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CHANGES IN THE LEVEL OF KINESTHETIC DIFFERENTIATION ABILITY IN TABLE TENNIS PLAYERS

Key words: kinesthetic differentiation ability, table tennis.

ABSTRACT

Kinesthetic differentiation ability in table tennis is probably most reflected by abilities connected with playing precision such as control of ball rotation, modulation of force, speed and direction of shots, and choosing the optimal racquet angle. The aim of the study was to evaluate changes in the level of kinesthetic differentiation ability in table tennis players. The study sample consisted of 19 young table tennis players. Kinesthetic differentiation ability was evaluated with the use of goniometric tests (measurement of task movement range), performed twice during the year. The performance of the majority of tasks showed that the precision of reproduction improved in young male table tennis players, which may point to the significance of this ability in this sport. Progress in some tasks is probably attributed to those task movement tests which are more specific to table tennis (movement range and direction).

INTRODUCTION

The kinaesthetic differentiation ability which enables one to act rationally in their surroundings and to perceive the force, time and space when performing motor activities is considered to be one of the most important coordination motor abilities [1].

The analysis of the literature on the subject reveals that the problem of significance of the kinaesthetic differentiation ability in sport has been often discussed; however, there are only few studies dealing with this issue in table tennis – a game where – according to both coaches and players – muscular and tactile sensibility (and the "ball sense" related thereto) is very important [2, 5, 11].

Theoretical studies of table tennis [4] show that the kinaesthetic differentiation ability is expressed, among other things, by differentiation of ball rotation, e.g. topspins and slices with different rotations; change of the place the ball drops; change of the speed of strokes (both adjustment of motion speed and change of ball speed).

Undoubtedly, selecting and placing a racket at an appropriate angle (closed and open position) is also a skill involving the discussed ability.

It seems that the skills discussed hereinabove depend on perceiving and differentiating muscle tensions and perceiving and controlling the position of different parts of the body. The perception of tactile and pressure sensations within the hand (gripping the racket) can also play a considerable role. The differentiation of space, force and speed parameters of motion in table tennis may thus have a critical influence on such important aspects of player's competence as the accurateness of playing, adequacy of shots as well as the use and control of changes in a game. The assessment of changes in the level of this ability (increase or decrease) in the

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training process may be crucial for specifying, among other things, its importance in table tennis. The aim of the study was the assessment of change in the level of kinaesthetic differentiation ability (so-called spatial components [7, 8]) of regularly training young female and male table tennis players.

METHODS

The study involved 6 female and 13 male table tennis players at different advancement levels, who were members of the Lower Silesian Province junior team from Poland. Table 1 presents the characteristics of female and male players.

Table 1. Characteristics of study subjects

	Age (years)	Weight (kg)	Height (cm)
Boys (n = 13)	14.35	52.44	160.73
Girls (n = 6)	13.66	45.75	157.60

The basic study method included observation in natural conditions. The study was longitudinal, and was repeated twice. The first study was carried out in February and the second one in December 2008. Both studies took place at a training camp of the junior team in Brzeg Dolny. The measurements were made between 9 a.m. and 2 p.m. in the gymnasium.

Following the assumptions and the goal of the work, the studies included assessment of changes in the level of kinaesthetic differentiation ability and the results of statistical analysis of the collected data.

The study was made with the use of a goniometer and a method of assessing the precision of reproducing a set movement range [1, 2, 9, 10]. The examination station (Fig. 1 and 2) was equipped with a specially constructed device which allowed pronation and supination of the forearm in the elbow joint. The changes of the angles were registered by a computer program via a potentiometer incorporated in a device connected with the analog-to-digital card.

Figure 1. Examination station – a goniometer

Each examined person in each series of study was ordered to perform two tasks. They first performed three times the pronation and supination of the forearm of the dominant hand (standard movement) starting from the so-called medial position (zero angle) and ending with a 45 degree angle. Reaching the angle of 45 degrees was signalled by a loud ring which was automatically activated. Immediately after that, the examined person repeated this movement five times from memory, with covered eyes and without a ring. Then he or she was ordered to do the same with the non-dominant hand. The level of kinaesthetic differentiation was determined in the task for both the dominant and non-dominant limb with the use of the precision indices which constituted the standard deviation of the reproduced values of angles. The following indices were adopted in the analysis: pronation – right limb (precision index – dominant limb – pronation), supination – right limb (precision index – dominant limb – supination), pronation – left limb (precision index – non-dominant limb – pronation), and supination – left limb (precision index – non-dominant limb – supination).

Figure 2. Goniometer station – the position of the examined person

A lower index of precision of reproducing the movement range indicated a higher level of kinaesthetic differentiation ability.

The statistical analysis of the obtained results was made with the use of Statistica for Windows software package, descriptive statistics were performed and the Mann-Whitney U test was applied.

RESULTS

The comparative analysis of the results reveals that both in the first and the second study in both groups it is possible to find an improvement in reproducing the set movement range. In the majority of the performed tasks, it was found that the arithmetic mean in the second study (the mean of 2) decreased in comparison with the first one (the mean of 1 – Table 2 and 3). Such observations were made for five out of eight tasks. The opposite tendency was found only in the female players reproducing the supination of their left limb (non-dominant, not used when playing) and in the male players pronating their left limb. In one task (supination – left limb) the results were almost identical. All results obtained in both groups in all tasks and series of study are presented in Figures 3 to 10.

Table 2. Arithmetic means and standard deviations of precision indices in both studies – female players

	N	Index 1 (°)	SD 1	Index 2 (°)	SD 2
Pronation right limb	6	4.43	2.72	3.46	1.19
Supination right limb	6	6.37	3.59	3.76	1.83
Pronation left limb	6	6.02	2.25	5.39	1.06
Supination left limb	6	5.79	2.55	7.31	2.88

Table 3. Arithmetic means and standard deviations of precision indices in both studies – male players

	N	Index 1 (°)	SD 1	Index 2 (°)	SD 2
Pronation right limb	13	6.57	5.99	6.20	3.51
Supination right limb	13	8.50	4.16	5.65	3.23
Pronation left limb	13	6.38	4.13	8.25	11.60
Supination left limb	13	6.68	4.42	6.99	4.50

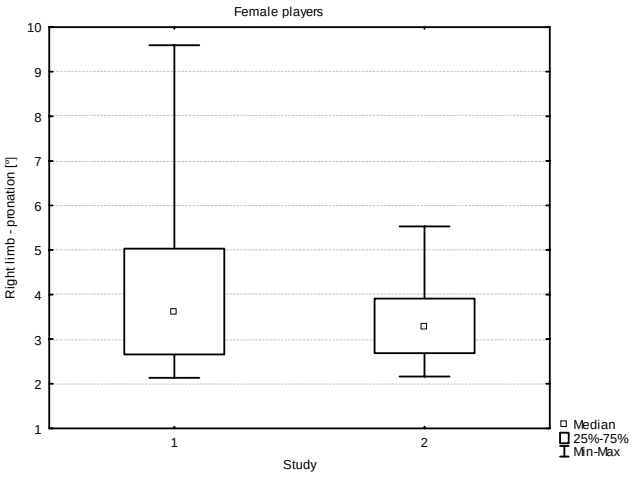

Figure 3. Precision indices in the first and the second study, female players, dominant limb, pronation

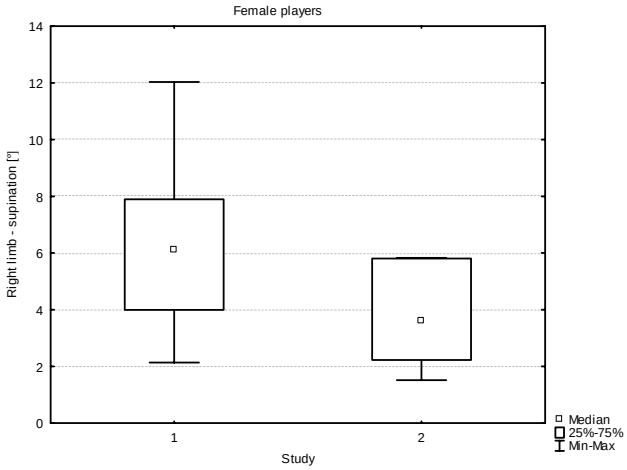

Figure 4. Precision indices in the first and the second study, female players, dominant limb, supination

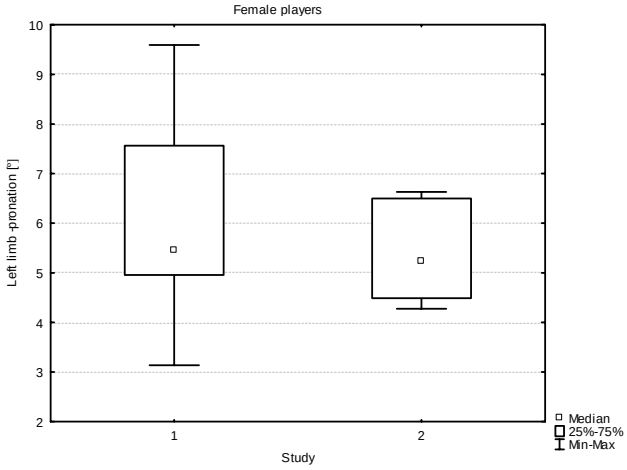

Figure 5. Precision indices in the first and the second study, female players, non-dominant limb, pronation

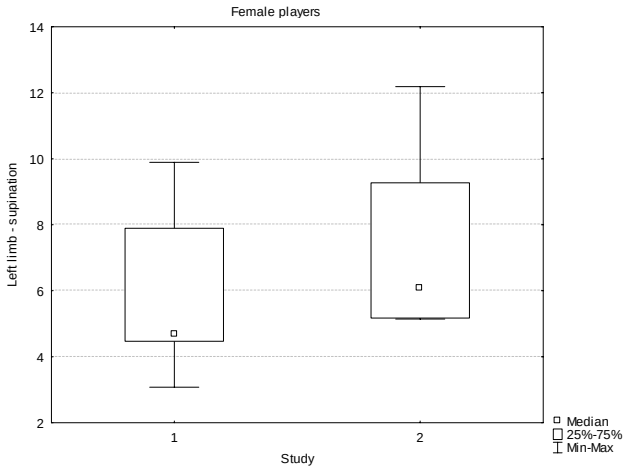

Figure 6. Precision indices in the first and the second study, female players, non-dominant limb, supination

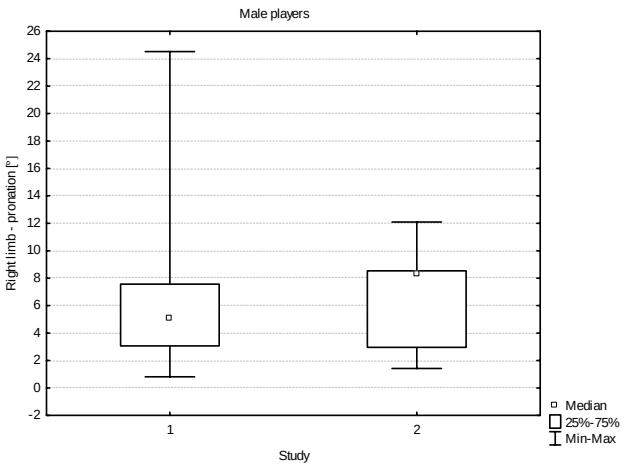

Figure 7. Precision indices in the first and the second study, male players, dominant limb, pronation

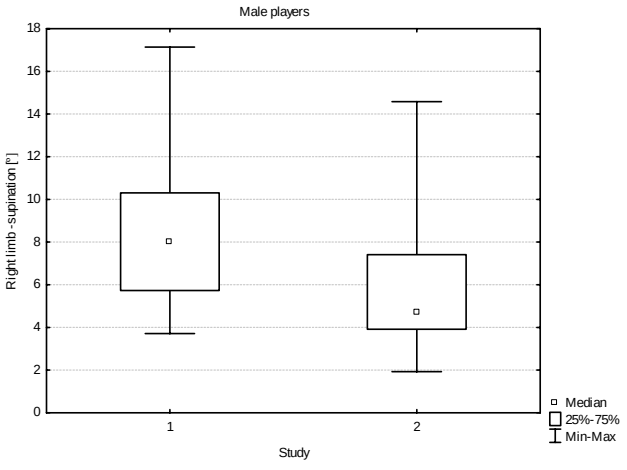

Figure 8. Precision indices in the first and the second study, male players, dominant limb, supination

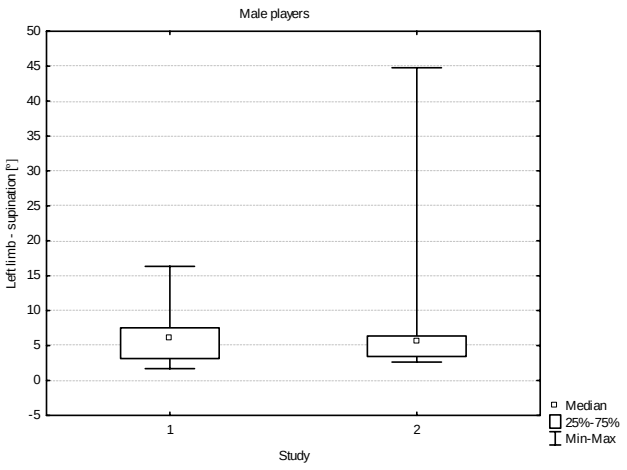

Figure 9. Precision indices in the first and the second study, male players, non-dominant limb, supination

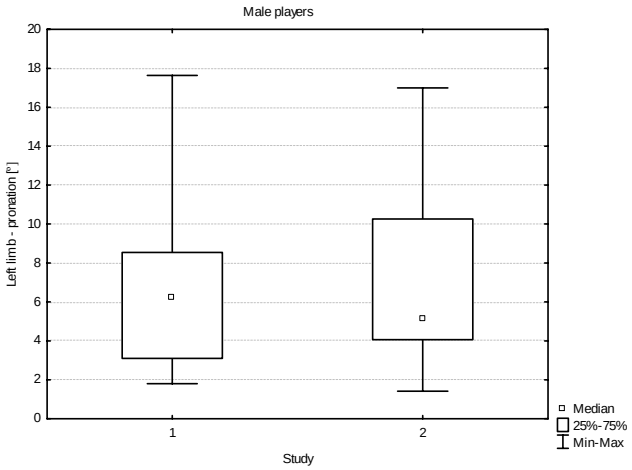

Figure 10. Precision indices in the first and the second study, male players, non-dominant limb, pronation

The greatest differences (decrease in the value of precision indices in the second series of study held in December) were found mainly in tasks performed with the dominant (used when playing) limb – in female players when reproducing the pronation and supination, and in male players – in the task involving supination (Fig. 3, 4 and 8). After performing the Mann-Whitney U test, the statistical significance was found in male players between the first and the second study in supination of the dominant limb (Table 4).

Table 4. The level of significance of differences (p) (the Mann-Whitney U test) in each task. The differences are significant at $p<0.05000$

	level p	
	Girls	Boys
Pronation right limb	0.936186	0.608077
Supination right limb	0.297954	**0.027446**
Pronation left limb	0.688921	0.849015
Supination left limb	0.173486	0.723674

DISCUSSION

The performed tests show that – in less than a year – it is possible to observe a diversified improvement of kinaesthetic sensibility in the scope of reproducing the movement range with the dominant limb in regularly training young male and female table tennis players. Theslight improvement was found in the majority of tasks in the performed studies, while in the task of supination of the right limb it was observed that the improvement in male players was at the level of statistical significance. It may indicate the significance of the studied component in table tennis. Some researchers emphasize that the kinaesthetic differentiation ability is manifested in table tennis most probably in many skills crucial for playing efficiency, and mainly in feeling and applying changes in the game (speed of shots, ball rotation, locating the ball on the table, etc.) [4]. The limited in time selection of appropriate racket angle upon hitting the ball, release of the optimal force through involving the muscles in the movement, and selection of optimal speed of movement to keep or change the pace of a game, are most likely to be the consequences of the kinaesthetic differentiation ability.

The mentioned improvement in kinaesthetic sensibility concerned the dominant limb (right limb in the present study), which is used when playing, and is most involved in playing. The high level of kinaesthetic sensibility, mainly in the parts of the body involved in sport activity, was also found in other studies. Ji and Huang [6] and Zając et al. [13] found that the level of kinaesthetic differentiation ability of upper limbs in basketball players was high. Stefaniak and Witkowski [12] assessed the level of kinaesthetic memory in combat sport athletes and noted its higher level in the limbs involved in sport activity (lower limbs in kick-boxers, upper limbs in boxers). Therefore it seems that the present study performed in this work confirm those findings. It may be that the studied supination of the right (dominant) limb is an activity more specific to table tennis than any other movements, which explains the greatest improvement in performing this task. Bearing in mind the improvement in kinaesthetic sensibility of the right (used when playing) limb with simultaneous (in the majority of cases) lack of such improvement (or even regression) in the left limb, it is worth noticing that we can speak of the increase in differences in the scope of kinaesthetic sensibility between both upper limbs in the subjects. It may be that the specificity of table tennis, i.e. definite predominance of unilateral strains, is connected with shaping the lateral diversification in the scope of the level of kinaesthetic sensibility. Therefore it seems that the conclusions found in the literature on the subject that the specificity of practiced sport (predominance of symmetric or asymmetric movements) is connected with shaping unilaterality or ambidexterity in the scope of kinaesthetic sensibility [1, 9] may be also applied to table tennis.

The study revealed the diversified improvement in the scope of tasks involving reproduction of the movement range. In the majority of tasks it was shown that the precision of reproduction in young male and female table tennis players improved, which may indicate the significance of this ability for this sport. The greatest improvement in the precision of reproducing the movement range was noted, in particular, in the tasks performed with the upper limb used when playing. Most probably, it results from the specificity of table tennis characterized by the predominance of unilateral strains and asymmetry of movements. The greatest improvement in the level of kinaesthetic differentiation ability was observed in the task of reproducing the supination of the dominant limb. It may be that this movement (direction and range) is the most specific one to table tennis of all of the studied movements.

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