Differences between indexes in situation efficiency of recreational table tennis players in two different seasons

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Abstract: For players' situational performance analysis, the basic and most useful indicator of game quality is precisely the result achieved in a particular sports competition. The basic aim of the research is to question to what extent indexes directly derived from the results of individual table tennis games can distinguish between table tennis players at different league levels, during two different years. The final sample comprised 1597 table tennis players competing in various recreational table tennis leagues in SOKAZ, during two championships in 2006 (803 players) and two championships in 2007 (794 players), playing in leagues ranging from 1 to 20. Indexes of efficacy for an individual in table tennis competition were defined. We found that there was a significant difference in the indexes of efficiency, according to the league level in the table tennis championships (relative competition success is not approximately the same). We found that there was a significant difference in the indexes of efficiency, according to the year of competition in the table tennis championships (relative competition success is different in 2006, compared with 2007). We found that there were no differences in the indexes of efficiency according to the interaction of the two factors: year of competition and league level in the table tennis championships (relative competition success is approximately the same).

Key words: *table tennis, analysis, competition, differences, indexes*

1. INTRODUCTION

The growth of sports science and the commercialization of racket sports in recent years have focused attention on improved performance, and this has led to a more detailed study and understanding of all aspects of racket sports. With the development of table tennis equipment, rule changes and player techniques, ball speed and spin have increased greatly, which shortens the rallies for each point. This is not what table tennis was in the past. Because of its complex nature, it is not easy for scientists to provide measurements, e.g., at the World championships or the Continental championships or even recreational leagues, to collect the necessary data for presentation to coaches and athletes.

The definition of tactical patterns of play in table tennis has been a profitable source of research. Downey (1973) initiated research in notational analysis of sport when he published his systems for tennis and badminton which, although providing a fund of ideas used by other analysts, were never actually used to gather data, owing to their complexity. Although many table tennis coaches are able to anticipate the game and make appropriate changes to influence player performance, even the best are prone to human errors which lead to unwise decisions. That's why we need a systematic analysis approach within coaching practice, using valid, reliable performance data to monitor and evaluate performers. Franks and Miller (1991) have highlighted memory retention problems, with coaches

able to recall only 30-50% of the key performance factors they had witnessed, even with special training in observation. Without such an approach, coaches are liable to form biased opinions of their players' performances, leading to potentially incorrect substitution decisions in the game or training prescriptions. In table tennis, analysis is an objective way of recording player performance, so that critical events in that performance can be quantified in a consistent and reliable manner. Table tennis is one of the fastest ball games in the world, and therefore it is difficult for the coach to notice and remember all the key elements occurring within a game or training session. Nevertheless, as in many other sports, analysis in table tennis is based on accurate observation and recall and forms a main tool for improving future performance of the player at the different stages.

Although the use of notation in the expressive arts to define and describe results dates back thousands of years, its usefulness as an aid to understanding sports performance in table tennis has only recently been recognised. Amongst different types of quality analysis of the table tennis players' game, the basic idea of this study was to detect those indicators (data) for collection of which only the final result would be sufficient. Sindik (1999) carried this out by the implementation of variables that could be directly derived from the results of competitions. However, those variables could be reduced to a smaller number of indexes. Sindik and Juričević (2007) derived 16 indexes as indicators of game quality, based exactly on

the achieved result in a particular table tennis competition, but for the former system of points in table tennis (game with two sets, played till reaching 21 points). Some attempts have been made in the past to establish additional information on the table tennis game (Schulman and Hamdan, 1977; Wilson and Barnes, 1998; Sindik, 1999; Otcheva and Drianovski, 2002; Baca et all., 2004; Noubary, 2007; Wu and Escobar-Vargas, 2007; Leser and Baca, 2009; Sindik and Vidak, 2009). Improvements in the data collecting equipment have enabled us to obtain more specific and accurate data, but at present there is still insufficient comparative theoretical research in different countries. However, theoretical research is indispensable to comparative table tennis research.

Aims and problems

The basic aim of the study is to establish to what extent indexes derived directly from the results of individual table tennis games can differentiate between table tennis players at different league levels, during two different years.

The problems of the research are to determine:
1. differences in the indexes of efficiency, according to the league level in the table tennis championships;
2. differences in the indexes of efficiency, according to the year of competition in the table tennis championships;
3. differences in the indexes of efficiency, according to the interaction of both factors: year of competition and league level in the table tennis championships.

2. METHODS

Data collection was performed by inspecting all the results of individuals (players-examinees) from the official web page of the Table Tennis Organization of Clubs and Activities of Zagreb (SOKAZ-www.sokaz.hr). The total result for an individual in a larger number of individual table tennis games and sets was determined. All results were collected from four championships in a period during 2006 and 2007 (spring and autumn season - championships), from the different competitive ranks in which the given team competed. The role of judges and audience was reduced to a minimum, while games were played for three sets won.

Sample
The final sample comprised 1597 table tennis players competing in various recreational table tennis leagues in SOKAZ, during two championships in 2006 (803 players) and two championships in 2007 (794 players). All players played in leagues, ranging from 1 to 20, with a minimum of 36 to a maximum of 59 players in each league per championship. In the final sample we included those individuals who played a minimum of 8 table tennis games. Each individual whose result was collected played at least 8 individual games in the relevant period, while the maximum number of individual games that the individual could play during one competition was 66. All the players were male, aged from 10 to 84.

Variables
The league level was the first basic variable to which we compared the success of table tennis players in competitions. (1=1st to 5th league; 2=6th to 10th league; 3=11th to 15th league; 4=16th to 20th league).

The variables in table tennis competition were defined and can be derived directly from the competition results, and then transformed into indexes.

Indexes (indicators of individual efficacy) in table tennis competition have been defined which can be derived directly from competition results (variables). These indexes are theoretically organized as a 'composition' of two particular variables, while their basic 'logic' is a calculation of the ratio between the effectively accomplished number of cases and the maximum possible number of cases, in relation to the hypothetical indicators of efficiency in competitive situations.

The following 'individual' indicators (indexes) were determined. As dependent 'variables', indexes which are direct indicators of players' game: i.e. criteria (in regression analysis) have been determined:
1. game index
2. set index

These indexes are also called direct efficacy indicators.

Independent 'variables' (indexes) were predictors directly derived from the results:
3. sets played on point difference index
4. games played in five sets index
5. turnover index

These indexes are also called indirect efficacy indicators. Finally, the total efficacy index is the sum of these three indexes (sets played on point difference, games played in five sets, turnover index), as a hypothetical measure of a player's total efficacy.

Data analysis
All data analysis was performed using the SPSS 15.0 package. Descriptive statistics (arithmetic mean and standard deviation) for all indexes were calculated. In order to determine differences in relation to variables and indexes of competitive efficacy in table tennis, we used a MANOVA design. The dependent variables were the efficacy indexes of table tennis players, while the fixed factors were the league level and the year of competition.

3. RESULTS AND DISCUSSION

The results provide insight into the average values of all the indexes for the independent variables in this study (Table 1). We can approximately compare these values with each other, to get a 'rough' perception of the differences and similarities between them.

Table 1. Descriptive statistics for all the indexes of efficiency for players in the SOKAZ table tennis championships

Variables	League level								Year of competition			
	M_{1-5}	σ_{1-5}	M_{6-10}	σ_{6-10}	M_{11-15}	σ_{11-15}	M_{15-20}	σ_{15-20}	M_{2006}	σ_{2006}	M_{2007}	σ_{2007}
game index	.4727	.25175	.4217	.25497	.4299	.26704	.4409	.25278	.4376	.25778	.4391	.25834
set index	.4607	.21632	.4518	.19363	.4274	.22844	.4432	.20803	.4439	.21228	.4434	.21461
sets played on point difference index	.4370	.19495	.4551	.27372	.4204	.24575	.4162	.20422	.4252	.20327	.4336	.25644
games played in five sets index	.3659	.27775	.3655	.25237	.3278	.26395	.2920	.26522	.3351	.26237	.3299	.27172
turnover index	.1451	.23795	.1009	.19848	.0984	.18683	.0917	.19150	.1173	.21930	.0994	.19039
total efficacy index	1.5411	.79880	1.5437	.79967	1.4783	.80273	1.4404	.82337	1.8146	.83130	1.2590	.70830

Legend: M= arithmetic mean (league range); σ= standard deviation; League level: 1ˢᵗ to 5ᵗʰ league; 6ᵗʰ to 10ᵗʰ league; 11ᵗʰ to 15ᵗʰ league; 16ᵗʰ to 20ᵗʰ league; Year: 2006 and 2007

The main results of the MANOVA analysis for the indexes-indicators of competitive efficacy of table tennis players are demonstrated in Table 2, which shows that, according to these values, there is a significant difference among table tennis players in relation to the four levels of league competition. However, there is also a significant difference among table tennis players in relation to two years of league competitions (two championships in 2006 and two championships in 2007). We didn't find significant interaction effects (league level – year of competition). Hence the uncertainty of the competition, which is also shown in the efficacy indexes, varies significantly from season to season of table tennis competition, but also depends on league levels, while interaction between those two factors is not present. In other words, it is probable that the uncertainty of competition undergoes constant significant variation, depending on the competition season, in any of which a 'concentration' of more successful or less successful players and teams in the same leagues may spontaneously occur. On the other hand, it seems that practically all the efficacy indexes that we used in this research have congruously higher values in 'stronger' leagues (1ˢᵗ to 5ᵗʰ league; 6ᵗʰ to 10ᵗʰ league). We can observe those tendencies in Table 3 and Table 4.

Table 2. Results of MANOVA for indexes-indicators of competitive efficacy of table tennis players in relation to the four levels of league competitions

Effect	Pillai's Trace	Wilks' Lambda	Hotelling's Trace	Roy's Largest Root	F-test	Sig.
Year	.131	.869	.150	.150	**39.646**	<.01
League level	.030	.970	.031	.016	**2.709***	<.01
Year * League level	.005	.995	.005	.004	.405*	>.20

League level: 1ˢᵗ to 5ᵗʰ league; 6ᵗʰ to 10ᵗʰ league; 11ᵗʰ to 15ᵗʰ league; 16ᵗʰ to 20ᵗʰ league; Year: 2006 and 2007;

The results of MANOVA analysis (individual comparisons, using Bonferoni's method) for indexes of competitive efficacy of table tennis players are shown in Table 3. It shows that significant differences exist among table tennis players in two different years of league competition, for two indexes: the games played in five sets index and the total efficacy index (higher results for 2006). First of all, this result means that the uncertainty of the competition varies significantly over different years, which also means in individual championships. During competition in 20 different leagues, the 'concentration' of more successful or less successful players and teams in certain leagues occasionally occurs (in terms of higher equalisation and higher competitive uncertainty). In other cases, player efficacy in the same league is significantly different (in terms of competition non-equalisation and evident result dominance of certain players and teams).

Table 3. Results of between-subjects effects for general statistical indicators from table tennis competitions in relation to the four levels of league competition (individual comparisons – Bonferoni's method)

Source	Dependent Variable	M_{2006}	M_{2007}	F	Sig.
Year	game index	.4376	.4391	1.812	.179
	set index	.4439	.4434	2.164	.142
	sets played on point difference index	.4252	.4336	1.008	.315
	games played in five sets index	.3351	.3299	**10.250**	<.01
	turnover index	.1173	.0994	1.857	.173
	total efficacy index	1.8146	1.2590	**202.912**	<.01

Legend: M= arithmetic mean (league range); F=analysis of variance
Bold: significant differences in Bonferoni

The results of MANOVA analysis (individual comparisons, using Bonferoni's method) for indexes of competitive efficacy of table tennis players are demonstrated in Table 4. It indicates that significant differences do exist among table tennis players in four levels of league competition, for three indexes: the game index, the games played in five sets index and the turnover index. In 'stronger' league levels, especially the first one (first to fifth league), all three significant different indexes have higher values than at other league levels. Clearly, the concentration of more equalised teams and table tennis players occurs in 'stronger' leagues, which makes league competition more uncertain. These results are also confirmed by previous research by Sindik and Vidak (2009). It is probable that discrepancy in competition quality equalisation of teams and individual players occurs at lower league levels for at least two reasons: the fact that there is a certain number of teams with young, ambitious players who want to make progress and who therefore train more (1); and the fact that a certain number of players and teams wants to 'rest' from 'more stressful' competitions in 'stronger' leagues and who therefore decide to play in lower league levels for a given period (2).

Table 4. Results of between-subjects effects for general statistical indicators from table tennis competitions in relation to the year of competition (individual comparisons – Bonferoni's method)

	Dependent Variable	M_{1-5}	M_{6-10}	M_{10-15}	M_{16-20}	F	Sig.
League level	game index	**.4727**	**.4217**	.4299	.4409	**2.980**	<.05
	set index	.4607	.4518	.4274	.4432	1.676	.170
	sets played on point difference index	.4370	.4551	.4204	.4162	1.712	.163
	games played in five sets index	*.3659*	*.3655*	.3278	*.2920*	**5.700**	<.01
	turnover index	*.1451*	*.1009*	*.0984*	*.0917*	**5.472**	<.01
	total efficacy index	1.5411	1.5437	1.4783	1.4404	1.059	.365

Legend: M= arithmetic mean (league range); F=analysis of variance
Bold: significant differences; Bold italic: significant mean differences in Bonferoni, in comparison with bolded means

The main research findings point to the conclusion that even with a small number of indexes that can be deduced directly from the results of table tennis matches, a relation can be found to the level of league competition in which a table tennis player competes.

One relevant fault of all efficiency indexes derived directly from competition results is that the total result need not necessarily be a real 'measure' of players' competitive efficiency. Because players could be 'laid-back' in situations of more significant result advantage or 'hold back' in relation to their opponent, or could make 'predictions' of convincing victory or defeat, while 'playing' with anticipated inferior or 'superior' opponents during the entire event (Sindik and Juričević, 2008). In addition, we should remember that we are not talking about top-quality table tennis, but recreational table tennis; therefore, we should be additionally careful in generalizing these results.

On the basis of this research (on the individual competition level) and the research done by Sindik and Vidak (2009) on the team competition level, we can propose different competition systems for the 'weaker' and in 'stronger' league levels in SOKAZ. For example, we can suggest that the teams from the 11th up to the 20th league could advance under the following system: top team advances by three leagues, second team advances by two leagues, third and fourth positioned team by one league. A similar method could be used to 'decelerate' the lowest ranked teams. However, it would be possible to think of other systems of 'acceleration' and 'deceleration' for the purpose of increasing the uncertainty coefficient in competition, and after that check the effects by application of the uncertainty coefficient after the championship.

4. CONCLUSIONS

We have found that there is a significant difference in the indexes of efficiency according to the league level in the table tennis championships (relative competition success is not approximately the same). We have also found that there is a significant difference in the indexes of efficiency, according to the year of competition in the table tennis championships (relative competition success is different in 2006, compared with 2007).

Finally there are no differences in the indexes of efficiency, according to the interaction of the two factors: year of competition and league level in the table tennis championships (relative competition success is approximately the same). In future research, we could use the same indexes on a sample of examinees of elite table tennis players, perhaps not only male, and from different age groups. We could also use more indirect indicators of player efficacy, as did Sindik and Juričević (2007). At the least, we can replicate this research in further SOKAZ championships.

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