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THE PHYSICAL TESTS FOR 13-15 YEAR OLD TABLE TENNIS PLAYERS

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Abstract

The achievement of high performance and optimal physical quality is the requirement that can not be ignored by a coach because every sport requires physical quality levels that vary according to the required physical qualities of the sport. Today, there are many types of tests to determine physical capabilities that are used for identifying the talent of table tennis players of all age groups. The available physical tests have not been tested empirically against the physical performance of a table tennis player. This study aimed to develop appropriate physical tests for men and women's table tennis players aged 13-15 years. The method used was research and development. The development steps included 1) a preliminary study, 2) needs analysis, 3) expert validation, 4) empirical validation, 5) evaluating the effectiveness. The research samples consisted of 73 men's players and 68 women's players aged 13-15 who were enrolled in the Indonesia table tennis club (PTMSI) in Central Java; the age chronologically following the practice for at least 2 years and the frequency of exercise being 3 times a week. The data were analyzed using inter-correlation and research instruments consisting of observations with the Likert scale in the form of a rating scale. The results of the research and development show that the appropriate physical tests for men and women's players aged 13-15 years consist of 6 test items including arm span, hands reaction speed, a tennis ball catching-throwing test, shuttle run, 20-meter sprint and multistage running. The conclusions of this research are: the developed physical tests are appropriate for men and women's table tennis players aged 13-15 years, including the length of arm span, speed of reaction hand, tennis ball catching-throwing test, shuttle run, 20-meter sprint, and multistage run tests.

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INTRODUCTION

Table tennis is a game that is simple and can be played by anyone. The movements performed in the sport are consistent hitting, directing, and placing the ball onto the receiver's table and competitor being expected to be unable to return the ball. According to Guoliang (in Kertamanah 2003) table tennis is a sport with a moving body while hitting the ball. First is moving the waist and then moving the feet in conjunction with the hand hitting the ball. The harmonious movement is one of the guarantees for very strong offensive barrage to score. The ball comes so fast and changes directions so quickly that the game requires relatively high concentration.

Table tennis game demands quick rhythm in an effort to receive and return the ball so that a player needs to have high reaction speed. For example, a player who has a low reaction rate will find it difficult receive the ball leading to him/her. Sometimes, the players are able to receive hard balls and return them to the hard target as well so that the table tennis players also need agility and reaction speed to be able to receive the ball and move in the direction of the ball. The power of the biceps in table tennis is also an important factor because the table tennis game requires explosive movement to end the game in order to obtain scores. The table tennis game is affected by hand-eye coordination. Coordination is defined as a harmonious relationship of mutual influence between groups of muscles during the work, which is shown in different levels of skill. This coordination is needed in an effort to hit and return the ball because when a player is going to hit he/she must firstly look at the direction of the ball, then take a position to hit the next ball into the desired target. The good coordination between eye and hand can influence the outcome of a punch in table tennis. So, players who have the ability to better coordinate between the eye and the hand will produce a forehand or backhand strikes which are right on target, compared to players who lack good hand-eye coordination. Therefore, developed physical tests have to adjust the player's physical requirements in a table tennis game. In line with the opinion of Larry Hodges (1999), a good table tennis player should be able to: (1) quickly move to various directions; (2) the establishment of coordination between the movement of the arms and legs during the match; (3) agile; (4) the strong lower leg; (5) do smashes repeatedly without exhaustion. Based on these opinions, it implies that the physical elements which are dominant in table tennis are among others: speed, coordination, agility, strength endurance, and speed endurance. Based on these opinions, this study examines how to develop physical tests for men and woman table tennis players appropriately through physical tests and measurements in the field.

The requirement of pace in the sport of table tennis is increasing, such as the allocation of time within one minute is to be able to launch as many as 40-45 times forehand strikes, one day it takes 5,000- punch practice of hitting the ball. Besides that, a player should also know how to maintain proper body position (e.g., bending the knees, swing rapidly in harmony as well and move the heel) to achieve better levels of punches efficiency. If these errors have been existing since the early practice and undetected, it will cause negative effects on the efforts undertaken to develop their skill.

The basic motion in the table tennis game clearly includes such movements as sprinting, jumping, stepping, running back and forth, moving to the right and left side and made a stride. All motions and activities are required so that players can hit the ball in the position that remained well controllable. Movements in table tennis often last long and repetitive, consequently impacting the process of fatigue on the player. This fatigue condition must be understood to relate to the work of the heart, blood circulation, lung, nerve system and energy use system.

Table tennis achievement is a result of training that includes aspects of motion or physical ability, technique, strategies, mental/psychological aims to achieve the

highest performance in a table tennis game. The highest achievement in a table tennis match is the culmination of all the coaching process, including socialization and nurseries. However, until now the system of coaching, scouting and development of table tennis sport achievements still face problems which include: (1) the absence of an adequate evaluation system; (2) the lack of time and funds in the efforts to increase the national sports achievements; (3) the handling in the process of coaching accomplishments that have not been done continually; (4) the scouting and recruitment of athletes are often done through observation or by experience of the coach; (5) the selection of prospective players by choosing through championships or matches; (6) the limited human resources for athletes coaching, (7) the tools and environmental facilities, (8) the coaching methods used, (9) the management, (10) and the habit and map of potential areas and finances. Other obstacles that occur in sports achievement and often become a national issue are; (1) the issues of the national sports management, (2) the center of sports organizations that has not implemented the long-term program consistently and in sustainable manner, (3) the absorption and scientific approach and technology in sport is still limited, (4) the existence of a wide gap between top athletes and common athletes in abilities and achievement, (5) the talent scouting system is done naturally showing inadequate results, and (6) the weakness of the coaching process at the basic level. The efforts for achievement need systematic planning, implemented gradually and continuously from the beginning up to the achievement of the highest goals (Affairs: 2010).

The guidance system is expected to provide the widest opportunity for all children and youth to participate in sports activities as a preparation for achievement. Many factors can affect the achievement of table tennis. It is stated by Nossek (1982) that sports achievement relies on such elements as: (1) skills and techniques required, developed, mastered and automated; (2) capabilities based on the exercise setting of fitness, motor skills, learning ability of coordination; (3) good behavior to deal with situations in competition; (4) development of tactics and strategy; (5) quality of affective, cognitive and social behavior. Pesurney (2005) suggests that the enhancement of physical ability is determined by purposeful exercise, in addition to the age of the players, the talent, the nature of body organs, the muscle size, the level of coordination, and the control of psychic ability. High achievement requires training to develop the physical, technical, tactical and psychological conditions, supported by the talent of the players, available infrastructure, and good competition.

Today, there are many types of development of the physical condition tests that are used for identification and development of the table tennis players' physical tests for men and women, but not yet tested how much is the effectiveness against the performance of the table tennis athletes. The test is supposed to be relevant to the characteristics of the player, reliable and specific as a measuring tool, either individually or in teams so that the validity of the test shows that it is able to distinguish the characteristics of the players' physical abilities. Selection of the elements of physical tests is usually based on the theoretical logic that the elements needed for physical ability test in table tennis game has not been tested empirically. According to Jimbaw, a coach of the Chinese table tennis team in Kertamanah (2003), the higher the quality of the techniques that must be mastered by player the greater physical performance an athlete needs. Similarly, the higher the quality of the championship or tournament that will be followed, the greater the physical condition an athlete needs for achievement in the championship.

Almost all table tennis clubs/PTM in Central Java do not have the same kind of test to measure the physical ability of the players; 2) it was found that many types of physical tests for table tennis players which are used for measuring the physical aspects are the same so it is expected to be difficult and burdensome to the players (e.g., players have to run a distance of 100m but also a sprint test; 3) the existing tests

for this still overlap, it is seen from two or more types of tests to measure the same components of physical test; 4) the exercise programs are focused more on training the skills, techniques and tactics. Based on the above data it seems difficult to take benchmark tests which should be used. It is, therefore, necessary that a test should be developed and are expected to be used for the 13-15 year old or equivalent of Secondary School Students. The focus of this research was the 13-15 year old students due to the wide gap between the top athletes and common athletes in abilities and performance so that more attention ius given tocoach junior high school students at that age by the Department of Youth and Sports of Central Java province. Its target is reliable players to be prepared for the National Student Sports Olympiad, in the National Student Sports week, as the representative of Central Java. Besides that, it is also an opportunity to reach certain achievement for junior and senior age groups. By recruiting the right players, the coaching process for achievements of table tennis players aged 13-15 years in Central Java became clear. It is implemented on an ongoing basis to achieve peak performance. Table tennis coaching accomplishments are managed by the Education Center for Student Training (PPLP), based in Sports Hall Jatidiri Semarang, Central Java. In line with the background, the problem in this research is: What development of physical tests is appropriate for men and women's table tennis players aged 13-15 years? The objective of this study is Obtaining table tennis physical tests which are appropriate for men and women's players aged 13-15 years.

RESEARCH METHODOLOGY

The method used in this study was research and development, which was in the form of physical tests of table tennis that have already existed and have been done in each of the table tennis clubs but until now they have not been tested empirically and also did not have standard values. The basic orientation of this research and development was products taking into account not only the emphasis on test items which were selected, but also the procedures and processes, the substance of the contents according to the characteristics, implementation is easy, clear, practical, safe, and beneficial and effective to help coach the table tennis club in conducting physical tests. Among the characteristics of the sample is that a player men's and women table tennis aged 13-15 who has been practicing at least 2 years, with the frequency of exercise three times a week and as a member of the table tennis club is listed in Table Tennis Association of Indonesia (PTMSI)/Central Java table tennis club, Test carried out on a limited scale of PTM/table tennis club in the city of Surakarta as many as 61 players (34 men's players and 27 women players), for wide-scale number of 80 players (male 39 and female 41). After the test results of the limited scale were revalidated by experts then it was continued to a wide-scale test of PTM player or official table tennis club or PTMSI Central Java, followed by 16 table tennis clubs. The test effectiveness as a field test employing 16 of the 1-8 ranked players of the National Student Sports Olympiad (O2SN) of SMP Central Java (8 men and 8 women) by way of round-robin matches. The validation test by experts, using a Likert scale, where values are created with a feasible, less feasible and infeasible categories. The limited scale test aimed to determine which physical test is appropriate for men and women's table tennis players aged 13-15 years.

RESULTS AND DISCUSSION

Results

Data analysis using the pre-determined methods shows the following results.

Table 1. Stepwise Regression for men's players

Step	1	2	3	4	5
Constant	704.4	670.2	540.8	424.8	189.0
X-4	-54.3	-37.4	-28.9	-23.4	-18.4
T-Value	-11.89	-10.44	-8.81	-9.06	-10.93
P-Value	0.000	0.000	0.000	0.000	0.000
X-2		-4.87	-4.31	-3.42	-2.66
T-Value		-9.28	-9.74	-9.61	-11.36
P-Value		0.000	0.000	-9.61	0.000
X-5			9.37	9.03	8.37
T-Value			5.84	7.47	11.04
P-Value			0.000	0.000	0.000
X-3				8.64	8.53
T-Value				7.31	11.55
P-Value				0.000	0.000
X-1					1.22
T-Value					10.37
P-Value					0.000
S	26.8	18.1	14.9	11.2	7.01
R-Sq	66.57	85.01	89.97	94.39	97.84
R-Sq (adj.)	66.10	84.58	89.54	94.06	97.68
Mallows Cp	970.0	398.9	246.7	111.4	6.0

Table 1 shows that the fourth test item (X4), i.e. the speed of reaction hand, has the highest correlation to the coefficient determinant criterion with 66.57, and a test item with the highest validity based on test Stepwise Regression. The item with the second highest validity was Multistage Fitness Test, then sequentially test items Hand-Eye Coordination (X5), Arm length (X2), and Shuttle Run (X1). The significant contribution to the six test items criterion by 97.84%, with the regression equation Y = 189 - 18.4 X4 - X5 2.66 X2 + 8:37 + 8:53 + 1:22 X1 X3.

Thus the six test items can be qualified as an instrument to predict the ability to play table tennis in the physical domain male students.

Table 2. The results of Stepwise Regression for women's players.

Step	1	2	3	4	5	6
Constant	410.4	490.0	490.0	423.9	316.2	300.5
X6	-23.4	-15.8	-12.9	-9.4	-7.7	-7.9
T-Value	-9.19	-7.04	-6.31	-4.85	-3.79	-3.90
P-Value	0.000	0.000	0.000	0.000	0.000	0.000

X5		-14.0	-10.7	-8.0	-6.3	-5.8
T-Value		-6.87	-5.54	-4.55	-3.37	-3.07
P-Value		0.000	0.000	0.000	0.001	0.003
X3			4.36	4.31	4.16	3.91
T-Value			4.65	5.31	5.27	4.79
P-Value			0.000	0.000	0.000	0.000
X2				-1.82	-1.73	-1.48
T-Value				-4.74	-4.61	-3.45
P-Value				0.000	0.000	0.001
X1					0.58	0.52
T-Value					2.20	2.09
P-Value					0.031	0.037
X4						2.2
T-Value						1.98
P-Value						0.044
S	22.8	17.5	15.3	13.2	12.8	12.8
R-Sq	56.13	74.59	81.01	86.00	87.02	87.30
R-Sq(adj.)	55.46	73.81	80.12	85.11	85.97	86.05
Mallows Cp	146.8	60.1	31.2	9.3	6.4	7.0

Table 2 shows that item six in the test (X6) namely Shuttle Run, has the highest correlation with the criterion determinant coefficient of 56.13, and the test item with the highest validity was gained on the basis of the test Stepwise Regression. The item with the second highest validity was Hand Reaction Speed (X5), then sequentially test items Hand-Eye Coordination (X3), Free Running 20 meters (X2), Arm Length (X1), and Multistage Fitness Test (X4). The significant contribution to the six test items towards the test criterion was 87.30%, with the regression equation of Y = 300.5 - X6 7.9 - 5.8 + 3.91 X3 X5 - 1:48 0:52 X1 + X2 + X4.

Thus the six test items can be qualified as an instrument to predict the ability to play table tennis in the physical domain of female students.

Discussion

The series of physical tests show that there is no difference between male and female players. This indicates that in order to identify the interpretation of table tennis dominantly influential factors were the right choice to be implemented. The selection of a series of such tests are represented in detail as follows.

1) The independent variable in the form of biometric instrument consisting of three types of elements, namely: 1) body height, 2) leg length, 3) arm span. Constructively, such elements were relevant to the tennis table achievement, because the quantity of the measurement results of these elements, logically span of arms associated with the ability to reach the ball away from the player in the game of table tennis. Although many segments of the size of the body which can affect the achievement of table tennis but these elements adequately represent the concept in the sport of table tennis training. The phenomenon of the size of one of the members of the human body is usually closely linked to the size of the other limb. In mechanics (levers) in length sleeve style, compared with the linear acceleration, synonymous with style sleeves longer profitable to produce greater force against the load.
2) The throwing-catching of tennis ball test as a set of table tennis elements as the physical domain can be accepted logically. The

throwing-catching of a tennis ball is the ability to hand-eye coordination with regard to performance of a variety of motor skills to manipulate objects without any difficulty in directing to the target and controlling the object. In a table tennis game the players should be able to hit the ball accurately towards the difficult position of the opponent, and can return the ball to opponent quickly. This is in line with Irene R. Faber, GJ Frits Oosterveld, Maria WG-Nijhuis Van der Sanden (2014). A test was administered to forty-three table tennis student players aged 10-15 years from the national training center (n = 13), regional training center (n = 11), and local training center (n = 19). The hand-eye coordination test, by throwing the ball with one hand to the targets that have been positioned and catching the ball with his hands correctly. The results of the analysis show that the players of the national and the regional centers scored significantly higher than those of from the local center. The coordination test is relevant to table tennis as part of the talent identification and the test is also relevant to a table tennis player as part of a motion in table tennis. Such skills can be predicted from the ability to catch and throw the ball toward the target. The quality of catching and throwing a tennis ball is affected by the element of basic motor skills manipulation, motor coordination and speed of reaction to the arrival of the ball. Table tennis players with good quality in catching and throwing tennis balls reflects the quality of manipulative motion of the racket to receive and hit the ball. The eye-hand coordination has an impact on the ability to provide a response to the arrival of the ball whose direction and motion are unexpected by manipulating the racket motion (motion hit) to return the ball to the opponent whose direction and motion can beat the opponent's motion. In addition, hand-eye coordination has played a large role because at the time of hitting the ball, the first thing the player needs to do is to anticipate the ball I order to see the opponent's movements, read the direction of the ball, and then determine the exact distance to swing the racket. Good hand-eye coordination will certainly help in the table tennis game; the players will not be difficult to hit and return the ball to the opponent.

3) The speed of hand reaction in a table tennis game is necessary to receive and return the ball. A table tennis player requires a high reaction speed. On the other hand, if the player's reaction speed is low then it would be late in reaching the ball coming so it will be difficult when receiving and returning the ball towards the opponent. The reaction velocity of the table tennis player's hands is a reflection of the mastery of special techniques that indicates the skills in table tennis requiring specific capability.

4) The agility of motion to the right, left, front, and rear is indispensable in reaching the achievement of the table tennis game. The ability to position as close as possible to the location of the ball will allow the player to play the racket making it easier to direct the ball to the opposite field, before the opponent has a change to position himself in a favorable location.

5) Instrument sprinting 20 meters as a physical test circuit element table tennis acceptable logic. Scamper 20 meters is the ability to achieve the maximum moving speed of immovable position. The capabilities required in the game of table tennis, table tennis since the game requires the player must always move quickly towards the placement of the ball from an opponent during a rally took place. Long rally in a game of table tennis players' average men and women's players 4:05 seconds 3.90 seconds, adaptation to move quickly during a rally in accordance with the distance sprinting 20 meters, test results an average speed of 20 meters sprinting players aged 13-15 years, player 3.97 seconds sons and daughters players 4:17 seconds.

6) The choosing of Multistage Fitness Test as an element of physical test set in table tennis is logically acceptable. Multistage fitness test is an indicator of maximal oxygen consumption (VO2max). Giorgos P. Paradisis1, Elias Zacharogiannis (2014) argue

that an international table tennis player requires to have a VO2 max, a minimum of 50-56 ml/kg/min for males and 50-55 ml/kg/min for females, meaning the player with a high VO2 max can fulfill the supply of oxygen to the body while playing table tennis at a high intensity and a long period of time. Researching 48 students (25 males and 23 females) using a treadmill test and laboratory-based field tests with a multistage run results in a significant correlation and accuracy to predict the students' VO2max. The most important element of the physical fitness is the cardio-respiratory endurance, which is influenced by a variety of physiological factors, among others (Faisal Yunus, 1997): (1) Heredity, it was found that 93.4% of VO2max was determined by genetic factors. This can be changed with the optimal mechanism; (2) age, there is an increase of the cardio-respiratory endurance from childhood and it reaches its peaks at the age of 18-20 years. When doing the practice, the VO2max in children of about 13 years of age who are still growing and developing will increase 10-20% greater than those not practicing; (3) Gender, prior to practice, was no difference in VO2max between males and females. After the age of 13 years the females VO2max is only approximately 70-75% of males (Astrand, 2006); (4) physical activity, the rate of oxygen consumption increases with the increasing intensity of work. A multistage running is a popular field test that is widely used to measure aerobic fitness by predicting the absorption of maximum oxygen (VO2max) and as a performance indicator that is better used to describe differences in the performance of male and female athletes, to monitor the training of athletes, and to predict the intensity of the optimal training. Similar measurements carried out by L.A. Leger, D. Mercier, C. Gadoury (2008) show the similarities of the multistage running test results for men and women aged 12-16 years. The reliability value was 0.95 for males and 0.89 for females. Of the running motion of the multistage test which requires a periodic basis to be faster also indicates that the quantity of multistage running score is associated with the ability to maintain the speed of the motion in a long period of time. This means that the demands for table tennis game must be quick to complete the game in a long period of time as it is reflected in the demands for the running motion in a multistage running test.

CONCLUSIONS

The conclusions of this research are as follows. The development obtained appropriate physical tests for men and woman table tennis players aged 13-15 years, including the long arm span, the speed of hand reaction, catching and throwing a tennis ball test, shuttle run, 20-meter sprint, and multistage sprint. This indicates that in order to identify the interpretation of table tennis influential factors are dominant is the right choice to be implemented. A table tennis player needs such quality physical abilities as follows.

The long arm span was chosen as a test element, this indicates that the size statistically has inter-correlation with the other elements, so that the long arm span can represent anthropometric measure that correlates with the table tennis achievement. The reaction speed of the hand in the table tennis game requires a speed in the game to receive and return the ball. A table tennis player requires a high reaction speed, and on the other hand, if a player has a low reaction speed, it will be too late to reach the coming ball so it is difficult to receive and return the ball towards the opponent. The reaction velocity of the hands of a table tennis player is a reflection of the mastery of special techniques indicating that the skills in table tennis require specific quality capability.

Good motor coordination has an impact on the ability to provide a response to the coming ball to the unexpected direction through the racket manipulating motion to return the ball to the opponent in order to hit the opponent. In addition, the hand-eye coordination has played a large role because at the time of hitting the ball, the first thing to do to anticipate the ball is to see

the opponent's motion, to read the direction of the ball, and then to determine the exact distance to swing a racket. Good hand-eye coordination will certainly help in the table tennis game; the players will not be difficult to hit and return the ball to the opponent. Agility motion to the right, left, front, rear is indispensable in the achievement of table tennis game, the ability to position as soon as possible to be close to the location of the ball will allow the player to play the racket making it easier to direct the ball to the opposite field, before your opponent could put a favorable position.

A 20-meter quick run as a series of physical tests is a necessary element in the table tennis game since the game requires the player to always move quickly towards the placement of the ball from the opponent during a rally. The cardio-respiratory endurance (VO2 max) that is inadequate for the activity at a relatively long period time is will provide the impact of poor achievement.

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