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## Developing criteria for physiological and psychological evaluation of table tennis team female athletes aged 16 to 18

Nguyen Pham Thanh Thuy An

University of Physical Education and Sport, Ho Chi Minh City, Vietnam

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### Abstract

The study employed traditional sports science research procedures to develop 07 assessment items, resulting in physiology and psychology evaluation criteria that are both reliable and informative to future researchers. The focus of this research is also to develop a scoring scale, classification table, general classification to assess the physiological and psychological conditions of female table tennis players aged 16 to 18 who perform for the Vinh Long provincial table tennis team.

**Keywords:** physiology, psychology, evaluation criteria, female table tennis athletes

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### Introduction

Table tennis is an individual sport that demands strong willpower since the match results are closely linked to the players' psychological processes. Decisiveness, boldness, ingenuity, and tenacity are some of the most important psychological characteristics of table tennis players (Nguyen Danh Thai-Vu Thanh Son, 1999) <sup>[5]</sup>. Because modern table tennis is primarily about speed, and the execution time is extremely short, the needed level of concentration is highly stable and durable. Athletes, moreover, are required a keen sense of movement as well as lightning-quick reflexes.

Table tennis is a sport that requires a lot of flexibility, thus table tennis players' nervous systems are put under a lot of stress. Their vision has to be precise, their actions need to be swift, and their thoughts also have to be focused so as to accurately and quickly detect the opponent's attitude, posture, and movement. As a result, the analytical organs are crucial, particularly the operation of the motor and visual analyzers. In fact, there is a close connection between the elasticity and sensitivity of nervous systems and the perfection of motor skills. In other ways, the motor analyzing organs have a significant impact on the formation of a synergistic neuronal response between the visual and auditory sensory organs (Kuu Trung Hue *et al.*, 1997).

The psychological trait of table tennis players is "psychological endurance" (Dao Duy Thu *et al.*, 1985) <sup>[6]</sup>. That is the ability of the athlete's mind-body system to sustain tremendous volumes of movement throughout training and competition, cited in his article. In the dialectical link of mental training, psychological endurance and physical endurance are so tightly intertwined. As a result, a scientific and comprehensive evaluation standard is required to appropriately measure athletes' psychological endurance. In light of the above significance, the author decided to carry out research on:

**“Developing criteria for physiological and psychological evaluation of table tennis team female athletes aged 16 to 18”**

### Objectives

The objective of this study is to determine the criteria for evaluating the physiology and psychology of 16 to 18-year-old female athletes from the Table Tennis team of Vinh Long province after one training year. The findings of the study will serve as a reference for coaches and specialists, enabling the province's young table tennis players to receive better instruction.

### Methodology

Document reference, questionnaires, direct interviews, medical testing, psychological tests, and mathematical and statistical analytics were all used in the research.

### Participants

- **Testees:** 5 athletes from the table tennis team in Vinh Long province, Vietnam
- **Surveyees:** 30 table tennis coaches, experts, specialists, lecturers from four provinces in Vietnam: Ho Chi Minh City, Vinh Long, Can Tho, An Giang

## Results and Discussions

### Determining the physiological and psychological evaluation criteria of 16-18-year-old female athletes of Vinh Long province's table tennis team.

The research process was conducted through 3 main phases:

#### Phase 1: Document reference

The author gathered reliable materials concerning the criteria that had been used to evaluate the physiological and mental conditions of table tennis athletes aged 16 to 18 by respectable scholars such as Khau Trung Hue *et al* (1997), Nguyen Ngoc Cu *et al* (1998) [2], Pham Ngoc Vien (1999) [11], Nguyen Tien Tien (2001), Nguyen The Truyen (2001) [7], Nguyen Trong Truc *et al* (2005) [8], Nguyen Quang Vinh *et al* (2013) [10], etc. Based on the research purpose and current training conditions, the writer chose 03 criteria on physiology and 04 ones on psychology.

#### Phase 2: Questionnaires and interviews

The information obtained from referring research materials was utilized to propose questionnaires and interview content for 30 experts. Two interviews, one month apart, using the same assessment procedure, test system, and participants, with the answers: agree and disagree. The findings of the two interviews were then double-checked using the index when squared ( $\chi^2$ ). Table 1 summarized the data.

**Table 1:** Comparison of the two interviews' results on physiological and psychological criteria for 16 to 18-year-old female athletes of the Vinh Long provincial table tennis team

Criteria	The 1st (n=30)		The 2nd (n=30)		$\chi^2$	p
	Number of 'agree' votes	%	Number of 'agree' votes	%		
Physiology						
Heart weight	29	96.67	28	93.33	0.44	>0.05
Vital capacity/P (ml/kg)	27	90.00	26	86.67	0.20	>0.05
VO2 Max (ml/ph/kg)	26	86.67	27	90.00	0.20	>0.05
Psychology						
Attention span (bit/sec)	25	83.33	26	86.67	0.16	>0.05
Simple reflex (ms)	26	86.67	24	80.00	0.60	>0.05
Selective reflex (ms)	25	83.33	28	93.33	1.82	>0.05
Information processing speed (p)	29	96.67	30	100.00	1.27	>0.05
<i>Intellectual ability</i>	19	63.33	20	66.67	0.09	>0.05

Table 1 shows that all indicators of both two interviews are  $\chi^2 < \chi^2$  table (=3.84), indicating that the difference between the two sample observations is not significant when the probability threshold is set at 5%. Thus, it is clear that the experts, coaches, administrators, referees, and table tennis lecturers have a high consensus on their responses. The criteria that would be chosen were the ones with the number of agreeing votes  $\geq 75\%$  of interview votes in the two interviews. As a result, 07 criteria were sorted out for evaluating physiological and psychological conditions of the research object as follows:

**Regarding physiological conditions:** Heart weight, Vital capacity/P (ml/kg), VO2 Max (ml/ph/kg).

**Regarding mental strength and psychological conditions:** Attention span (bit/sec), Simple reflex (ms), Selective reflex (ms), Information processing speed (p).

#### Phase 3: Assessment of the reliability and informativeness of the tests.

**Regarding reliability:** the author conducted reliability testing with physiological and psychological indicators since they are typical indications with minor variation and are measured using modern and accurate techniques, resulting in excellent dependability.

**Regarding informativeness:** To measure the information quality of the research indicators, the author used the Spearman hierarchical correlation technique to determine the correlation between the physiological and psychological assessment criteria and their sports performances. Table 2 displays the gathered data.

**Table 2:** Coefficient of hierarchical correlation between physiological and psychological parameters and sports performance of Vinh Long province's table tennis team's 16-18-year-old female athletes

Factor	Criteria	r	P
Physiology	Heart weight	0.7	<0.05
	Vital capacity/P (ml/kg)	0.8	<0.05
	VO2 Max (ml/ph/kg)	0.8	<0.05
Psychology	Attention span (bit/sec)	0.8	<0.05
	Simple reflex (ms)	0.9	<0.05
	Selective reflex (ms)	0.8	<0.05
	Information processing speed (p)	0.9	<0.05

All criteria possess hierarchical correlation coefficients ( $r > 0.6$ ,  $P < 0.05$ ), as shown in Table 2. It suggests that these criteria are suitably informative and practical for evaluating the physiology and psychology of the research participants.

Through document synthesis, interviewing, and testing for reliability and informativeness, the writer has identified the criteria for physiological and psychological evaluation involving:

**Regarding physiology:** Heart weight, Vital capacity/P (ml/kg), VO<sub>2</sub> Max (ml/ph/kg).

**Regarding mental strength and psychology:** Attention span (bit/sec), Simple reflex (ms), Selective reflex (ms), Information processing speed (p).

### Proposing the specific criteria for physiological and psychological assessment of 16 to 18-year-old female athletes of Vinh Long province's table tennis team.

#### C-score (10-point scale)

The scale scores were built up in line with the C-scale and a classification table to enable the identification of the extent of progress for each test, as well as to measure the technical and tactical level of each athlete and compare the levels among them.

Furthermore, the researcher utilized the Shapiro-Wilk test technique to assess the normality of the data distributions and then achieved the results presented in Table 3.

**Table 3:** Normality test of the data set of physiological and psychological evaluation criteria of 16 to 18-year-old female athletes of the Vinh Long province table tennis team

No	Types of the test	Time	SW Testing		
			S	b	SW
Physiology	Heart weight (HW)	Entry	0.77	1.52	0.98
		After 1 year	0.87	1.62	0.87
	Vital capacity/P (ml/kg)	Entry	3.50	6.78	0.94
		After 1 year	3.43	6.30	0.85
	VO <sub>2</sub> max/kg	Entry	4.77	9.38	0.97
		After 1 year	4.55	9.03	0.99
Psychology	Attention span (bit/sec)	Entry	0.09	0.17	0.88
		After 1 year	0.07	0.18	0.91
	Simple reflex (ms)	Entry	19.35	35.30	0.83
		After 1 year	18.47	34.31	0.86
	Selective reflex (ms)	Entry	20.21	37.35	0.85
		After 1 year	63.22	123.92	0.96
	Information processing speed (p)	Entry	0.05	0.10	0.90

Table 3 clearly shows that the testing results of all test samples have  $SW \geq SW_{\alpha}$  ( $= 0.687$ ), implying that the hypothesis  $H_0$  is accepted and the sample set has a normal distribution at the significance level  $\alpha = 0.01$ . Based on the mean score ( $\bar{x}$ ) and standard deviation (S), each item's score is calculated by a C-scale on the criterion at the initial stage (entry) and after one year of practice. The results are shown in Table 4.

**Table 4:** Scoreboard of achievements in physiological and psychological evaluation criteria of 16 to 18-year-old female athletes of Vinh Long province table tennis team

Factor	Test	Time	Score									
			1	2	3	4	5	6	7	8	9	10
Physi-ology	Test 1	Entry	10.8	10.4	10.0	9.7	9.3	8.9	8.5	8.1	7.7	7.4
		After 1 year	10.6	10.2	9.7	9.3	8.9	8.4	8.0	7.6	7.1	6.7
	Test 2	Entry	43.5	45.3	47	48.8	50.5	52.3	54.0	55.8	57.5	59.3
		After 1 year	44.8	46.5	48.2	49.9	51.6	53.3	55.0	56.8	58.5	60.2
	Test 3	Entry	39.7	42.0	44.4	46.8	49.2	51.6	54.0	56.3	58.7	61.1
		After 1 year	40.7	43.0	45.2	47.5	49.8	52.1	54.3	56.6	58.9	61.1
Psych-ology	Test 4	Entry	4.41	4.48	4.54	4.61	4.67	4.74	4.80	4.87	4.93	5.00
		After 1 year	4.12	4.19	4.27	4.35	4.43	4.51	4.59	4.67	4.75	4.83
	Test 5	Entry	246	236	226	217	207	197	188	178	168	159
		After 1 year	240	231	222	212	203	194	185	175	166	157
	Test 6	Entry	337	327	317	307	297	287	276	266	256	246
		After 1 year	408	376	345	313	282	250	218	187	155	124
	Test 7	Entry	1.65	1.68	1.71	1.73	1.76	1.79	1.82	1.84	1.87	1.90
		After 1 year	1.69	1.72	1.75	1.78	1.81	1.84	1.87	1.90	1.93	1.96

**Note:** Test 1: Health weight, Test 2: Vital capacity/P (ml/kg), Test 3: VO<sub>2</sub> max/kg (ml/ph/kg), Test 4: Attention span (bit/sec), Test 5: Simple reflex (ms), Test 6: Selective reflex (ms), Test 7: Information processing speed (p)

### General classification standards

To make it easier to quantify different criteria, the writer set up a standard categorization for each criterion. The evaluation metrics were categorized into five levels in accordance with the following convention:

- Excellent from 9 to 10 scores.
- Good from 7 to below 9 scores.
- Average/Medium from 5 to below 7 scores.
- Below average from 3 to below 5 scores.
- Poor/Weak from 0 to below 3 scores.

Relying on the above convention, a scorecard was designed to classify the physiological and psychological evaluation tests of the young female table tennis athletes, and the results are shown in Table 5.

**Table 5:** Classification of physiological and psychological evaluation criteria of 16 to 18-year-old female athletes of Vinh Long province's table tennis team

Factors	Test	Time	Type				
			Poor/Weak	Below average	Average	Good	Excellent
Physiology	Test 1	Entry	>10.0	10 → >9.3	9.3 → >8.5	8.5 → >7.7	≤7.7
		After 1 year	> 9.7	9.7 → >8.9	8.9 → >8.0	8.0 → >7.1	≤7.1
	Test 2	Entry	< 47	47 → <50.5	50.5 → <54.0	54.0 → <57.5	≥57.5
		After 1 year	< 48.2	48.2 → <51.6	51.6 → <55.0	55.0 → <58.5	≥58.5
	Test 3	Entry	<44.4	44.4 → <49.2	49.2 → <54.0	54.0 → <58.7	≥58.7
		After 1 year	< 45.2	45.2 → <49.8	49.8 → <54.3	54.3 → <58.9	≥58.9
Psychology	Test 4	Entry	< 4.54	4.54 → <4.67	4.67 → <4.80	4.80 → <4.93	≥4.93
		After 1 year	< 45	45 → <49	49 → <53	53 → <57	≥57
	Test 5	Entry	> 226	226 → >207	207 → >188	188 → >168	≤168
		After 1 year	< 39	39 → <42	42 → <44	44 → <47	≥47
	Test 6	Entry	> 317	317 → >297	297 → >276	276 → >256	≤256
		After 1 year	< 13	13 → <15	15 → <17	17 → <19	≥19
	Test 7	Entry	< 1.71	1.71 → <1.76	1.76 → <1.82	1.82 → <1.87	≥1.87
		After 1 year	< 53.10	53.10 → <55.40	55.40 → <57.70	57.70 → <60.00	≥60.00

### Criteria for physiological and psychological evaluation of Vinh Long provincial table tennis team female athletes aged 16 to 18 years old

With the data from Table 5, I combined each athlete's total score and categorised their physiological and psychological assessments into Table 6.

**Table 6:** Scoreboard and classification of physiological and psychological conditions of five 16-18-year-old female athletes of the Vinh Long province table tennis team

Physiology	Athlete	No1		No2		No3		No4		No5	
		Entry	After 1 year	Entry	After 1 year	Entry	After 1 year	Entry	After 1 year	Entry	After 1 year
	Total score	6.3	6.6	4.4	4.9	5.9	5.9	4.4	4.0	4.0	3.6
	Type	Average	Average	Weal	Weak	Average	Average	Weak	Weak	Weak	Weak
Psychology	Total score	5.5	5.9	5.3	5.9	5.9	7.0	3.7	4.7	4.6	3.6
	Type	Average	Average	Average	Average	Average	Good	Weak	Weak	Weak	Weak

The data in table 6 shows;

Regarding the physiological state: before and after a year of training, the athletes did not change significantly; 40% were rated as Average/Medium, while the remaining 60% were rated as Weak.

Regarding the psychological state: in the beginning, 60 percent of athletes were rated Average, and 40 percent were rated Weak; after a year of training, there is an improvement, with 10% of athletes being Good, 40 percent being Average, and 40 percent being Weak.

### Conclusion

- The study has offered the following key factors of physiological and psychological criteria for 16 to 18-year-old female athletes of the Vinh Long provincial table tennis team:

**Physiology:** Heart weight, Vital capacity/P (ml/kg), VO<sub>2</sub> Max (ml/ph/kg).

**Psychology and mental health:** Attention span (bit/sec), Simple reflex (ms), Selective reflex (ms), Information processing speed (p).

- The article has successfully formed a scoreboard, classification table and synthetic classification scoreboard to measure the conditions of physiology and psychology of 16-18-year-old female athletes from the Vinh Long province table tennis team.

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