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## Changes in special fitness efficiency of ten-year-old tennis players in the annual training cycle

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# Changes in special fitness efficiency of ten-year-old tennis players in the annual training cycle

## Authors' Contribution:

- A Study Design
- B Data Collection
- C Statistical Analysis
- D Data Interpretation
- E Manuscript Preparation
- F Literature Search
- G Funds Collection

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## abstract

- Background** The course of match actions is definitely gaining pace and dynamics because offensive and aggressive styles of the game are preferred. So there is no doubt that an appropriate level of competitors' physical preparation has a fundamental meaning. The goal of the research was to determine changes in special fitness efficiency.
- Material/Methods** The research was based on a group of 16 tennis players aged 10 training tennis in the annual training cycle. In order to evaluate the level of special fitness efficiency, two tests reflecting physical fitness were used: "The game against the wall" and "The test of 100 balls".
- Results** Results of the examination showed a significant difference in the fitness level, and the analysis points out an influence of sports training on changes in special fitness efficiency.
- Conclusions** Significant differences in the level of special fitness efficiency in the study group of tennis players can be a result of an individual rate of assimilation of motor skills and the development of the motor skills level. A balanced and dynamic growth of the pace of development in special fitness efficiency of young tennis players can testify to the proper achievement of the program content that is favorable to the proper mastery of technical skills in tennis. In the tests of "The game against the wall" and "The test of 100 balls" the significance of differences between average results of the first and fourth term of the test was found, which means that sport training influences special fitness efficiency.
- Key words** physical fitness, tests of special efficiency, tennis player's training

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## INTRODUCTION

Sport is gaining more and more popularity in a range of interests of contemporary man. Practiced for pleasure, it builds a base for health and essential character traits. However, professional sport is more and more opened towards innovation, uses development and professional achievements in science, puts new challenges in front of competitors, coaches as well as producers of sport equipment. It is more and more difficult to achieve the result giving bigger advantage over the opponent, and often a bit of luck or availability of the competitor decides about the triumph. In pursuit for the result for young talented teenagers, coaches are lowering the age to begin systematic trainings and more often involve them in rivalry with seniors. Achieving success in modern sport requires comprehensive preparation of athletes. Often specialists from different fields, such as technical preparation, tactical, condition, doctors, psychologists, nutritionists, etc. work with a person who practices competitive sport. The main aim of this team is to help the competitor to achieve the best sports results, while maintaining physical and mental health. Such an athlete requires comprehensive preparation from coaches, seeking new assumptions and tactical solutions and using more effective methods of training that will enhance the player's individual capabilities [1, 2, 3, 4, 5].

Developmental tendencies and progress of sport in tennis is clearly visible in the growth of complexity and precision of fragments of the game that consist of tactical formations. In the past ten years, speed and power of the game has drastically increased through better mastery of technical and tactical skills and comprehensive physical preparation of tennis players. The course of match actions is definitely gaining pace, and dynamism as well as an offensive and aggressive style of the game are preferred. Modern rivalry in tennis is characterized by an ability to play in a such a way to end the game from any position on the court. There is no doubt that an adequate level of players' physical preparation, including various symptoms of speed and coordination has a fundamental meaning. It is the reaction speed and technical skills that distinguish outstanding among the best tennis players [6, 7, 8, 9, 10, 11, 12, 13].

The constantly changing image of modern tennis involves major changes and progress in methods of directing the training process. The training process in competitive tennis becomes more complex and requires an influx of increasingly precise data [14, 15, 16].

Activity of a coach who is in charge of sports training should focus on collecting, analysing and securing scientific information about biological development, preparing general and special information about the state of preparation and body's response to training loads and sport activity [1, 16, 17, 18, 19, 20, 21, 22]. Special fitness efficiency tests are useful forms of coaching control. They present the real picture of adaptive changes of organism under an influence of applied forms and methods of training. These tests are used at early stages of training. Their goal is to assess a child's motor skills, i.e. accuracy, durability, plasticity of learning and to explore a tennis player's basic motor skills (speed endurance, aerobic endurance, strength and power reaction rate, agility, manoeuvrability, balance, rhythmization of movements and other aspects of coordination) [16, 23, 24, 25]. In the process of professional tennis training, coaches have a wide range of special fitness efficiency tests.

The basis for the selection of tests is the knowledge of how they influence the sphere of physical movement of the contestant. The coach guided by the methodical knowledge and experience is looking for such a set of tests that reflect situations of the game on the court. During matches cyclic, dynamic movements are observed, frequent changes of the direction of movement, copying the route run. Interval effort, developing mainly speed endurance, agility and manoeuvrability is also a characteristic point. Checking the level and the dynamics of development of this type of motor abilities must find its place in special fitness efficiency tests [2, 6, 7, 16, 26, 27, 28].

Costill [29], Czerwiński [30], and Ważny [31] emphasize that a skilful selection of tests should be an impetus for creative inspiration for a coach in finding effective solutions, where their own experience and knowledge will enrich the arsenal of measures leading to the best solutions in mastering even the most complex motor skills. The problem of defining special fitness efficiency and its impact on the effectiveness of training or the level of technical preparation has not been sufficiently solved yet. Further clarification is needed basing on scientific research investigations.

In context of the above, the aim of this study was to determine changes in special fitness efficiency for boys aged 10 years who practiced tennis in the annual training cycle.

## **MATERIAL AND METHODS**

Examinations were conducted four times in: March, May, September, and November 2013. The research was based on a group of 16 tennis players born in 2003 (boys aged 10). Young competitors participating in the examinations trained tennis in six clubs of the Podlasie province: UKS "Return" Łomża, UKS "Ekonomik" Suwałki, TT "Stanley" Białystok, KT "Okuła" Białystok, UKS "Sokół-Asy" Białystok, and KT "Zwierzyniec" Białystok.

The research on special fitness efficiency was conducted using indicators proposed by: A. Królak, T. Schefke and J. Zieliński [6, 7, 8, 9].

1. The game against the wall.
2. The test of 100 balls.

### **THE GAME AGAINST THE WALL**

The test studies the level of control for forehand and backhand hits in the rhythm and fluidity of technique of these strokes carried out after hitting the ball against the wall within two minutes for forehand and two minutes for backhand. It allows evaluating specific high-speed endurance and long-lasting nature of focusing attention. The obtained results allow assessing preparation for further technical training and teaching high-speed elements in tactical solutions and needs in efficiency preparations, particularly in technically advanced groups.

*The place of a test:* a training wall with a selected height of the net with a width of 10 cm at a height of 90-100 cm from the ground and hard flat surface drawn with a line parallel to the wall at a distance of 6.0 m from the wall or a room with the wall not shorter than 6 m.

*Equipment:* 6 identical balls and a stopwatch.

*The manner of conducting:* the player is set by the control line with a ball in his hand and with a hit from forehand introduces it to the game. At the moment of contact between the ball and the wall, the coach's assistant or another competitor who helps in this test turns on the timer and starts counting bounces against the wall. If a player crosses the control line located 6m from the wall (before or during the ball bounce) or plays the ball below the net line, the stroke does not count. In case of a failure, the player introduces another ball into game. The coach or the appointed player should count aloud each successful ball bounce.

*Evaluation:* the number of good bounces against the wall (above the line indicating the height of the net) in 2 minutes.

*Remark:* attempts are carried out with the same objects and in similar conditions [6].

## THE TEST OF 100 BALLS

The test studies an ability to steer the ball by basic shots (backhand and forehand from deep inside of the court, volley backhand and forehand on the half of the court and tennis serve). Thanks to its simplicity, easiness of realization, and great attractiveness, the test is applied both in professional and recreational groups. It consists of performing 100 shots in 12 series (forehand and backhand from deep inside of the court and volley), but 80 shots are realised from the machine for reproaching balls, and the last 20 shots are independently performed services in order to check the accuracy of the shot. The sum of received points for accuracy and force of 100 shots gives the final result of the test.

*Order of attempts:*

- I series - 10 forehand shots diagonally,
- II series - 10 forehand shots along the line,
- III series - 10 backhand shots diagonally,
- IV series - 10 backhand shots along the line,
- V series - 10 volley forehand shots diagonally,
- VI series - 10 volley forehand shots along the line,
- VII series - 10 backhand shots diagonally,
- VIII series - 10 volley backhand shots along the line,
- IX series - 5 serves into the outside zone of the right service box,
- X series - 5 serves into the medial area of the right service box,
- XI series - 5 serves into the medial area of the left service box,
- XII series - 5 serves into the outer zone of the left service box,

*The place of a test:* A tennis court for a single person to play, divided lengthwise into four equal parts of a width of 205 cm and a line drawn behind the baseline of the court at a distance of 33 cm on the extension of the side lines of the court and within 38 cm in the middle.

*Equipment:* 20 new or equally identical balls, a ball container.

*Preparation:* the player is set just behind the baseline of the court, centred between side lines in expectant position to rebound the ball with a forehand. The coach is on the other side of the court in approximately 3-4 meters from the net. An appointed judge, evaluating the accuracy of strokes and their strength is behind the baseline on the side of the coach. The coach starts hitting the balls with a racquet according to order of attempts appointed for forehand.

After finishing the first series of 10 balls on forehand, which should be played diagonally, the coach does not make any breaks and only informs about changing the zone to which the competitor should aim the balls and starts the second series of passing the ball.

After completing 40 strikes from the deep of the tennis court, the player is set to the middle of the court just behind the service line and begins the first series of shots with a volley forehand diagonally. After completing 40 volleys (series V, VI, VII, VIII), he/she goes across the main lines of the court to complete four series of five serves (series IX, X, XI, XII).

*Evaluation:* every shot is scored twice, for accuracy (2 points for a ball in the basic control box, 1 point for a ball in a complementary control box and 0 points – a ball out or into the net) and for the stroke force (2 points for a ball of which the second hit will be outside the line located 33 and 38 cm from the base line of the court, 1 point for a second bounce of the ball on the surface between the line and the line of the court and 0 points if the ball makes a second bounce in front of the baseline of the court). The total number of points for accuracy and strength of 100 shots gives the final result of the test, with the maximum number of points being 400.

Result summary:

0-99 points - beginner  
100-149 - novices,  
150-174 - level C,  
175-199 - level B,  
200-224 - level A,  
225-249 - level AA,  
250-299 - level AAA,  
300-349 - champions,  
350-400 - professionals /6/.

Collected results were analyzed in the statistical program STATISTICA version 7.0, StatSoft Poland. During the tests, the minimum, the maximum, the mean and the standard deviation of results were calculated. Next, the significance of differences between mean values of the conducted tests of special fitness efficiency were compared. The sided significance test T for dependent and independent groups was applied.

## RESULTS

Analysis of the results of the conducted tests concerning tennis players' special fitness efficiency based on an attempt "The game against the wall" showed a systematic improvement in average test results. The group of 10-year-old tennis players started the study with an average score of 109.33 in the repetition test and ended with a score of 129.80. The average value of the test results at the end of the year increased by 20.47 repetitions. The weakest results of the test were recorded in the first and the second term of the study (March and May) 100.00 reps, while the maximum number of repetitions (147.00) was obtained by a tennis player in the fourth term of the research (November).

In the attempt "The game against the wall" significance of differences was found between average values of the first and second term of the study ( $p = 0.0366$ ) and between the first and the fourth term ( $p = 0.0050$ ).

Table 1. Test results of "The game against the wall" among 10-year-old boys (the number of shots in 2 minutes)

Term	Average	Minimum	Maximum	Standard Deviation	p
I	109.33	100.00	120.00	6.13	-
II	114.93	100.00	124.00	5.98	0.0366*
III	119.87	112.00	135.00	6.42	0.1750
IV	129.80	116.00	147.00	7.66	0.0750

\* significance level  $p \leq 0.05$

0.0050\*

The most dynamic growth of an average value in the conducted tests was observed in the third and fourth term of the study. It increased by 9.93 repetitions. There was a clear progress in specific speed endurance and longer time of focus.

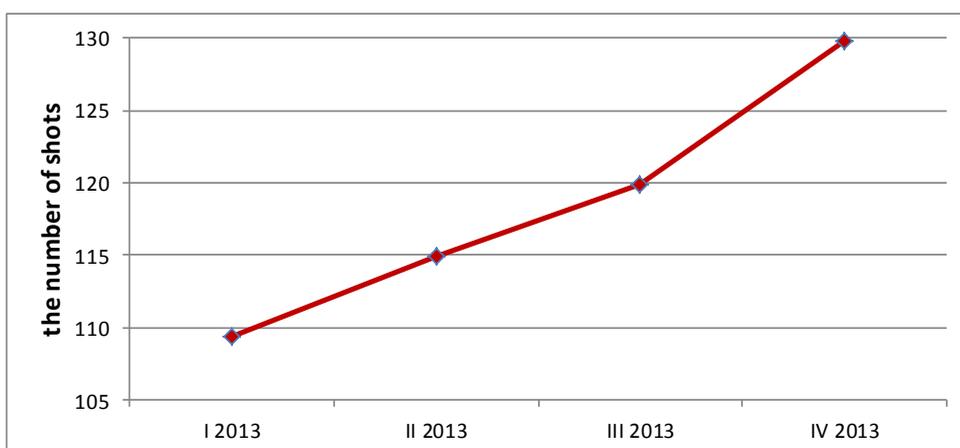


Fig. 1. Distribution of average results of the attempt "The game against the wall" among 10-year-old boys

Analysis of the results concerning tennis players' special fitness efficiency based on an attempt "The test of 100 balls" also showed a systematic improvement in average test results. The group of 10-year-old tennis players star-

ted the study with an average test result of 176.33 points and ended with a score of 236.53. The average value of the test result at the end of the year increased by 60.22 points. The weakest result of the test was reported in the first term of the study (March) - 142.00 points, while the maximum number of points was achieved by a tennis player in the fourth term of the study (November) - 330.00.

In the attempt of "The test of 100 balls" significance of differences was found between the average values of the third and fourth term of the study ( $p = 0.0007$ ) and between the first and the fourth term ( $p = 0.0010$ ).

Table 2. Results of "The test of 100 balls" among 10-year-old boys (the number of shots in 2 minutes)

Term	Average	Minimum	Maximum	Standard Deviation	p
I	176.33	142.00	204.00	22.41	-
II	196.73	176.00	213.00	12.00	0.1108
III	222.07	197.00	267.00	20.19	0.0509
IV	236.53	197.00	330.00	34.49	0.0007*

\* significance level  $p \leq 0.05$

0.0010\*

Dynamic growth in the average value in the conducted tests was observed at the end of the second and third term of the study. It increased by 25.34 points. There was a rapid progress in the ability to lead the ball and the power of tennis shots.

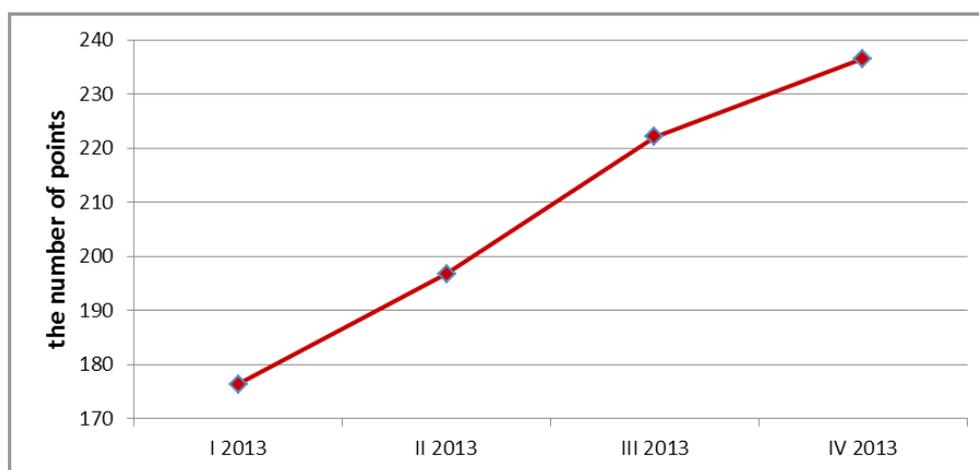


Fig. 2. Distribution of average results of the attempt "The game against the wall" among 10-year-old boys.

## DISCUSSION

A long process of sport training requires a continuous flow of information on athletes' biological development, their physical fitness training, load volume and the body's response to specific physical effort during workouts and athletic competitions [1, 17, 18, 19, 32]. Królak [6, 7] and Ziemann and Garszt-

ka [15] point out to the need to conduct tests of special fitness efficiency for competitors, as they provide important information for coaches and players at early stages of training about their progress, they improve training activities as well as illustrate the players' attitudes in situations of sport competition.

These studies support the point of view of outstanding experts in the theory of sport training that information about the level and the development of special fitness efficiency from the beginning of the training process for competitors is necessary not only to optimize training with regard to individual predispositions and acquired motor skills, but it also allows predicting various stages of training and their effects on a sport career.

Ryguła, Olsza and Olsza [33] present the results of special fitness efficiency tests of players from the macro-region of Silesia in three age categories of 12, 14 and 16 years. The special fitness efficiency test was carried out by modifying "The test of 100 balls". In the modification the authors took into account the direction of strokes and resigned from the assessment of the stroke force. However, the study was also changed by giving up 200 points for the stroke force. The analysis presented in the study concerning 16-year-old tennis players showed that the average test result was at the level of 116.26 points [33].

When comparing the test results of special fitness efficiency of 10-year-old tennis players from the region of Podlasie with the test results by Królak [6], a high level of results obtained in various tests by tennis players of Podlasie is visible.

In the trial "The game against the wall" the obtained mean result of children from the Podlasie region clubs during the year was in the range of 109.33 - 129.80. In the above test the significance of differences was found between the first and second term at  $p = 0.0366$ , and between the first and the last (fourth) term of the research, which proves the influence of sport training on changes in special fitness efficiency. A considerable progress in the number of bounces of a tennis ball against the wall was recorded between the third and the fourth term of the research. The mean number of bounces rose from 119.87 to 129.80. The attempt in which we can determine the level and the pace of development of the examined tennis players from the Podlaskie Province is a test of 100 balls. The average value of the results obtained from the four-term study for 10-year-old players ranged between 176.33 and 236.53 points. The above-mentioned results in comparison to Królak's scale showed a high level of special fitness efficiency of tennis players. During the first term of the study the average test result was 176.33, which puts young tennis players at the B level, i.e. the fourth one. However, in the fourth term of the study, the average test result was already much higher and amounted to 236.53, which means that it reached the level AA - the sixth one in the ten-point scale.

The research has shown a systematic development of individual indicators of special fitness efficiency. In the attempts "The test of 100 balls" and "The game against the wall", it was stated that the significance of differences between the average scores of the first and fourth term of the research proves the influence of sport training on changes in special fitness efficiency.

## CONCLUSIONS

Significant differences in the level of special fitness efficiency in the study group of tennis players can be a result of an individual rate of assimilation of motor skills and the development of the motor skills level.

A balanced and dynamic growth of the pace of development in special fitness efficiency of young tennis players can testify to the proper achievement of the program content that is favorable to the proper mastery of technical skills in tennis.

In the tests of "The game against the wall" and "The test of 100 balls" the significance of differences between average results of the first and fourth term of the test was found, which means that sport training influences special fitness efficiency.

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