with fast and strong ball speed at various dropping points, etc., (Le Van Inh, 1991) [5], athletes are required to possess comprehensive knowledge, unique skills, agility, and flexibility (Mason, 1986) [6] in order to smoothly coordinate different techniques like loop and block the ball spin (Neal, 1991) [7].

One of the keys to success in table tennis is believed as highly efficient footwork (Welford, 1980) [12]. Appropriate footwork allows athletes to move nimbly and implement techniques more accurately. Generally, there are two types of footwork in table tennis, the side-step, and the forward-backward move. In addition, to conduct good footsteps in each movement, it is important to constantly stand in a prepared position on two toes. That aims to keep the body leaning forward, along with bending the knees to lower the center of gravity for better balance. These basic movements need to be paid attention to optimize foot movement and improve performance in table tennis. Thus, in the training of young athletes, more attention should be paid to improving the efficiency of their foot movements along with appropriate assessment footwork tests. The tests are created to provide a foundation for predicting possible situations in competitions and how athletes quickly move to proper positions to hit and receive a ball. That is the objective of our study:

"Building up the evaluation tests to access the efficiency footwork for talented female table tennis athletes aged 14-15 in Ho Chi Minh City".

The object of the study is a system of tests used to evaluate footwork efficiency in table tennis.

Research subjects are 15 experts, including managers (2 people), lecturers (4 people), and coaches (9 people), all of whom have more than 5 years of experience in training and teaching table tennis.

The study applied conventional scientific research methods in sports such as document synthesis, expert interviews, and statistical analysis.

Results

The procedure of identifying footwork tests for female table tennis athletes aged 14 -15 in Ho Chi Minh CityTP is followed with three following steps:

Step 1: Synthesing national and international physical tests in table tennis
Step 2: Surveying coaches, experts, and managers
Step 3: Evaluating the validity and reliability of the tests.

2.1: Synthesing national and international physical tests in table tennis

Footwork tests in table tennis were referenced and synthesized through books, and authentic research from domestic and foreign journals. Particularly, Baigulop (1982) [2] suggested footwork tests for 10-13-year-old table tennis players conclude 20m sprint (s), long jump (m), jumping over chairs (times/minute), and moving sideways in 30 seconds (m). Nguyen Danh Thai & Vu Thanh Son (1999) [9] also introduced physical tests to evaluate footwork for 13-15-year-old table tennis players including 30m sprint(s), jumping over chairs in 1 minute (times), and skipping in 1 minute (times). Pham Ngoc Vien (1991) [10], at the same time, applied the tests to assess the effectiveness of footwork for table tennis players such as 30m sprint (s), horizontal movement to pick up 42 balls x 4m (s), and skipping in 2 minutes (times). Moreover, Bui Huy Quang & Nguyen Danh Thai (1995) [8] identified tests to evaluate the quality of footwork of male table tennis players aged 9 to 12, including long jump (cm), 30m sprint (s), 8 x 8m shuttle run (s), and horizontal movement to pick up the 30 balls x 3m (s). Le Thiet Can (2002) [3] also contributed to the

footwork tests for male table tennis players aged 13-14, which were 5mx30m run (s), horizontal movement to pick up 3m x21 balls (m), and long jump (m).

The aggregate results show that many authors have used different tests to evaluate the moving steps of table tennis athletes but there is no unity among them. Based on the research objective, ping pong's characteristics, research conditions, and the consultation with experts working at popular ping-pong clubs in District 1, Binh Thanh District, People's Police, gifted schools in Ho Chi Minh City, as well as surrounding provinces such as Tien Giang, Vinh Long, Dong Thap, etc., several tests were removed as they were not suitable with the current condition in Ho Chi Minh City. 13 tests were selected as follows: 1. 30m sprint (s), 2. 8mx8m shuttle run x 8 times (s), 3. 4 laps of running around a table continuously (s), 4. Jumping over a chair in one minute (times), 5. long jump (cm), 6. Long jump with 3 consecutive steps and change legs (cm), 7. Moving around to pick up 42 balls x 3m (s), 8. Moving around to pick up 21 balls x 3m (s), 9. Moving around to pick up 30 balls x 3m (s), 10. Smashing the ball on left and right in 1 minute (times), 11. Moving around two-thirds of a table and swinging a ball in one minute (times), 12. 2-minute skipping (times) and 13. 60m sprint (s).

2.2: Consultation with experts

15 questionnaires were delivered to 15 experts individually, who were qualified and experienced trainers in table tennis. The questionnaire was sent 2 times, 1 week apart, to the same subjects. The responses were three levels - Never used, Rarely used, and Frequently used. After collecting the results, the selected criteria would be converted into points according to the following specifications: Frequently used: 2 points, Rarely used: 1 point, and Never used: 0 points. The outcomes of the expert consultation were presented in Table 1.

Table 1: Results of the frequency of each footwork test used by experts and trainers in table tennis

Test	1st (n=15)					2nd (n=15)					% two times
	Frequency			Total score	%	Frequency			Total score	%	
	Frequently used	Rarely used	Never used			Frequently used	Rarely used	Never used			
1	11	1	3	23	76.67	10	3	2	23	76.67	76.67
2	12	2	1	26	86.67	12	2	1	26	86.67	86.67
3	9	4	2	22	73.33	9	5	1	23	76.67	75
4	11	1	3	23	76.67	10	3	2	23	76.67	76.67
5	8	4	3	20	66.67	9	3	3	21	70	68.33
6	9	4	2	22	73.33	9	5	1	23	76.67	75
7	11	1	3	23	76.67	10	3	2	23	76.67	76.67
8	8	5	2	21	70	8	4	3	20	66.7	68.33
9	13	1	1	27	90	13	1	1	27	90	90
10	13	2	0	28	93.3	13	2	0	28	93.3	93.3
11	11	3	1	25	83.33	11	3	1	25	83.33	83.33
12	13	2	0	28	93.3	13	2	0	28	93.3	93.3
13	15	0	0	30	100	15	0	0	30	100	100

Note: 1. 30m sprint (s), 2. 8mx8m shuttle run x 8 times (s), 3. 4 laps of running around a table continuously (s), 4. Jumping over a chair in one minute (times), 5. long jump (cm), 6. Long jump with 3 consecutive steps and change legs (cm), 7. Moving around to pick up 42 balls x 3m (s), 8. Moving around to pick up 21 balls x 3m (s), 9. Moving around to pick up 30 balls x 3m (s), 10. Smashing the ball on left and right in 1 minute (times), 11. Moving around two-thirds of a table and swinging a ball in one minute (times), 12. 2-minute skipping (times) and 13. 60m sprint (s). %: percent

Based on Table 1, the research team conducted a selection of the footwork tests that reached over 80%, along with a total score of 25 points or more. According to the criteria, 06 tests were chosen to evaluate the effectiveness of footwork for gifted female table tennis players aged 14 -15 in Ho Chi Minh City, as follows: 1. 60m sprint (s), 2. 8mx8m shuttle run x 8 times (s), 3. Moving around to pick up 21 balls x 3m (s), 4. Smashing the ball on left and right in 1 minute (times), 5. Moving around two-thirds of a table and swinging a ball in one minute (times) and 6. 2-minute skipping (times).

2.3: The reliability and validity of the tests

The reliability of the tests

Each indicator that is used in scientific research needs to ensure its reliability and relevance. To do that, the article has synthesized evaluation tests from reliable sources and authors to guarantee high reliability. As the participants are 08 gifted female table tennis players aged 14 -15 in Ho Chi Minh City, the assessment implemented in the group is relatively appropriate.

According to Duong Nghiep Chi (2004) [4], the reliability of tests refers to the degree of concordance across different times of applying the tests on the same experimental subjects under the same conditions. However, during the implementation process, it still exists many variables that are difficult to control such as changes in the state of the experimental objects, changes in the environment during the experiment, permissible errors, carelessness when measuring, or imperfection of the test techniques. Thus, to efficiently evaluate the reliability, the analysis of variance with the correlation coefficient inside the classes is highly recommended (Lam Quang Thanh *et al*., 2016) [11]. Analysis of variance can divide test results into parts that are influenced by different factors (differences between experiments, between experimental subjects, etc.).

In the case of two experiments (and the test results do not increase or decrease systematically over the experiments), the correlation coefficients within the classes and the normal pairwise correlation coefficients will overlap. Thus, it is possible to use the pair correlation coefficient between two quantities (1st and 2nd) to evaluate the reliability of the tests

(with the same conditions, methods, and test subjects) with the evaluation levels of Correlation coefficients ® as follows: from 0.95-0.99 is excellent, 0.90-0.94 is good, 0.80-0.89 is acceptable, 0.70-0.79 is weak and 0.60-0.69 is not sufficient (qualitative only). In this study, 6 footwork tests were chosen for gifted table tennis players aged 14-15 in Ho Chi Minh City (n=8), according to the following criteria: method to calculate the correlation coefficient between the results of two tests, seven days apart (test-retest) with the same conditions in terms of time, test sequence, implementation process, yard, etc. The correlation coefficient (r) evaluating the efficiency of foot movement in table tennis before and after seven days is described in Table 2.

Table 2: Reliability coefficients of footwork tests in table tennis before and after 7 days (n=8)

Order	Test	1st $\overline{X}$ ± S	2nd $\overline{X}$ ± S	r	p
1	60m sprint (s)	10.24±0.65	10.15±051	0.845	<0.05
2	8mx8m shuttle run x 8 times (s)	20.51±0.93	20.45±1.12	0.991	<0.05
3	Moving around to pick up 21 balls x 3m (s)	62.00±0.91	61.75±0.99	0.952	<0.05
4	Smashing the ball on left and right in 1 minute (times)	61.38±2.34	62.13±2.57	0.906	<0.05
5	Moving around two-thirds of a table and swinging a ball in one minute (times)	61.75±2.44	61.75±2.33	0.979	<0.05
6	2-minute skipping (times)	308.88±6.27	308.75±6.03	0.995	<0.05

Table 2 indicates that all footwork tests have r>0.8 and p<0.05 (reliability at the probability threshold of 0.05), so the six chosen tests have enough reliability to evaluate the effectiveness of footwork for gifted female table tennis athletes aged 14-15 in Ho Chi Minh City.

Validity of the tests

Test validity refers to how accurate a test is in its measurement to determine a certain characteristic (quality, capability, characteristic, etc.) In order to test the validity of the foot movement efficiency tests for 14-15-year-old female athletes in Ho Chi Minh City, the authors calculated the correlation coefficient between the performance of the two experiments: the initial results vs competition outcomes to rank the order of Spearmen hierarchical correlation formula. The result was shown in Table 3.

Table 3: Coefficient of hierarchical correlation between footwork tests for female athletes aged 14-15 years old in Ho Chi Minh City

Order	TEST	1st		2nd	
		r	P	r	P
01	60m sprint (s)	0.84	<0.01	0.83	<0.05
02	8mx8m shuttle run x 8 times (s)	0.78	<0.01	0.78	<0.05
03	Moving around to pick up 21 balls x 3m (s)	0.69	<0.01	0.70	<0.05
04	Smashing the ball on left and right in 1 minute (times)	0.77	<0.01	0.78	<0.05
05	Moving around two-thirds of a table and swinging a ball in one minute (times)	0.78	<0.01	0.77	<0.05
06	2-minute skipping (times)	0.81	<0.01	0.80	<0.05

The results in Table 3 compared with r_{table} with degrees of freedom n - 2, it can be interpreted that all footwork tests have hierarchical correlation coefficient (r > 0.6, P < 0.05). Hence, the validity of the six footwork tests is ensured to assess the agility of gifted female table tennis players aged 14-15 in Ho Chi Minh City.

In summary, after three steps, six tests were selected to evaluate the agility of foot movements in table tennis, including (1) 60m sprint (s), (2) 8mx8m shuttle run x 8 times (s), (3) Moving around to pick up 21 balls x 3m (s), (4) Smashing the ball on left and right in 1 minute (times), (5) Moving around two-thirds of a table and swing a ball in one minute (times) and (6) 2-minute skipping (times).

Conclusion

Through three main steps of referencing reliable documents, surveying experts, and checking the reliability and validity of the tests, along with analyzing the current conditions in Ho Chi Minh City, the article has selected six footwork tests for gifted female table tennis players aged 14-15 in Ho Chi Minh City, involving (1) 60m sprints (s), (2) 8x8m shuttle run (s), (3) 3m for picking up 21 balls (s), (4) smashing the ball on left and right in 1 minute (times), (5) moving 2/3 the table for hitting in 1 minute (times), and (6) skipping in 2 minutes (times).

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