



## ASYMMETRY OF ANTHROPOMETRIC DIMENSIONS AND MOTOR EFFICIENCY OF TABLE TENNIS PLAYERS FROM MACEDONIA COMPETING IN THE SUPER AND THE FIRST LEAGUE.

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### **Abstract:**

*The research has been carried out on a sample of 54 table tennis players (male), competing in the Macedonian First and Super League, in order to determine the asymmetry of anthropometric characteristics and motor efficiency between the dominant and non-dominant arm. Out of 54 respondents, 50 played with the right hand and 4 with the left one, and their results are shown separately. The total sample of applied variables was 18, out of which 12 variables for assessing anthropometric characteristics and 6 variables for assessing motor skills. The asymmetry was estimated from the differences between the arithmetic mean values as well as the differences between the arithmetic mean values expressed in percent, while the asymmetry coefficient of hand strength was calculated according to the formula of Bragina and Dobrokhotova, 1988.*

*The obtained results and the analysis made show that there are differences in the anthropometric characteristics and motor efficiency between the dominant and non-dominant side. In the anthropometric measurements (paired segments), the morphological asymmetry was observed on the upper part of the body that is distinguished by better results of the dominant hand (the hand that holds the paddle), and it is reflected in percentually greater arm's length, wrist width, upper arm circumference and smaller percentage of subcutaneous adipose tissue. Insignificant difference was found only in the legs' volume variable indicating that table tennis players' structure of leg movements and their engagement is approximately the same in both legs. Asymmetries were determined in motor efficiency where the better results are in favor of the prevailing side, both in the tests for assessment of arm muscles and in the tests for assessment of velocity of frequency movements, and no significant differences were observed between the left and right side when conducting the test for assessment of the manner and direction of movement.*

**Key Words:** *anthropometry, motor, asymmetry, table tennis players, dominant side, non-dominant side*

### **Introduction**

Table tennis is an acyclic and situation sport where automation of strokes reaches 40 %. Table tennis is also an asymmetric sport and with the different engagement of the dominant (active) arm in relation to the non-dominant (passive) one it leaves consequences that increase the asymmetry of the whole body, in both biomotor tasks and anthropometric parameters. According to (N.N. Bragina, T.A. Dobrokhotova, 1988) asymmetry of arms can be changed with long workouts. For example, with the increase of years of tennis experience, a coefficient of right-handedness in right-handed tennis players has been shown to increase, i.e. the coefficient on left-handedness in left-handed. Therefore, the aim of this study was to determine the biomotor and morphological asymmetries of table tennis players in Macedonia competing in the First and the Super League.

### **Material & methods**

The sample of respondents for this survey was comprised of 54 active table tennis players (male) who competed with their teams in the Super and the First League of the Republic of Macedonia in the competition season 2008/09. The respondents are members of the following teams: PPK Rabotnicki, PPK Vlae-Farmahem, PPK Vardar, PPK Floraskop and PPK Gorce Petrov from Skopje, PPK Kriva Palanka and PPK Kriva Palanka 2007 from Kriva Palanka, PPK Bregalnica and PPK Philip II from Stip, PPK Strumica from Strumica, PPK Mladost and PPK Mladost 96 from Prilep and PPK Ohrid from Ohrid.



In this research, a total of 30 variables were applied on the selected sample of respondents, out of which 18 for assessment of the anthropometric area and 12 for assessment of the biomotor space. Out of 18 anthropometric variables, 12 were measured according to the International Biological Program (IBP), while the remaining 6 measures, due to research tasks (determining the asymmetry), were measured according to the IBP, but to opposite segments of the body. The biomotor variables: MPT30, MSKDM, MDPKL, MTLRA were measured following the recommendations of Kurelič, Momirovič, Stojanovič, Šturm, Radojevič, Viskič - Štalec (1975). MTDRA variable was measured by the same methodology as MTLRA. The variables: MPONA, MCHESST, MONLS and MONDS were measured according to the recommendations of Metikoš Protas, Hoffman, Pintar, Oreb (1989), while the variables MDLRA and MDDRA were measured by a mechanical Tiedemann dynamometer with the accuracy of 1.14 kg.

The measurement was carried out in January and February 2009, during the break between the autumn and spring competition season of 2008/09. It was completed in one day for a Ping-Pong Club, with previously determined program identical for all clubs, taking the anthropometric measurements first, and then the biomotor tests. All measurements were taken by bachelors in physical education, who were previously instructed and trained in the manner in which the anthropometric measurements and biomotor tests were executed, as well as in the assessment and recording of the results. Some of them had already participated in similar measurements. The same test for all respondents was measured by the same examiner.

Basic descriptive analysis was obtained for the purposes of this research, while the asymmetry between the dominant and non-dominant hand was calculated by the percentage difference of the asymmetric mean values. The asymmetry coefficient of hand strength was determined according to the formula (Bragina and Dobrokhotova, 1988):  $A = S / D$

A - coefficient of arms' asymmetry

S - strength (muscle) of the left hand

D - strength (muscle) of the right hand

## Results

Table 1. Asymmetry of anthropometric variables in right-handed table tennis players N = 50

Variable	Arithmetic mean	Difference between right and left side	Difference between right and left side in %
Arm length	L. 739.91 mm	15.82 mm	2.09%
	R. 755.73 mm		
Upper arm circumference	L. 269.45 mm	19.27 mm	6.67%
	R. 288.75 mm		
Upper leg volume	L. 527.18 mm	1.85 mm	0.35%
	R. 529.04 mm		
Wrist width	L. 56.01 mm	1.38 mm	2.40%
	R. 57.39 mm		
Upper arm skinfold	L. 13.51 mm	0.20 mm	1.45%
	R. 13.71 mm		
Back skinfold	L. 17.95 mm	-0.47 mm	-2.61%
	R. 17.48 mm		

Table 2. Asymmetry of anthropometric variables in left-handed table tennis players N = 4

Variable	Arithmetic mean	Difference between right and left side	Difference between right and left side in %
Arm length	L. 747.5 mm	22.5 mm	3.01 %
	R. 725.0 mm		
Upper arm circumference	L. 282.0 mm	14.5 mm	5.14 %
	R. 267.5 mm		



Upper leg volume	L. 525 mm	10.0 mm	1.9 0 %
	R. 515 mm		
Wrist width	L. 58.25 mm	0.75 mm	1.28 %
	R. 57.50 mm		
Upper arm skinfold	L. 12.15 mm	-1.15 mm	-8.60 %
	R. 13.30 mm		
Back skinfold	L. 19.75 mm	-0.27 mm	-1.35 %
	R. 20.02 mm		

Table 3. Asymmetry of biomotor variables in right-handed table tennis players. N = 50

Variable	Arithmetic mean	Difference between variables	Difference between variables in %
Eights by tilting	L. 20.18 sec.	0.20 sec	0.98 %
	R. 20.38 sec.		
Finger tapping	L. 40.60 points	5.68 points	12.27 %
	R. 46.28 points		
Dynamometry	L. 31.91 kg.	5.3 kg	14.24 %
	R. 37.21 kg.		

Table 4. Asymmetry of biomotor variables in left-handed table tennis players. N = 4

Variable	Arithmetic mean	Difference between right and left side	Difference between variables in %
Eights by tilting	L. 19.17 sec.	0.50 sec.	2.60 %
	R. 18.67 sec.		
Finger tapping	L. 49.75 points	5.5 points.	11.05 %
	R. 44.25 points		
Dynamometry	L. 36.75 kg.	9.5 kg.	25.85 %
	R. 27.25 kg.		

## Dicussion

The results obtained from the tested anthropometric indicators included in this study showed that the results of the dominant side (the hand holding the paddle) in all variables are higher compared to the non-dominant side (Table 1 and 2), except for the back skinfold variable, i.e. upper arm skinfold of left handed table tennis players (Table 2).

Percentually, the largest differences between the dominant and non-dominant side of table tennis players, who play with the right or the left hand, are observed in the variables of the upper part of the body, i.e. arms and back. The greatest difference was observed in the variable for assessment of the circular dimension - upper arm circumference with 6.67 % in right-handed table tennis players and 5.14% in those who play with the left hand. This difference is due to the characteristics of the table tennis game, where the engagement between the active and passive hand is different. In this case, the right hand has a larger volume, as a direct consequence of its intensive use in the game.

In the variables for assessment of the longitudinal and transverse dimensions, differences were also registered in the upper part of the body that was in favor of the dominant side. In the arm length variable, the dominant arm of the right-handed was longer for 15.8 mm or 2.09%, and in left-handed 22.5 mm or 3.01%, while in the palm width variable those differences were 2.40% for right-handed and 1.28% for left-handed. Smallest and insignificant difference was found in the leg volume variable of only 0.35%. This indicates that the structure of table tennis players' leg movements is approximately the same in both legs.

Smaller values between dominant and non-dominant side were observed only in the variables for assessment of subcutaneous adipose tissue. Among the right-handed, in the back skinfold variable there



was a difference of 2.61 %, and among the left-handed 1.35%, while among the left-handed there was a difference in the upper arm skinfold variable of 8.60 %. Hypothetically, the difference is due to the greater activity of the active arm (arm that holds the paddle), which entails greater appropriate activity in upper segments of the body, which means less deposition of fat in the more active segment.

The results of the applied biomotor tests included in this study (in both groups, right-handed and left-handed) showed that in all variables the results of the dominant side (the hand holding the racket) is higher compared to the non-dominant side ( Table 3 and 4 ). The greatest difference was observed in the variable for assessment of the grip strength - grip strength dynamometer of 5.3 kg or 14.24% in right-handed and 9.5 kg or 25.85% in left-handed, which arises as a result of the strong grip of the paddle when performing strokes after long practicing of table tennis.

In the variable for assessment of hand movement velocity as a key biomotor ability, characteristic for table tennis game, measured through finger-tapping tests, there was a difference of 12.17% in right-handed and 11.05% in left-handed in favor of the active arm relative to the passive one.

Smallest and insignificant difference was observed only in tilt test on the right and the left side of only 0.20 seconds or 0.98% in right-handed and 0.50 seconds or 2.60% in left handed. This variable, which serves to estimate the fast-agile running, favors table tennis game where the movements, without priority to the left and right leg, are performed in different ways and directions.

Among right-handed table tennis players the asymmetry coefficient is equal to 0.85 while among the left-handed this coefficient is 1.34.

This ratio is less than 1 in right-handed, and higher than 1 in left-handed players, and it is equal to 1 in ambidextrous (Bragina and Dobrokhotova, 1988).

## Conclusions

Anthropometric measurements (paired body segments) revealed morphological asymmetry of the upper part of the body. In relation to the non-dominant hand, the dominant hand (the hand holding the paddle) achieved better results. The dominance of the dominant hand is reflected in percentually greater arm's length, wrist width, upper arm circumference and a lower percentage of subcutaneous adipose tissue in relation to the non-dominant hand where all values of the arithmetic mean are percentually smaller. Only the measurement for assessment of the subcutaneous adipose tissue, i.e. the variable of back skin fold on the active arm has smaller values in relation to the skin fold on the passive side of the body. Significant difference was observed in the upper arm circumference in favor of the dominant hand. There was the lowest and insignificant difference in the leg volume variable of only 0.35%. This indicates that the structure of table tennis players' legs movements and their engagement was approximately the same in both legs. As a result of biomotor asymmetry, differences were determined only on the upper segments of the body, where the tests realized with the dominant hand show better results (dynamometry test to assess the palm muscles, and finger-tapping test to assess the speed of movement frequency). The volume and the length of the hand that is bigger than the non-dominant hand contributes to the biomotor dominance of the dominant hand. The speed of finger movement frequency as a key biomotor ability, characteristic for table tennis game, measured through the finger tapping tests, manifested a difference of 12.17% in right-handed and 05.11% in left-handed respondents, in favor of the dominant hand. In the variables for rapid assessment of the manner and direction of movement-coordination (MONLS and MONDS) no significant differences were observed between the left and right side when conducting the test.

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