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Research on morphological assessment indicators for female table tennis athletes aged 08 – 09 in long An Province, Vietnam

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Abstract
Morphological characteristics are one of the factors that need to be considered in the selection of young table tennis athletes, alongside physical fitness, technique, tactics, psychology, and functionality. Determining the appropriate morphological indices for age and gender contributes to providing objective data for the evaluation and selection of athletes in the initial training stage. The study has identified appropriate morphological indicators to evaluate 8–9-year-old female table tennis players in Long AN province, Vietnam. The study was conducted on 32 talented 8–9-year-old female table tennis players and 16 experts, professionals, managers, and instructors with experience in selecting, teaching, and coaching table tennis. The research methods included document analysis and synthesis, expert interviews, medical-anthropometric examinations, and mathematical statistics. The study has identified 03 morphological indicators that are valuable for evaluating 8–9-year-old female table tennis players in Long An province. These indicators provide an additional quantitative basis for the evaluation and selection of young athletes; however, morphology should be considered in conjunction with physical fitness, technique, tactics, psychology, and functionality rather than being used as an independent selection criterion.

Keywords: Index, morphology, table tennis athletes, 08–09 years old, Long An Province, Vietnam

Introduction

Table tennis is a high-speed competitive sport that requires athletes to perform technical activities in very short spaces of time. The effectiveness of competition not only depends on technique, tactics, physical fitness, and psychology but also relates to morphological characteristics that align with the demands of specialized movement. In selecting sports talents, body morphology is one of the indicators that need to be considered along with functional factors and motor abilities, especially in the initial selection stage. [1, 2].

For table tennis, there is no single body type that determines performance. However, the characteristics of body size and the ratio of body parts can create different biomechanical conditions when athletes move, maintain posture, perform strokes, and control the racket. Specialized literature on table tennis athlete selection has mentioned various morphological indices such as height, weight, Quetelet index, wrist circumference, upper limb length, hand length, hand area, shoulder width, ankle circumference, Achilles tendon length, and waist circumference [3, 5]. The overview in the thesis also shows that studies from China and Vietnam both consider morphology as a component of the table tennis athlete selection system, but the indicators used are not entirely the same across the studies [6].

In young athletes, the use of morphological indices in selection needs to be more cautious compared to adult athletes, as the body is in a growth process and anthropometric characteristics change with age and gender. Therefore, the value of an index lies not only in its ability to describe body size but also in its suitability to professional characteristics and its capacity to help distinguish athletes with development potential. Le Nguyet Nga and colleagues believe that talent selection in sports should be conducted on a scientific basis, combining multiple criteria groups and aligning with the characteristics of each sport [7]. In table tennis, the studies compiled in the thesis also use a system of morphological indices alongside physical fitness, technique, tactics, psychology, and function to serve the selection and evaluation of young athletes [6].

For female athletes aged 8–9, this is the initial stage of specialized sports training, so selecting too many anthropometric indices can reduce the feasibility of practical selection. Conversely, if we only rely on height or weight, it is difficult to reflect the morphological characteristics related to the specialized requirements of table tennis. Therefore, it is necessary to identify some representative, easily measurable indicators that are age-appropriate and have practical value in selection. The thesis in Long An initially compiled a fairly extensive system of morphological indicators from both domestic and international works and then proceeded to select them through literature review, expert interviews, and criterion validation [6].

In Long An province, the selection of table tennis athletes aged 8–11 before the study did not have a unified set of criteria; the selection was mainly based on the coach's experience and performance in youth, junior, and cadet competitions [6]. This raises the need to establish objective evaluation criteria that are appropriate for each age group and gender. For female athletes aged 8–9, determining

appropriate morphological indices is not aimed at creating an "ideal physical model," but rather at supplementing the quantitative evidence for the potential assessment process, while also integrating physical, technical, tactical, psychological, and functional factors in athlete selection.

Based on the above issues, the research was conducted to determine the morphological assessment indicators for 8–9-year-old female table tennis players in Long An province, Vietnam, contributing to the establishment of a scientific basis for the inspection, evaluation, and training of young table tennis players in the locality.

Materials and methods

1. Research method

To determine the appropriate morphological indices for 8–9-year-old female table tennis athletes in Long An province, the study used the following methods:

Method of document analysis and synthesis: Scientific works and specialized documents, both domestically and internationally on the selection of young athletes, morphological characteristics, and anthropometric indices in table tennis have been researched and systematized. Based on that, the study identifies an initial set of morphological indicators that can be used in the evaluation and selection of 8–9-year-old female table tennis players. The source thesis shows that previous studies have used various indicators such as height, Quetelet index, wrist circumference, upper limb length, hand length, ankle circumference, Achilles tendon length, and waist circumference.

Expert interview method: The questionnaire was used to gather opinions from 16 experts, specialists, managers, and instructors with experience in selecting, teaching, and training table tennis. The morphological indices synthesized from the literature were evaluated to determine their suitability and select the valuable indices for use with female table tennis players aged 8–9 in Long An province. This approach aligns with the original research process, which includes indicator synthesis, expert interviews, and criterion testing before being incorporated into the selection system.

Anthropometric method: Used to determine the morphological characteristics of athletes through selected indicators. The measurements are conducted following the same procedures and testing conditions to minimize errors and ensure comparability between athletes. The obtained data serve as the basis for analyzing morphological characteristics and validating the utility of the indicators in evaluating 8–9-year-old female table tennis players.

Mathematical statistical methods: The data were entered, checked, and processed using SPSS software version 22.0. Descriptive statistical parameters and appropriate tests were used to analyze the characteristics of each index and to help identify morphological indices that are valuable for evaluating the research subjects.

2. Research subject

The subjects of the study included 32 talented female table tennis players aged 8–9 who are training in Tan An city, the districts of Ben Luc, Thu Thua, Chau Thanh, Duc Hoa, and Kien Tuong town in Long An province. All athletes in the study sample use the horizontal grip style.

The interview subjects include 16 experts, professionals, managers, and instructors with experience in selecting, teaching, or coaching table tennis, from Long An, Dong Thap, Vinh Long, Tay Ninh, Ho Chi Minh City, and training institutions such as the Ho Chi Minh City University of Physical Education and Sports, Hanoi University of Physical Education and Sports, Ho Chi Minh City University of Sports, Da Nang University, and Ho Chi Minh City University of Economics.

Results

To determine the morphological assessment indicators of female table tennis players aged 08–09 in Long An province, Vietnam, the research was conducted in three steps.

Step 1: Compile the morphological assessment indicators in table tennis from works and authors both domestically and internationally.

Step 2: Interview experts, specialists, and coaches.

Step 3: Check the informativeness of the indicators.

1. Summarizing the morphological evaluation indicators in table tennis from various works and authors both domestically and internationally.

The thesis synthesizes morphological assessment indicators in table tennis from works by authors both domestically and internationally, such as: Nguyen Ngoc Cu (1998) [8], Nguyen The Truyen (1999) [9], Liang Yang (2016) [10], Bui Quang Hai (2007) [11], Trinh Hung Thanh, Le Nguyet Nga (1996) [12], Trinh Hung Thanh (2002) [13], Zhu Lin *et al.* (1999) [14], Zhou XingDong (2020) [15], Nguyen Toan (1997) [16], Xing Wenhua (2008) [17], Li Hao Song (2001) [18], Pham Trung Hiep (2023) [19],… To select the evaluation indicators scientifically and logically, the thesis is based on the principles of (1) measurable and (2) comparable and assessable by individuals, regions, and different countries [20]. Based on the aggregated results and based on the experience in the selection and training of PhD students and consulting with experts, we conducted the synthesis and selection of 16 indicators to evaluate the morphology of female table tennis athletes aged 08-09 in Long An province to include in the interview forms for experts, coaches, lecturers, and managers.

2. Interview experts, specialists, and coaches.

From the above summary, the thesis constructs a questionnaire and conducts interviews; the interviews are conducted twice with a 15-day interval, using the same index system, the same subjects, the same evaluation method, and the same response scoring as follows: Strongly agree: 5 points, Agree: 4 points, Hesitant: 3 points, Disagree: 2 points, and Strongly disagree: 1 point.

The interview subjects are 16 experts, specialists, managers, and lecturers from universities who have experience and a long history in selecting, teaching, and training in table tennis. To verify the consistency of the results from the two interviews, they were compared using the chi-square index as shown in Table 1.

Table 1: Comparison of the results from two interviews selecting evaluation indices for the morphology of female table tennis athletes aged 08-09 in Long An province

	Index	First time N = 16		Second time N = 16		x^2	Sig
		Total Score	%	Total Score	%		
01	Standing height (cm)	62	77.50	62	77.50	0.00	1.00
02	Quetelet Index (g/cm)	61	76.25	60	75.00	0.04	0.84
03	BMI Index (kg/m²)	52	65.00	51	63.75	0.03	0.85
04	The length of the dominant arm (cm)	52	65.00	52	65.00	0.00	1.00
05	Length of the dominant forearm (cm)	52	65.00	52	65.00	0.00	1.00
06	Arm length/forearm length x 100 (%)	57	71.25	57	71.25	0.00	1.00
07	Length of the dominant hand (cm)	53	66.25	52	65.00	0.03	0.85
08	Width of the dominant hand (cm)	53	66.25	52	65.00	0.03	0.85
09	Length of hand/length of forearm x 100 (%)	58	72.50	58	72.50	0.00	1.00
10	Hand area (cm²)	60	75.00	59	73.75	0.04	0.84
11	Length of the dominant hand (cm)	59	73.75	58	72.50	0.04	0.84
12	The dominant wrist (cm)	58	72.50	58	72.50	0.00	1.00
13	Wristband x 100/hand length (%)	59	73.75	58	72.50	0.04	0.84
14	Ankle circumference x 100/Achilles tendon length (%)	58	72.50	58	72.50	0.00	1.00
15	Waist (cm)	56	70.00	56	70.00	0.00	1.00
16	Somaty physique	53	66.25	53	66.25	0.00	1.00

The comparative data from Table 1 show that, for all results of the two interviews of the indicators, the chi-square test < chi-square table = 3.84 at the significance level Sig > 0.05, so the difference between the two comparative values is not statistically significant at the significance level Sig > 0.05. Thus, the results between the two interviews of the managers, experts, specialists, coaches, and lecturers show a high level of consistency in their responses.

Through the interview results, the study selected the indicators with a total score of more than 55 interview points (agreement level). According to the above principle, the study selected 10 indicators to assess the morphology of female table tennis athletes aged 08–09 in Long An province, including standing height (cm), Quetelet index (g/cm), arm length/forearm length x 100 (%), hand length/forearm length x 100 (%), hand area (cm²), dominant hand length (cm), dominant wrist circumference (cm), wrist circumference x 100/hand length (%), ankle circumference x 100/Achilles tendon length (%), waist circumference (cm).

3. Informativeness checking

To test the informativeness of morphological assessment indicators for female table tennis players aged 08-09 in Long An province, the study determined the informativeness coefficient by identifying the correlation between the test results of the indicators and the competition performance (round-robin ranking results) of the research subjects. Using the Spearman correlation coefficient formula [20], the analysis results are presented in Table 3.

Table 2: Correlation coefficient between morphological index performance and competition performance of female table tennis athletes aged 08–09 in Long An province

	Index	r	P
1	Standing height (cm),	0.11	>0.05
2	Quetelet Index (g/cm)	0.11	>0.05
3	Arm length/forearm length x 100 (%)	0.11	>0.05
4	Hand length/forearm length x 100 (%)	0.12	>0.05
5	Hand area (cm²)	0.15	>0.05
6	Dominant hand length (cm)	0.16	>0.05
7	Dominant wrist circumference (cm)	0.62	<0.05
8	Wrist circumference x 100/hand length (%)	0.57	<0.05
9	Ankle circumference x 100/Achilles tendon length (%)	0.28	>0.05
10	Waist circumference (cm)	0.66	<0.05

The results in Table 2 show that among the 10 tested indicators of the informativity of table tennis players aged 08-09 in Long An province, all indicators correlate with competition performance (r > 0.4 and P < 0.05). These indicators ensure the informativeness for assessing the morphology of female table tennis players aged 08-09 in Long An province are dominant wrist circumference (cm), wrist circumference x 100/hand length (%), and waist circumference (cm).

Through the synthesis of documents, interviews, and the verification of reliability and informativeness, the research has identified three indicators to assess the morphology of female table tennis athletes aged 8-9 in Long An province, which include dominant wrist circumference (cm), wrist circumference x 100/hand length (%), and waist circumference (cm).

Discussion

In table tennis, there is no specific model for athletes; for example, Deng Yaping from China, a three-time world champion and two-time Olympic champion, is less than 150 cm tall [21]. However, Ding Ning from China, the world's number one player (2/2013), is 170 cm tall [22]. Therefore, there is no model for the height of a table tennis player.

According to the research by Ben Larcombe (2012), the author measured the height, weight, and BMI of 50 top table tennis players in the world participating in the London 2012 Olympics, which showed that the average height of the top 50 table tennis players in the world is 1.79m; among them, the tallest are Alexander Shibaev at 1.94m, Kirill Skachkov at 1.91m, and Vladimir Samsonov at 1.89m; the shortest are Koki Niwa at 1.62m, Chuang Chih-Yuan at 1.67m, and Seiya Kishikawa at 1.68m [23].

According to the author's research, 8 out of the top 50 players in the ITTF rankings have a BMI greater than 25, which is considered overweight; among them, the highest BMI is Patrick Baum at 26.37, Jian Zhan at 26.09, and Jens Lundqvist at 25.95; there is no one with a BMI below 18.5. The three athletes with the lowest BMI are Koki Niwa 19.43, Alexander Shibaev 20. 46 and Xu Xin 20.49. The average BMI of elite players is 23.02, commonly ranging from 21.25 to 24.80. [23, 24].

The above results indicate that there is no ideal morphological model for table tennis players; however, the author shows that table tennis players need to have an average height and BMI ranging from 21.25 to 24.80.

According to Larry Hodges' research (2010) in table tennis, there is no ideal model for athletes; height does not create a difference in strategy when choosing a playing style. The important thing is that athletes must know how to use what they have. Tall athletes have a significant advantage due to their wider reach compared to shorter athletes. Because they are shorter, athletes have to move more, which helps them develop their legs better and turn more effectively. According to the author, shorter athletes have a slight advantage over taller athletes in terms of reflexes. Nerve impulses travel from the brain to the muscles at about 300 feet per second (205 mph), and therefore, a shorter player reacts a bit faster. If the distance from the brain to the wrist differs between two athletes, the one with the shorter distance will be able to change the angle of their racket faster [25].

According to Chinese researchers (2001), the morphological indicators in the selection of table tennis athletes do not have common points. In practice, we can demonstrate that athletes who have won world championships. For example: Liu Deliang (刘德良), Wang Liqin (王励勤), and Deng Yaping (邓亚萍). Only their outward appearances have no common points. However, when studying the elite athletes of China, the important morphological indices related to their performance are shoulder width/upper limb length × 100 and shoulder width/height × 100. Analyzing these indicators shows that the correlation is mainly due to the technical movements of table tennis players during ball contact, using a reference point to execute speed rotations in order to achieve maximum strength, speed, and rotation. From a biomechanical perspective, short arms can help athletes exert their strength more effectively, thereby improving the quality of their strokes [26].

According to the summary from China [25], elite male table tennis players have an average height of 170.54cm ± 5.124cm and a weight of 58.48kg. As for the female athletes, the average height is 159.05cm ± 5.124cm and the average weight is 50.10kg ± 5.256kg. According to the Chinese authors, it has been concluded that the average height of elite table tennis players is the most suitable, as being too tall or too short can both be disadvantageous for achieving outstanding performance. As for the weight of table tennis players, it is also at an average level, with the Quetelet index not being too high or too low.

Among high-level Vietnamese table tennis players [25], the average height for male athletes is 167.23cm, and for female athletes, it is 156.54cm. The average weight of male athletes is 56.55kg and female athletes is 48.35kg. Thus, the height and weight of Vietnamese athletes are lower than those of Chinese athletes, but they still belong to the category of athletes with average height and weight suitable for achieving excellent results.

According to the trend of modern table tennis development, players are using their wrists more and more, and it plays a decisive role in their strokes. The flexibility of the wrist and forearm largely determines the accuracy of the shot, especially for spin shots. Developing forearm muscles helps players easily create high-precision shots and better control over the trajectory and speed of the ball [27]. Nowadays, table tennis players are using the backhand flick more, and it is proving to be highly effective in competitions. Specifically, the term "Flick" is understood as a wrist snap executed right on the table by the player. The flick technique in table tennis is a method that is extremely popular in modern table tennis. This is an extremely effective way to launch an attack with table tennis speed. After the flick, the athlete can implement a high-speed offensive play and finish decisively. The most successful user of the flick technique in the world is the Chinese table tennis legend Zhang Jike. Nowadays, many young athletes are also applying this technique in competitions [28]. A study observing the number of backhand flicks used in serves by the top four men's singles players at the Tokyo 2020 Olympics from the third round, fourth round, quarter-finals, semi-finals, third-place match, and finals shows that gold medalist Ma Long (China) had 261 serves, using the backhand flick 118 times (45.21%), while silver medalist Fan Zendong (China) had 230 serves, using the backhand flick 108 times (46.96%), and athlete Dmitry Ovtcharov (Germany), the bronze medalist, had 262 serves, using a backhand 113 times (43.13%). Athlete Lin Yun Ju (Taiwan), in fourth place, had 275 serves, using a backhand 275 times (65.09%). From the statistics, it is observed that modern table tennis primarily adopts an offensive strategy, with top athletes using the backhand flick technique to attack immediately upon receiving the serve. The effectiveness is evident as these athletes achieved high rankings at the table tennis event in the 2020 Tokyo Summer Olympics. To effectively perform the Backhand flick technique, a good, flexible wrist and strength are required, as these strokes need a wide range of motion. On the other hand, in table tennis training and competitions, athletes need to move quickly and pivot rapidly to the left and right continuously throughout the match. Therefore, selecting morphological criteria for choosing table tennis players aged 8-9 is appropriate.

Conclusion

The study has identified 03 appropriate morphological indicators to evaluate 8–9-year-old female table tennis athletes in Long An province. The indicators were selected through a process of literature review, expert interviews, and validation, ensuring scientific basis and practical applicability. The research results provide a quantitative basis to support the evaluation of morphological

characteristics and the selection of young female table tennis players and should be used in conjunction with physical, technical, tactical, psychological, and functional factors to comprehensively assess the athletes' potential.

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