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Designing and Validating Tests for Measuring the Performance Level of Some Basic Skills for Table Tennis Juniors

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Abstract:

Aim: *To design a set of specific tests, establish standardized levels and establish benchmarks for measuring performance endurance of some basic skills for junior table tennis players using ball canon.* ***Methods:*** *The researchers used descriptive (survey) approach. Research community included all junior table tennis players who were registered in the Egyptian Table Tennis Federation during 2016-2017 (n=352). Participants (n=112) were distributed to pilot sample group of (16) players (14.3%) and main sample group of (96) players (85.7%).* ***Results:*** *The researchers designed a set of validated tests for measuring performance endurance of some basic skills for table tennis junior players using the ball canon. The set of tests enjoy high validity and reliability and this indicates it objectivity. The set of tests diagnose weaknesses and strengths of junior table tennis players less than 18 years concerning performance endurance of some basic skills on various places of the table. The set of tests cover the most frequently used basic skills in various game situations. Criteria of tests (velocity – spin – direction – place) can be used in measuring all individual and complex basic skills according to various game situations. The set of tests help categorizing players and improving their abilities according to fast improvements in table tennis. The researchers established the standard levels of performance endurance tests for junior table tennis players less than 18 years. The researchers established the benchmarks of performance endurance tests for junior table tennis players less than 18 years. The researchers established the levels of performance endurance for junior table tennis players less than 18 years using these tests.*

Keywords: *Validated Tests – Ball Canon – Performance Endurance – Basic Skills - Table Tennis*

Introduction:

Sports excellence is a modern aspects of nation's development as increased achievements in sport refer to scientific development of nations and levels of using science in improving sport. Evaluation methods in general, and especially tests and measurements, are basic pillars for making physical education and sport a science and profession.

Farahat, L. (2012) indicated that recent years witnessed major improvements in objective methods of measurement and evaluation and most problems of the sports field can be solved using specialized measurements and tests that are scientifically validated. This means that coaches should have accurate and validated objective measurements that can be used to identify effort exerted during training process and the extent to which training programs achieve its desired objectives to reach elite sports levels (Farahat, L. 2012: 4).

Abd El-Fattah, A. (2012) indicated that the concept of endurance is not limited to performance for a prolonged period of time. Instead, as a general concept endurance is the ability to overcome all types of fatigue. Specific endurance is the athlete's ability to overcome fatigue resulting from specific loads of the specific sports activity during training and competition. He thinks that external aspects of specific endurance can be summarized in the athlete's ability to maintain performance level during competition. It is manifested in: maintaining performance speed – increasing the number of effective attack – overcoming gradual increase in performance intensity – maintaining a high level of technical performance during competition (Abd El-Fattah, A. 2012: 196).

Abd El-Zaher, M. (2014) indicated that specific endurance is a complex quality as it is related to directing elements of competitive success in the specific sport including style of performance, technical and tactical economics, specific speed endurance and high levels of mental qualities

required for the specific activity (Abd El-Zaher, M. 2014: 122).

The researchers think that specific endurance is the athlete's ability to maintain high intensity physical and technical abilities for a relatively long period of time. Therefore, coaches should consider linking specific endurance exercises to specific performance according to temporal and dynamic tempo. Competitive and specific exercises should take a longer period of time during training units.

Kondric, M. et al (2013) and Ghareeb, M. (2013) indicated that table tennis has evolved greatly during recent years due to investing and using modern technologies from various scientific fields. This is clear in ball velocity as it reached 180km/h and major improvements on racquet leather coatings. These applications can be used in improving training programs to achieve elite levels as it increases the physical performance level of the player which in turn is reflected positively on his/her technical and tactical performance levels in international competitions (Kondric, M. et al 2013: 362) (Ghareeb, M. 2013)

ITTF laws (2016) indicated that match runs should be an odd number, according to the competitive level and method of organization in a given championship. Therefore, several organization committees of international championships modified the number of runs to be (7) for the 16-round, instead of (5). This reflects the player's physical, physiological and technical level of control over the match (20, 29)

Abd El-Gawad, M. (2014) indicated that a table tennis player should master all basic skills as they are all equal in importance. Mastering these skills requires continuous practice in every training unit for each skill individually and then to practice them in the form of complex tactical patterns similar to competitive situations considering that training duration should be proportionate to match duration so that the player can choose the best skills suitable for each game situation from the beginning to the end (Abd El-Gawad, M. 2014: 10).

The researchers reviewed the available studies related to designing tests for basic table tennis skills (Pushpendra Purashwani et al 2010: 89) (Saleh, S. 2011: 114) (Kastikadelis, M. et al 2014).

This review of literature revealed that most of these studies designed tests for speed or accuracy of basic skills, other aspects of physical fitness or counterattack. None of these studies discussed performance endurance or using double-head ball canon that can control ball velocity, direction, place or progression through the control unit of the device. This led the researchers to try to design validated tests for basic skills performance endurance for junior players less than 18 years.

According to the first researcher's experience as a national and international coach, chairman of the coaches' committee and secretary of the scientific committee of the Egyptian Table Tennis Federation, and according to the second researcher's experience as a former table tennis player and champion and coach in several sports clubs, in addition to review of related literature, they noticed that the training process requires objective evaluation for achieving its general objectives. They also noticed that performance endurance for basic skills requires validated objective evaluation the coach can rely on as most players seem weak at the end of each round especially round five and seven when the match reaches its peak duration when regular methods of scoring points are transformed into alternative methods when the mean time of match reaches 30 minutes. Coaches usually use individual estimations which are considered non-objective methods of evaluation. This led the researchers to design tests for evaluating performance endurance of some table tennis basic skills through physical-technical evaluation and establishing standard levels reflecting the real level of the player so that players are encouraged to perform better and try to reach elite levels.

Previous studies indicated that there are no unified standards for evaluating the performance level and progressive development of performance endurance abilities for table tennis players during training or competitions through objective standardized levels that turn raw points into standard points for each age group (Pradas, F. et al 2010: 177) (Kasai, J. et al 2010: 14) (Katsikadelis, M. et al 2010: 51) (Pushpendra Purashwani et al 2010: 89) (Katsikadelis, M. et al 2014).

This research is a try towards objective evaluation as designing training programs is linked to providing evaluation tools that enable us to monitor the effects of the training program and recognize improvements in results through comparison of pre- and post-tests. Therefore, this research is required for the following reasons:

1- It is applied on a critical age group as player transfer from cadets to juniors and then to men championships and this age group controls the player's attitudes towards continuing his/her career or withdrawal.

2- Previous studies concerning this topic are insufficient.

3- The current research tries to identify the performance endurance level of juniors less than 18 years and their mastery of complex skills in game-like situations

4- It is a try to establish objective versus subjective tests.

Aims:

The current research aims to:

1- Design a set of specific tests for measuring performance endurance of some basic skills for junior table tennis players (less than 18 years) using ball canon

2- Establishing standardized levels for performance endurance tests of some basic skills for junior table tennis players (less than 18 years) using ball canon

3- Establishing benchmarks for performance endurance tests of some basic skills for junior table tennis players (less than 18 years) using ball canon

Methods:

Approach:

The researchers used descriptive (survey) approach.

Participants:

Research community included all junior table tennis players who were registered in the Egyptian Table Tennis Federation during 2016-2017 (n=352). Participants were purposefully chosen from players who participated at the open Republic Championship – RAS ELBAR 2016. Table (1) shows description of participants.

Table (1)

Description of participants

Sample	Number	Percentage
Pilot sample	16	14.3%
Main sample	96	85.7%
Sum	112	100%

Table (1) shows that total number of participants was (112) distributed to pilot sample group of (16) players (14.3%) and main sample group of (96) players (85.7%). Homogeneity of participants is shown in table (2).

Table (2)

Homogeneity of participants on main research variables (n=96)

	Variable		Measurement	Mean	SD	Median	Squewness
1	Growth factors	Age	Year	17.0468	0.5438	16.60	0.160
		Height	Cm	171.415	1.448	170.2	- 0.149
		Weight	Kg	64.806	1.614	65.00	0.315
2	Experience		Year	6.135	0.3550	5.700	0.864

Table (2) indicated that squewness values ranged from 0.864 to 0.149 (between ±3). This indicates data normality and participants' homogeneity.

Planning for main experiment:

Participants were divided into two groups (48 participants each). Group 1 was also divided into two sub-groups (24 participants each). Table (3) shows participants division on groups.

Table (3)

Division of participants into groups

Groups	Number	Purpose
Group 1	N1=24	Assuring suitability of tests (easiness – difficulty) to participants
	N2=24	Calculating validity of tests
Group 2	N3=48	Calculating reliability of tests
Sum	N=96	Preparing benchmark tables of tests

Table (3) showed division of participants (n=96) into three groups for preparing benchmark tables of recommended tests. For homogeneity of participants of the three groups, the researchers calculated homogeneity for each group.

Table (4)

Homogeneity of the three groups on basic research variables

	Variables	Measurement	Groups	Mean	SD	Median	Squewness

	Variables		Measurement	Groups	Mean	SD	Median	Squewness
1	Growth factors	Age	Year	N1=24	17.0214	0.5630	16.780	0.218
				N2=24	17.0536	0.5384	16.860	0.136
				N3=48	17.0468	0.5520	16.440	0.190
		Height	Cm	N1=24	171.563	1.032	172.00	0.208
				N2=24	171.231	1.414	171.00	-0.370
				N3=48	171.415	1.126	174.01	0.096
		Weight	Kg	N1=24	64.614	1.6297	65.000	0.329
				N2=24	64.123	1.6895	64.500	0.662
				N3=48	62.893	1.5672	65.00	0.251
2	Experience		Year	N1=24	6.092	6.092	0.3731	5.800
				N2=24	6.1079	6.1079	0.3560	6.100
				N3=48	6.121	6.121	0.3737	5.899

Table (4) indicated that squewness values ranged from 0.921 to 0.370 and this indicates homogeneity of the three groups and data normality.

To assure that there are no differences in basic variables among the three groups, the researchers performed One-Way ANOVA as seen in table (5)

Table (5)

One-Way ANOVA for comparison of the three groups

	Variables		Measurement	Variance resource	Sum of squares	Freedom degrees	Means squares	F
1	Growth factors	Age	Year	Inter-group	0.013	2	0.00712	0.022
				Intra-groups	33.157	93	0.308	
				Sum	33.170	95		
		Height	Cm	Inter-group	2.361	2	1.182	0.821
				Intra-groups	151.568	93	1.430	
				Sum	153.929	95		
		Weight	Kg	Inter-group	7.143	2	4.061	1.302
				Intra-groups	314.570	93	2.914	
				Sum	321.713	95		
2	Experience		Year	Inter-group	0.007	2	0.00341	0.033
				Intra-groups	12.859	93	0.146	
				Sum	12.866	95		

F table value on P≤0.05 = 3.55

Table (5) indicated that there are no statistically significant differences among the three groups on basic variables.

Procedures for designing tests:

A) Designing Tests

B) Identification of Tests

C) Trying Final Versions of Tests

D) Procedures for Measurement and Running the Ball Canon According to Each Test

E) Validating Tests

F) Deriving Standards

A) Designing Tests: The researchers designed (10) tests for measuring performance endurance of some basic skills for junior table tennis players less than (18) years using a ball canon (TIBHAR – ROBO Pro Master). The researchers considered the following:

- Tests should be consistent with this research aims

- Tests should cover the whole area of the table surface

- Players should perform with forehand, backhand or both faces

- Performance situation should be similar to real competitive situations

- Tests should be exciting to stimulate players' motivation

- Tests are designed for right-handed players. Therefore, ball trajectory should be modified for lift-handed players.

The researchers established a preliminary version of these tests and presented them to (8) experts of table tennis (4 of them were faculty members and 4 were experienced coaches). Experts expressed their opinions to accept, modify or eliminate tests.

B) Identification of Tests: The researchers reviewed the available studies related to this research (Suchomel, Ales 2010: 75) (Pushpendra Purashwani et al 2010: 89) (Saleh, Sherif F. 2011: 116) (Lefta, Murtada A. 2012: 10) (Sharma, R. 2013: 84-88) (Katsikadelis, M. et al 2014) (Li, Tao 2015) (Letts, Greg 2016).

The researcher benefited from these studies in designing the recommended tests for evaluating the performance endurance level of basic tables tennis skills that are frequently used in real competitions. They also used the double-head ball canon for programming each test instantly through the easy-to-use control unit. The researchers modified the tests according to experts' opinions.

C) Trying Final Versions of Tests: The researchers followed the following procedures:

1- Interviews with coaches of junior teams less than 18 years for getting their agreement on application

2- Preparing a data recording form for each player

3- Preparing the tools required:

- TBHAR (ROBO Pro Master) double-head ball canon

- Hundred (100) certified table tennis balls (ITTF approved)

- One certified table (ITTF approved)

- One certified net (ITTF approved)

- One table tennis racquet (Each player is required to bring his/her own racquet to the test)

Pilot study:

Pilot study was performed on a randomly chosen (16) players from the same research community and outside the fain sample to: Verify the validity of the ball canon - Verify the suitability of ball variables (velocity – spin – place – direction – progression) on the table surface to the age group - Verify the applicability of tests after experts' modifications - Verify conditions and criteria of tests - Identification of each test's duration - Identification of between-tests rest intervals - Identification of total duration of test battery - Identification of the suitable number of daily tested players - Assuring tests progression from easy to difficult - Assuring the suitability of data recording form.

D) Procedures for Measurement and Running the Ball Canon According to Each Test:

1- The ball canon is fixed to the middle of table surface facing the player and 30cm away from the table

2- The player stands 50cm away from the middle of table holding the racquet and ready for the test

3- The ball canon is calibrated according to each test's objective as seen in the following tables:

Test (1): Straight forehand stroke

	Head 1	Head 2	Head 1	Head 2
Ball	1	2	3	4
Velocity	5	6	5	6
Spin	2	3	2	3
Place	10	7	4	1
Ball/min	60balls / min			
Duration	Performance for 2 min			

The previous table undicates that the device has two heads for ball throwing. Each head can control ball speed, type of spine, place of contact with the table and sequence of balls during the time identified by the coach.

Recording:

- The coach records the number of balls hit from different places on the table to reach the other side

- Balls that do not touch the table surface of the other side are not recorded

Statistical treatment:

The researchers calculated the following: mean – SD – median – squewness – Person's correlation coefficient – Cronbach's Alpha – One-Way ANOVA – benchmarks

E) Validating Tests:

For verifying easiness and difficulty levels of tests the researchers applied the (10) tests to group 1 (n=24) to identify any difficulties that may arise during main application.

Table (6)

Mean, SD, Median and Squewness for group 1 on the recommended tests (n=24)

	Tests	Mean	SD	Median	Squewness
1	Straight forehand stroke	56.25	0.737	56.0	0.444
2	Straight forehand/backhand stroke	60.16	0.816	60.00	0.716
3	Spiral forehand stroke	44.65	0.494	45.00	0.551
4	Spiral forehand/backhand stroke	53.54	0.508	54.00	0.179
5	Smash forehand stroke	57.00	0.780	58.00	1.119
6	Forehand/backhand block and suppression	47.29	0.806	47.00	0.604
7	Balloon backhand defense and spiral forehand stroke	60.54	1.382	60.50	1.225
8	Forehand/backhand various attack strokes	51.45	0.779	52.00	1.065
9	Forehand/backhand various defense strokes	50.250	1.073	50.00	0.086
10	Forehand/backhand various attack and defense strokes	71.20	0.832	71.00	0.426

Table (6) indicated that squewness values ranged from 0.086 to 1.224-5. This indicates normality of data as it is free of radical distributions.

Validity of Tests:

The researchers calculated distinct validity through identifying the upper and lower quartiles for each player in addition to internal consistency in distinguishing high and low levels. For this purpose, the researchers applied the tests to group 3 from 7-9-2016 to 10-9-2016.

Table (7)

Distinct validity of the recommended tests (n=48)

	Tests	Lower quartile (n=12)		Upper quartile (n=12		(t)
		Mean	SD	Mean	SD	
1	Straight forehand stroke	52.250	0.753	59.750	1.288	17.40*
2	Straight forehand/backhand stroke	56.166	0.834	61.75	1.125	13.11*
3	Spiral forehand stroke	40.583	0.514	45.083	0.792	16.48*
4	Spiral forehand/backhand stroke	50.57	0.514	54.91	0.799	15.87*
5	Smash forehand stroke	55.58	0.515	59.916	0.900	14.47*
6	Forehand/backhand block and suppression	45.50	0.522	49.91	0.903	14.70*
7	Balloon backhand defense and spiral forehand stroke	57.91	0.668	60.66	1.435	12.57*
8	Forehand/backhand various attack strokes	49.58	0.514	53.91	0.792	15.87*
9	Forehand/backhand various defense strokes	48.41	0.515	52.33	0.887	13.22*
10	Forehand/backhand various attack and defense strokes	68.08	0.668	73.75	0.866	17.94*

(t) table value on P≤0.05 = 2.07

Table (7) indicated statistically significant differences between the high and low groups on results of the recommended tests. This indicates the validity of tests as they distinguished between the two groups.

Reliability of Tests:

To calculate reliability of tests, the researchers used the test/retest procedure on group 2 (n=24) from 17-9-2016 to 21-9-2016 as tested the group and retest them with 3-day interval between test and retest to calculate Cronbach's Alpha.

Table (8)

Reliability of recommended tests (n=24)

	Variables	Test		Retest		R	Alpha
		Mean	SD	Mean	SD		
1	Straight forehand stroke	59.750	1.288	60.08	0.996	0.939	0.952

2	Straight forehand/backhand stroke	61.75	1.125	62.00	1.044	0.859	0.903
3	Spiral forehand stroke	45.083	0.792	45.58	0.792	0.783	0.842
4	Spiral forehand/backhand stroke	54.91	0.799	55.75	0.965	0.920	0.994
5	Smash forehand stroke	59.916	0.900	60.08	0.996	0.921	0.911
6	Forehand/backhand block and suppression	49.91	0.903	50.03	0.778	0.827	0.903
7	Balloon backhand defense and spiral forehand stroke	6.66	1.435	64.41	1.50	0.954	0.913
8	Forehand/backhand various attack strokes	53.91	0.792	53.58	1.223	0.863	0.905
9	Forehand/backhand various defense strokes	52.33	0.887	52.66	0.984	0.867	0.803
10	Forehand/backhand various attack and defense strokes	73.75	0.668	74.16	0.834	0.817	0.854

R table value on P≤0.05 = 0.707

Table (8) indicated high test/retest correlation for all tests. Total Cronbach's Alpha coefficient for the whole set of tests was 0.971 indicating high reliability of tests.

F) Deriving Standards:

After verifying validity and reliability of tests, the researchers applied the (10) tests for all participants (n=96) from 5-10-2016 to 10-10-2016 during the Open Republic Championship (RAS ELBAR 2016). Accordingly, the researchers prepared standard levels tables and benchmarks tables.

Table (9)

Standard Levels of Performance Endurance Tests (n=96)

(1) straight forehand stroke		(2) straight forehand/backh and strokes		(3) spiral forehand stroke		(4) spiral forehand /backhand strokes		(5) Smash forehand stroke		(6) forehand/bac khand block and suppression		(7) backhand balloon defense and spiral forehand stroke		(8) various forehand/back hand attack strokes		(9) various forehand/back hand defense strokes		(10) various forehand/back hand attack and defense strokes	
Raw	Standard	Raw	Standard	Raw	Standard	Raw	Standard	Raw	Standard	Raw	Standard	Raw	Standard	Raw	Standard	Raw	Standard	Raw	Standard
35	-1.755	49	-1.120	30	-1.33	26	-1.628	32	-1.318	45	-1.292	28	-1.856	31	-1.755	37	-1.370	42	-1.795
38	-1.601	52	-0.964	32	-1.24	28	-1.542	35	-1.164	48	-1.184	35	-1.603	35	-1.563	39	-1.300	45	-1.673
40	-1.498	55	-.0809	35	-1.109	30	-1.369	37	-1.061	52	-1.014	38	-1.490	38	-1.418	42	-1.196	50	-10.471
42	-1.395	57	-0.705	37	-1.021	32	-1.354	39	-0.958	55	-0.934	42	-1.350	42	-1.226	45	-1.092	59	-1.106
45	-1.240	59	-0.601	41	-0.844	35	-1.239	42	-0.803	60	-0.756	45	-1.242	48	-0.937	55	-1.057	65	-0.863
48	-1.086	60	-0.549	45	0.-667	37	-1.153	50	-0.391	62	-0.684	49	-1.098	52	-0.745	60	-0.571	70	-0.660
52	-0.880	65	-0.185	47	+0.579	40	-1.109	52	-0.288	65	-.577	55	-0.882	55	-0.600	68	-0.294	75	-0.457
55	-0.725	67	-0.793	52	-0.357	45	0.807	55	-0.134	70	-0.398	60	-0.702	59	-0.408	75	-0.50	78	-0.341
59	-0.519	70	0.029	58	-0.0926	48	-0.677	59	0.719	75	-0.220	65	-0.522	65	-0.119	79	0.087	80	-0.255
65	-0.210	75	0.229	60	-0.0041	55	-0.374	62	0.226	79	-0.077	70	-0.311	69	0.0732	85	0.296	85	-0.142
68	-0.055	79	0.437	65	0.217	58	-0.245	65	0.380	85	0.137	72	-0.269	72	0.0521	90	0.469	88	0.069
70	0.047	85	0.749	68	0.349	62	-0.072	68	0.535	86	0.173	75	-0.161	75	0.361	95	0.643	92	0.231
73	0.201	90	1.009	70	0.438	75	0.490	72	0.741	90	0.316	80	0.0187	77	0.412	99	0.782	95	0.352
75	0.304	95	1.268	72	0.526	80	0.706	76	0.947	95	0.494	89	0.199	80	0.602	101	0.872	100	0.556
79	0.5100	98	1.432	75	0.659	85	0.922	79	1.102	99	0.637	92	0.451	82	0.698	105	0.990	105	0.758
82	0.665	100	1.528	79	0.836	90	1.136	80	1.153	102	0.744	96	0.595	84	0.751	112	1.233	109	0.920
85	0.819	103	1.310	82	0.968	92	1.225	85	1.41	105	0.852	100	0.739	86	0.891	119	1.47	112	1.042
87	0.923	105	1.053	86	1.145	95	1.354	88	1.565	111	1.066	105	0.920	88	0.987	120	1.511	116	1.204
90	1.077	107	1.892	89	1.278	97	1.441	90	1.668	116	1.245	109	1.064	89	1.035				
92	1.180	110	2.048	92	1.41	99	1.527	92	1.771	125	1.566	115	1.280	92	1.180				
95	1.335	112	2.152	97	1.63	101	1.614	93	1.823	132	1.816	118	1.388	95	1.324				

Table (10)

Benchmarks and its related degrees for performance endurance tests (n=96)

Benchmarks	(1) straight forehand stroke	(2) straight forehand/backhand strokes	(3) spiral forehand stroke	(4) spiral forehand/backhand strokes	(5) Smash forehand stroke	(6) forehand /backhand block and	(7) backhand balloon defense and spiral	(8) various forehand /backhand attack	(9) various forehand /backhand defense	(10) various forehand /backhand attack

						suppression	forehand stroke	strokes	strokes	and defense strokes
100	95	112	97	101	93	132	118	95	127	116
95	92	109	93	96	87	125	116	90	121	112
90	86	104	90	90	81	121	112	85	118	109
85	83	99	88	85	77	118	106	79	112	104
80	79	93	85	82	70	115	101	74	109	99
75	74	91	80	76	68	112	98	71	106	93
70	71	89	76	73	64	109	95	70	101	88
65	69	85	74	70	63	105	90	68	98	85
60	66	83	70	64	61	101	86	64	93	82
55	63	80	67	59	58	98	84	61	88	78
50	59	77	63	55	55	95	80	57	84	77
45	58	76	59	52	53	91	79	55	82	72
40	56	75	52	49	49	86	74	53	78	68
35	54	69	48	46	46	81	67	48	74	62
30	51	65	45	43	42	78	55	45	67	59
25	45	63	43	40	39	75	47	40	62	55
20	53	60	39	36	37	63	41	37	59	51
15	39	55	35	32	36	59	38	34	52	49
10	38	52	33	29	34	51	35	33	45	45
5	35	49	30	26	32	45	28	31	37	42

Table (10) showed benchmarks and its related degrees for performance endurance tests of basic skills for junior table tennis players using the ball canon. Through these benchmarks junior players can be categorized according to their raw scores and benchmarks from very weak to excellent. The researchers think that this can be as follows: less than 5% to 25% = very weak – 26% to 45% = weak – 46% to 60% = acceptable – 61% to 79% = good – 80% and higher = excellent. This indicates the importance of these standard levels and benchmarks for coaches of this age group as it enables them to categorize their players objectively and design their training plans accordingly.

The researchers thinks thatr these tests are clear and valid indicators for improoving the physical aspects in general and especially performance endurance and its effects on the technical performance of the table tennis player during this critical age stage. This particular stage represents the transformation from junior stage to strong and violent competitions of the youth and men championships.

Heaton, J. (2012) indicated that performance endurance is a major physical component required by table tennis players to improve their physical and functional effeciency. It has positiive effects on several variables that control the improvement of technical performance. It also affects steady focus and readiness for struggle from the beginning to the end of the match as it includes ball rally with speeds exceeding 50m/sec (Heaton, J. 2012: 72).

Schlager, W. & Berned, G. (2011) indicated that performance endurance is a major variable trhat affects the player's long-term physical and mental resistance that may reach the limits of major fatigue. This fatigue may lead the player to lose the match, which in turn affects his/her rank or being denied a world champion title along with his/her country (Schlager, W. & Berned, G. 2011: 154).

The researchers think that controling the endurance level of table tennis players have significant effects on match results as seen in several world championship finals recently. In some cases, players managed to win the match by its end although the opponent advanced by some runs. This is because the winner enjoyed higher levels of performance endurance under physical and mental pressure. This competitive performance endurance enables players to reach draw and even win the match as it helps such players to deal with the ball speed, timing, location and spine type for his/her own benefit.

Conclusions:

According to this research aims, methods and statistical treatments, the researchers concluded the following:

1- The set of tests enjoy high validity and reliability and this indicates it objectivity

2- The set of tests diagnose weaknesses and strengths of junior table tennis players less than 18 years concerning

performance endurance of some basic skills on various places of the table

3- The set of tests cover the most frequently used basic skills in various game situations

4- Criteria of tests (velocity – spin – direction – place) can be used in measuring all individual and complex basic skills according to various game situations

5- The set of tests help categorizing players and improving their abilities according to fast improvements in table tennis

6- The researchers established the standard levels of performance endurance tests for junior table tennis players less than 18 years

7- The researchers established the benchmarks of performance endurance tests for junior table tennis players less than 18 years

8- The researchers established the levels of performance endurance for junior table tennis players less than 18 years using these tests

Recommendations:

According to these conclusions, the researchers recommend the following:

1- Using performance endurance tests of some basic skills for junior table tennis players in training and selecting junior players

2- Using performance endurance tests of some basic skills for junior table tennis players as a means for evaluating players and as a means for training endurance in table tennis

3- Considering the results of this research when designing training programs for junior table tennis players less than 18 years

4- These tests are indicators for technical performance. Therefore, it is important to use them in evaluating players through follow-up measurements.

5- It is important to improve the physical level of table tennis players less than (18) years in general, and especially the performance endurance componenet, because of its positive effects on the technical performance levels during matches.

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