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STUDY OF THE AGILITY OF MOVEMENT OF SOFIA UNIVERSITY STUDENTS PARTICIPATING IN TENNIS CLASSES

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ABSTRACT

Tennis is an athletic complex game that places great demands on tennis players and their motor skills. Agility is an important component that they must possess. In order to be successful in rallies, players must perform quick, multi-directional movements in response to the high speed of the ball and/or the opponent's position. The aim of the study is to establish the current state of motor quality 'agility' of students from Sofia University participating in tennis classes. Methods: For the purposes of the study, we used field testing, analytical-synthetic and mathematical-statistical methods (variation analysis, sigma method). Results: The data from the study are based on the results of three tests – "Fan", "Compass" and "Pair of compasses". The totality of the variation analysis provides information on the state of agility in the movement of the subjects studied. Conclusions: The standard tables for assessing the motor quality 'agility' will serve sports specialists and teachers to assess the quality of skills acquired by student-tennis players in the learning process. In sports practice, agility is a component related to the coordination and motor abilities of tennis players in mastering the basic technical elements in tennis. That's why we recommend periodic control of the different manifestations of agility, which is essential for tennis training of students as well as in their sports training activity.

Keywords: Sofia University, students, tennis, agility, indicators

INTRODUCTION

At Sofia University, tennis is one of the most popular and attractive sports practised by students. It is part of the curriculum for the subject 'Physical Education and Sports'. In the classes, students not only gain new knowledge, but also improve their motor and functional abilities. The social aspect of sports gives them the opportunity to overcome the mental tension from the intense study and workload, provides them with an opportunity for active recreation and social communication – an aspect leading to good health, high academic achievements and professional realisation.

Modern tennis is characterised by a high level of athleticism; it is a sport with a variable motor content, high dynamics and variability of movements placing great demands on both the physical and the technical and tactical preparation of the players. It belongs to the group of mixed sports in which movements are not standard and are constantly changing. Depending on the specific setting of game situations, tennis players must frequently adjust their actions and reorganise their motor activity in accordance with a complex or rapidly changing game environment. To a large extent, the outcome of the matches is determined by the manifestation of the different degrees of fatigue which affects the speed of movements, the start and change of direction, the accuracy and force of the hits from the different starting positions performed in attack and defence. In turn, the components listed so far depend mainly on the manifestation and degree of development of the motor quality 'agility'.

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Agility is related to the body's ability to coordinate separate movements and actions in terms of time, space and effort, according to the motor task. It is an immanent (functional) property of the CNS through which different types of locomotion are managed and the activity of the motor apparatus is optimised (11).

According to some authors (Gavriyski et al., 2005), the formation and development of the motor quality 'agility' is related to the development of motor habits. They argue that the high perfect coordination of movements is at the foundation of the motor habits created through training (4).

The mobility and dynamics of the neural processes in the cerebral cortex form the physiological basis of agility which directly depends on the activity of the motor analyser. The more motor habits a person has mastered, the more motor combinations they have mastered and the more they can perform increasingly complex exercises requiring agility.

The manifestation of the motor quality 'agility' is a function of the degree of development of the other motor qualities – speed, accuracy of complex motor reactions, strength and flexibility, as well as of the coordination abilities of athletes. It is a complex quality with specific characteristics that are related to the control of movements, the rapid initiation of new movements and motor adaptation (rearranging of movements in response to changing conditions). It is considered an integral part of general physical training and is required for all motor activities (10).

Special exercises for developing agility solve two functional-motor tasks:

1. to increase the learner's ability to quickly and correctly react to sudden (unexpected) stimuli, i.e. to refine their sense of space, rhythm and time;
2. to master various elements of motor actions and increase coordination abilities.

In sports literature, scientific data on agility – compared to other motor qualities – are scarcer. The structure and psycho-physiological mechanism of agility are unclear, the factors that determine its manifestation are insufficiently studied, there are no quantitative criteria for an objective description, for evaluating it as a component of the structure of motor ability (9).

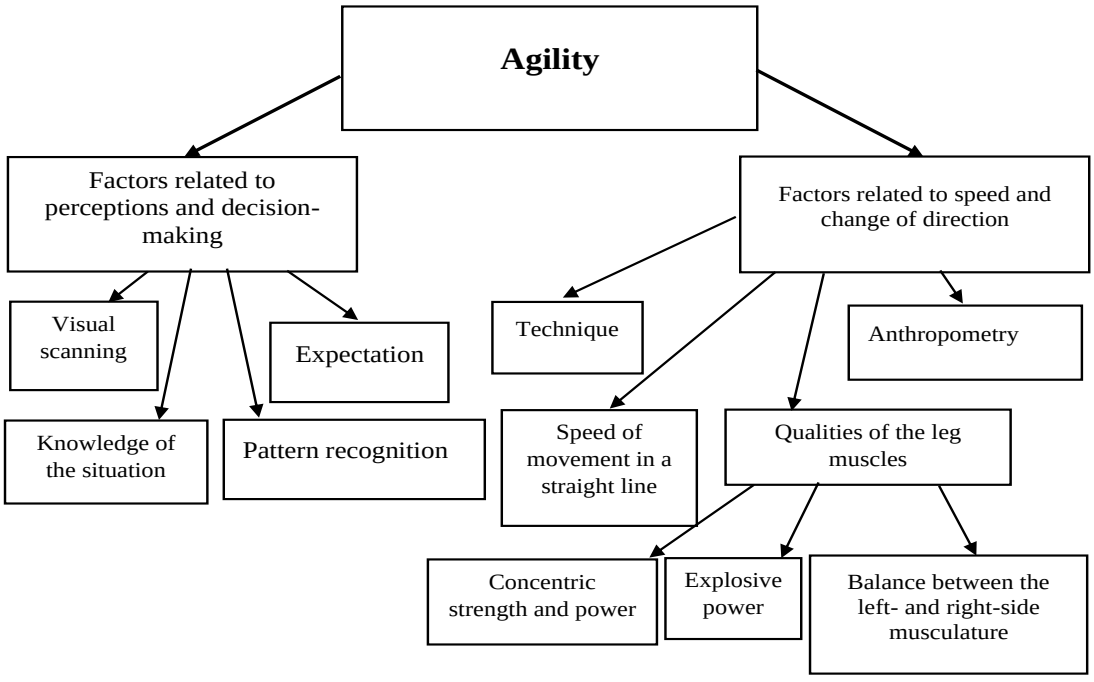


Figure 1. Universal Agility Components Model (Sheppard and Young, 2006)

According to Sheppard and Young (2006), in order for games to be successful, tennis players must execute quick, multi-directional movements in response to the ball and/or the position of the opponent. Agility can be defined as 'a rapid whole-body movement with change of velocity or direction in response to a stimulus'. The authors divide the components of agility into two main directions. On the one hand, they determine the ***factors related to perceptions and decision-making*** – visual scanning, knowledge of the situation, expectations, pattern recognition. And on the other hand – the ***factors related to speed and change of direction*** – technique, anthropometry, speed of movement, qualities of the leg muscles (concentric strength and power, explosive power, asymmetry, balance between the left- and right-side musculature of the tennis player (7). **(Figure 1).**

Agility in tennis involves a number of elements, including: **Footwork** – the ability to move quickly and accurately around the court to reach the ball and hit a good shot. **Balance** – the ability to maintain balance while moving and to remain in control of the body while hitting a shot. **Coordination** – the ability to hit the ball with the correct technique and to adjust the body's position to hit different shots. **Speed** – the ability to move quickly and accurately to the ball and to execute shots quickly (12).

METHODOLOGY:

The ***objective*** of the study is, as follows: to determine the current state of the motor quality 'agility' of the students from Sofia University participating in the profiled tennis activities.

In connection with this objective, we set the following ***tasks*:**

1. To study the literary sources.
2. To establish and analyse the level of development of agility of movement.
3. To develop standards for assessment.

The ***object*** of the study are indicators from tests characterising the agility of movement.

The **subject** of the study is the level of the motor quality 'agility' in students participating in tennis classes at Sofia University.

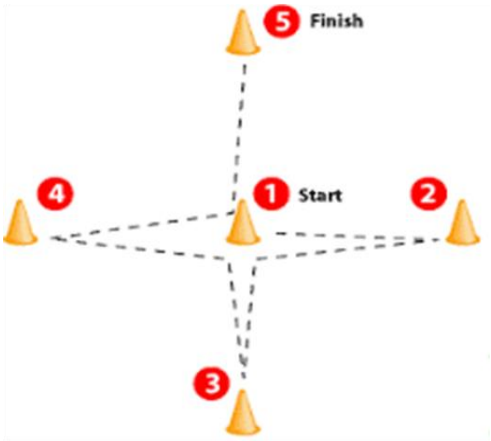
Group: a total of 90 students (male and female) from SU participating in tennis study groups.

Organisation: The study took place in May of academic year 2022.

For the needs of this research we used onsite testing, analytical synthetics and mathematical statistics (variation analysis, sigma methodology). To implement the study methodology, we used three agility tests – "Fan", "Compass" and "Pair of compasses".

Information survey – field testing**.**

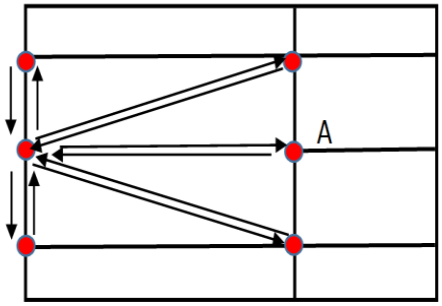
The ***"Compass" test*** is a study of a 28-meter distance running where the person tested must touch certain markers (cones) located 4 meters apart. The start is at position 1, in front of cone 5. The person tested must cover the distance between all cones in the shortest time. Approach to cones 2 and 4 is with lateral movement, and to cone 3 is with backwards movement. The finish is after the last fifth cone is touched. The person tested can make two attempts and the best score is counted. A contact and photo-transducer is used to measure the result /if not available, it can also



be measured with an electronic stopwatch with an accuracy of up to 0.01 sec. **(Figure 2).**

Figure 2. "Compass" test

The ***"Fan" test*** is a study of sprint sections with a racket in hand along the marked route to points set at a distance of 4 m in the shape of a fan, with a change of direction. The person tested must reach the end point and simultaneously touch the ground in front of the ball or cone placed there. The return from section 'A' is performed by running backwards. The time to run the distance is recorded in seconds. Two trials are performed,



and the better one is taken into account **(Figure 3).**

Figure 3. "Fan"

The ***"Pair of compasses" test*** consists of lateral strides and touching a medicine ball with a racket. The person tested stands in a tennis stance with a racket in hand inside a marked square measuring 40 cm wide and 40 cm long. Solid balls are placed symmetrically on both sides of the square at a distance from each other depending on the height of the person. At the signal, the person tested makes a cross-step with the right leg and touches the solid ball on their left with the racket, while the left leg does not leave the square (as in the low palm shot from the air). Immediately after that, passing through the stance again in the opposite direction, the person makes a cross-step with the left foot, touching the solid ball on the right, with the right foot not leaving the square. A precondition for the correct performance of the test is that the extended leg at the back must not leave the square. The person tested repeats this exercise as quickly as possible for 1 minute. The number of touches of the balls is counted, provided that the steps are taken with the correct foot. A higher score is obtained with a greater number of touches on the balls. Equipment includes a tennis racket, solid balls, marked square and stopwatch **(Figure 4).**

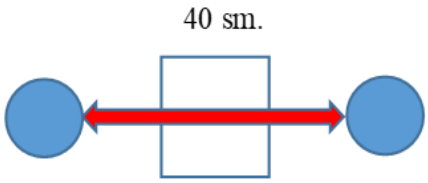


Figure 4. Pair of compasses" test

ANALYSIS OF THE RESULTS

Among the main tasks of sports specialists at SU is to analyse the effect of students' sports activities and to search for scientific evidence in this regard. In order to find the right way to evaluate the physical and technical-tactical skills of the young people trained in our tennis groups, we approached the study of agility because it is precisely the tennis-specific quality that occupies an essential part in the complex preparation of modern competitors. Motor qualities are manifested in a complex manner, but with a view to their study and purposeful development, they are differentiated (3).

To measure the motor quality 'agility, in sports games a combination of exercises is created where the indicator is the time to complete the entire complex. In most of the exercises the precision of execution is not measured, which introduces some error in the overall test score. That is why 'agility' control tests must use state-of-the-art optical and electronic methods, photo-contact transducers, a projector or monitor and a timer operating in full synchronisation through specialised software for the respective sport. When sound and light cues are used to lead, the person tested can respond adequately depending on the motor task set (1).

There are a number of tests to control agility in the practice, but in most cases their information value, determined by the criteria of reliability, objectivity,

validity and standard execution, has not been established in different groups of individuals (2).

Table 1 shows the results from the study after the mathematical and statistical processing.

Table 1. *Variation analysis of the results obtained (male, female)*

indicators	Gender	n	min	max	R	X	S	V	As	Ex
Compass (seconds)	Male	41	9.18	12.56	3.38	10.363	0.802	7.742	0.881	1.010
	Female	49	10.02	13.45	3.43	11.250	0.844	7.503	1.090	1.131
Fan (seconds)	Male	41	15.05	20.22	5.17	16.971	1.357	7.994	1.054	0.813
	Female	43	16.61	22.77	16.61	19.04	1.789	9.395	0.781	-0.417
Pair of compasses (number/minute)	Male	40	49	75	28	65.545	5.244	7.880	-0.927	1.423
	Female	47	49	69	22	61.957	6.041	9.751	-0.741	-0.788

The coefficient of variation **(V)** provides information about the homogeneity of the sample. For all indicators studied, we define the group of men and women as homogeneous. For men, in the "Compass" test **V = 7.74 %**, in the "Fan" test **V = 7.99 %**, and in the "Pair of compasses" test **V = 5.24 %.**

The results obtained for the coefficient of variation in the women's group are, as follows: "Compass" test – **V = 7.50 %,** "Fan" test – **V = 9.39 %,** and "Pair of compasses" test – **V = 9.75 %.**

The wide range (R) in all indicators examined in the sample should be noted. It is due to the fact that a proportion of students scored very low on the test. The values of asymmetry (**As)** and excess **(Ex)** have a normal or close to normal distribution.

Figure 5 presents the average values of the results of the conducted study.

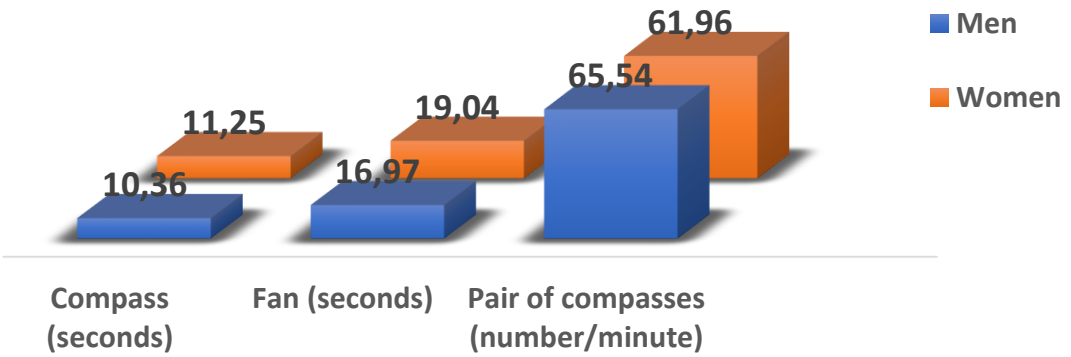


Figure 5. Average values of the indicators studied

The results from the tests are, as follows: in the "Compass" test men achieved a result **X** = 10.36 sec. and women – **X** = 11.25 sec.; in the "Fan" test men achieved a result **X** = 16.97 sec. and women – **X** = 19.04 sec.; in the "Pair of compasses" test men achieved a result **X** = 65.54 touches per minute and women – **X** = 61.69 touches per minute.

Table 2. *Standards for assessment*

Gender	Assessment indicators	High	Above average	Average	Below average	Low
Male	**Compass (seconds)**	**Below 8.76**	**8.76 – 9.55**	**9.56 – 11.17**	**11.18 – 11.97**	**Above 11.97**
Female		**Below 9.56**	**9.56 – 10.40**	**10.41 – 12.09**	**12.10 – 12.94**	**Above 12.94**
Male	**Fan (seconds)**	**Below 14.26**	**14.26 – 15.60**	**15.61 – 18.33**	**18.34 – 19.69**	**Above 19.69**
Female		**Below 15.46**	**15.46 – 17.24**	**17.25 – 20.83**	**20.84 – 22.62**	**Above 22.62**
Male	**Pair of compasses (number/minute)**	**Above 76**	**72 – 76**	**60 – 71**	**55 – 59**	**Below 55**
Female		**Above 74**	**69 – 74**	**56 – 68**	**50 – 55**	**Below 50**

The properties of the normal distribution have a great application in the scientific applied activity in sports and physical education. Most often, they are based on the development of standards for evaluation of results in sports and pedagogical tests (6, 8).

For the needs of the study we developed precisely such ***standards for assessment*** using Martin's "sigma method" for preparing assessment tables. All studied indicators have a normal or close to normal distribution. The "sigma methodology" uses the mean (X) and the standard deviation (S). We drew up the number of levels and the boundaries using the five-point scale of Shefko (5). **(Table 2).**

CONCLUSION

In tennis, the efficiency of the motor activity and the variety of specific forms of motility are the result of the adaptation of the motor apparatus and are determined by the capabilities of the tennis players. The development of the motor quality 'agility' is of particular importance in the performance of a large part of game situations. The successful mastering and use of the various technical elements of tennis by the students depends to a large extent on the development of the quality 'agility'. Establishing the level of development of this motor quality and its future improvement is essential for the effectiveness of the training activity. Control and assessment are at the heart of this effectiveness and they are an important component of tennis training as part of physical education and sports activities in universities. They allow instructors to track students' progress and guide students to improve their technique and fitness, and help increase students' focus on goals and their motivation to succeed. Control and assessment can also be used as a tool to improve communication between sports instructors and trainees.

We believe that the normative table developed by us for assessing the motor quality 'agility' would help sports specialists in the field of tennis to perform quick, accurate and qualitative determination of the level of students in tennis activities.

We recommend for the needs of university tennis sports to develop and test in practice similar tables for all other motor qualities in order to better control and manage the training process.

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