ASSESSMENT OF AGILITY IN MIDDLE SCHOOL STUDENTS BY USING THE BASKETBALL GAME METHODS

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Abstract

The purpose of this paper is to determine the level of agility development using basketball methods and the relationship of their indices with the anthropometric measurements in the 13-15-year-old girls of middle school. This scientific approach entailed the organization of an ascertaining pedagogical experiment carried out in the „Mircea cel Bătrân" Middle School of Pitesti, Romania. The subjects of the research were 26 girl students aged 13-15 years. Research methods: bibliographic study, method of pedagogical observation, method of tests, method of (ascertaining) pedagogical experiment, statistical-mathematical and graphical representation methods. Agility was tested by means of Witty SEM with 4 LEDs placed in the form of a 3x3 m square, with signal delay of 3 sec. along 10 impulses. Ball passing with two hands from the chest was used between impulses. Measured indices: total time (sec) and reaction time at each LED (Lap L1-10, sec). The results of the anthropometric measurements in the 13-15-year-old girls in the research were compared with the averages of the biometric potential values. The analysis of the results of agility test shows that the average value is 0.9 sec lower than the minimum values and 10.06 sec lower than the maximum value. The response at each LED reveals minimum values lower by 30%, reaction difference under 1.0 sec, 40% maximum values above 3.0 sec and the average shows 90% differences under 3.0 sec. The results of the correlation highlight 30% strong connections at $p<0.05$ between weight and execution time, 40% strong connections between height and execution time and 90% negative weak connections between BMI and agility indices. The agility test performed using basketball methods and the relationship of their indices with the anthropometric measurements of the 13-15 years old students established the development level and the value of the connections between the studied indices.

Key words: *spatial-temporal orientation, reaction speed, biomotor potential, game technique, correlative analysis*

1. Introduction

Basketball is one of the most frequently practiced sports games, especially in Romania, where it is included in the physical education school programs and the national competition system as well. The fact that basketball sport is the most widespread sport in the world after football is also due to its multiple characteristics: dynamism and speed, complex technique and tactics, spectacularity, participation of all teammates in attack and defense, tendency of universalism, organizational accessibility, very developed game theory and educational value (Sotiriu R. & Sotiriu, D., 2008).

Basketball game equally demands and develops the entire complex of biomotor skills. The motor skills (conditional and coordinative) are manifested in the following forms (Predescu & Moanță, 2001): dexterity, coordination and suppleness shown through fine movements, speed in all its forms (reaction, execution and movement), strength manifested by spring, agility, flexibility, general and specific endurance (Negulescu, 2002; Popescu & Porfireanu, 2003; Tarcău, Ciordaș & Boca, 2015).

One of the most important motor skills developed in school physical education is the combination of speed, coordination and balance referred to as agility nowadays (Szabo, Neagu & Sopa, 2020). Agility is one of the major determinants of performance in soccer, basketball, ice-hockey and handball (Little & Williams, 2005).

Technical and tactical improvement of modern basketball, speed of individual movements, high level of physical fitness, increased ability to work during the competition and the stability of willpower highlight the increasing responsibility of basketball players (Delextrat, Grosgeorge, & Bieuzen, 2015).

The technique of a sports game is "the ensemble of specific motor skills, also known as technical skills, technical procedures used in order to practice the game with maximum efficiency" (Predescu, 1999). The basketball game technique is the ensemble of specific movements that an athlete performs during a game, in conformity with the competition rules and tasks. Thus, the systematization of the technical elements and individual tactical actions in basketball game is carried out both according to the attack and defense phases and the technique of playing with and without ball (Ghițescu & Moanță, 2013).

Pubertal age represents an active proliferation stage in the evolution of the ossification process; ligaments and joints are still poorly developed. Size and weight undergo important changes in puberty stage. Skeletal musculature develops mainly through the elongation of muscle fibers. During the puberty period (13-15 years), muscle strength develops in a slower rate (Popescu & Porfireanu, 2003).

This paper intends to determine the agility development level with the help of basketball methods and the relationship of their indices with the anthropometric measurements in the middle school girl students aged 13-15 years.

2. Material and method

This scientific approach led to the organization of an ascertaining pedagogical experiment conducted within the „Mircea cel Bătrân" Middle School of Pitesti, Romania.

The subjects of the research were middle school girls aged 13-15 years (mean±SD), weight of 47.46±8.52 kg, height of 161.46±7.14 cm and body mass index (BMI) – 18.11±2.21 kg/m^2; all subjects have normal mass, according to the recommended age. BMI was automatically calculated, compared with the average BMI of other children (https://calculator-imt.com/ro-md/imc-copii/) and with the biometric

potential data from the National Research Sports Institute (http://www.biomotric.ro/). The following research methods were used: bibliographic study, method of pedagogical observation, method of (somatic and motor) tests, method of (ascertaining) pedagogical experiment, statistical-mathematical and graphical representation methods.

Figure 1. *Agility testing by basketball methods in girl students aged 13-15 years*

For agility testing, Witty SEM was used. It is a „ smart indicator" formed of a 7x5 LED matrix, which can display different symbols and colors. During the assessment, 4 LEDs placed in the form of a 3x3 m square were used, signal delay of 3 sec., duration of 10 impulses. Between the impulses, the task of two-handed ball pass from the chest was also performed. Measured indices: total time (sec) and reaction time at each Lap L1-10 (sec).

The statistical analysis was carried out by means of KyPlot 6.0 software, calculating the usual descriptive indices (min, max, avg (mean), SD – standard deviation, Cv – coefficient of variation). The correlational analysis was made using Pearson coefficient between anthropometric measurements and agility indices at $p<0.05$.

3. Results and Discussions

The results of the anthropometric measurements of the 13-15-year-old girls who participated in the research were compared with the averages of the three middle school grades (6^{th}, 7^{th} and 8^{th}) in terms of biometric potential values. The comparative analysis highlights the following values: *weight* of 47.46±8.52 kg, lower by 2.86 kg than the national average; *height* of 161.46±7.14 cm, higher by 3.42 cm; *body mass index* (BMI) – 18.11±2.21 kg/m^2 lower by 1.93 kg*m^2, which shows normal mass at 50% (18.9-20.2 kg/m^2).

Table 1 and figures 2 and 3 show the results of agility testing in students aged 13-15 years, using the basketball methods.

Table 1. *Results of agility testing in the girl students of 13-15 years old (n=26), using basketball methods*

Indices	Min	Max	Avg	Std Dev	Cv(%)
Time (sec)	42.94	52.13	42.07	2.28	4.74
Lap L1 (sec)	4.27	7.61	4.96	0.65	13.08
Lap L2 (sec)	4.09	8.30	5.03	0.82	16.28
Lap L3 (sec)	3.89	6.71	4.82	0.59	12.34
Lap L4 (sec)	4.28	5.91	4.83	0.43	8.85
Lap L5 (sec)	4.22	5.84	4.73	0.39	8.26
Lap L6 (sec)	3.93	5.32	4.58	0.33	7.24
Lap L7 (sec)	4.11	5.99	4.74	0.45	9.48
Lap L8 (sec)	4.15	6.86	4.86	0.59	12.32
Lap L9 (sec)	4.15	5.51	4.83	0.39	8.27
Lap L10 (sec)	3.91	5.47	4.69	0.37	7.78
Avg L1-10 (sec)	**4.10**	**6.35**	**4.81**	**0.50**	**10.39**

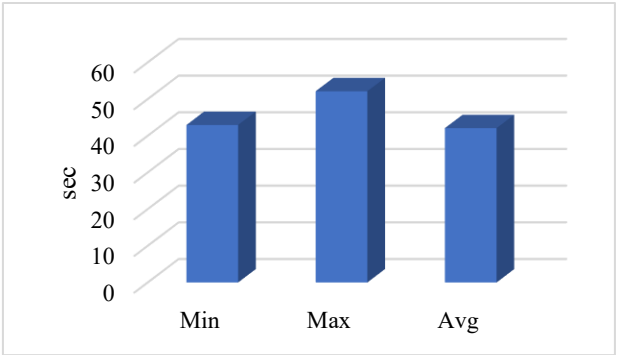

Figure 2. *Results of the minimum, maximum and average values of agility testing through basketball methods (students aged 13-15)*

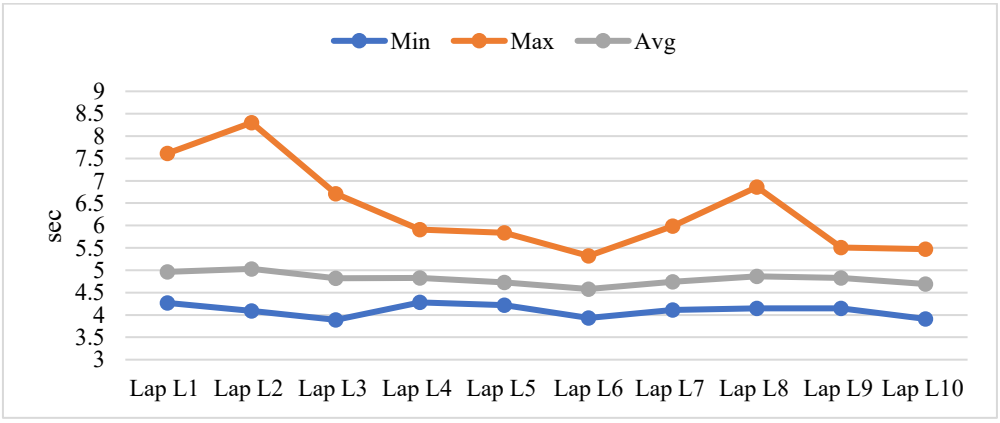

Figure 3. *Dynamics of minimum, maximum and average values of reaction time testing between LEDs during agility testing through basketball methods (students aged 13-15)*

The analysis of the results reveals the average value of 42.07±2.28 sec, closer to the minimum values and 10.06 sec above average maximum value (fig. 2).

Regarding the reaction time between LEDs, one can observe minimum values of 4.10 sec, maximum values of 6.35 sec and an average of 4.81±0.50 sec with Cv (%) – 4.74%.

As for the values at each LED from the 10 impulses at 3 sec response delay, one can notice lower minimum values with difference of reaction below 1.0 sec 30% at L3, L6 and L10, 40% of maximum values over 3.0 sec at L1, L2, L3 and L8; the average shows 90% differences under 3.0 sec (fig. 3).

Figure 4 shows the results of the correlational analysis between the agility and anthropometric indices in the middle school students aged 13-15 years.

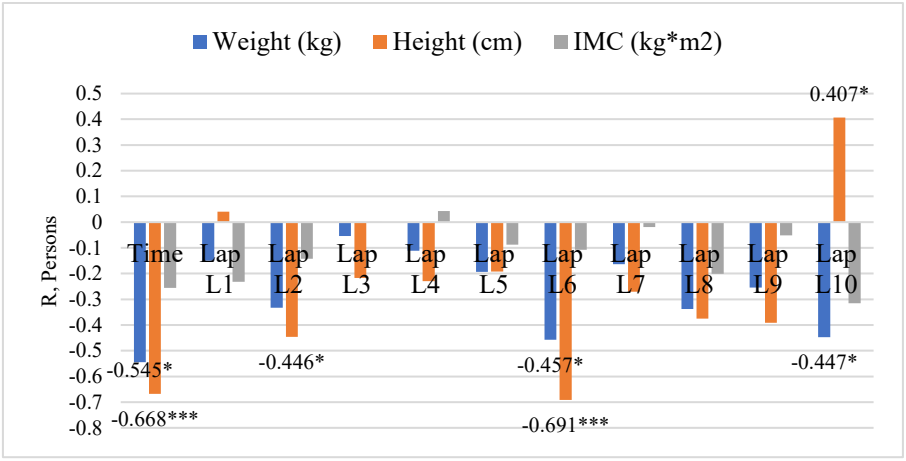

Figure 4. *Correlation analysis between agility and anthropometric indices in the middle school students aged 13-15 years*

Correlation results reveal 30% strong connections at $p<0.05$ between weight and execution time, Lap L6 and L10, response to minimum value under 1.0 sec), 40% strong connections between height and execution time ($p<0.001$) and with L2 and L6 at $p<0.05$, with response under 3.00 sec and 90% negative weak connections between BMI and agility indices.

The specialized literature highlights that the unilateral use of exercises specific to basketball game during training sessions contributes to progress in terms of movements coordination. But it was also highlighted that the inclusion of elements for global postural reeducation, along with coordination methods non-specific to basketball, improve this motor skill to a greater extent (Tarcău, Ciordaş, & Boca, 2015).

The Illinois Agility Test (IAT) is a popular and simple method that has been used for a long period to test the agility. The specialized literature highlights that there are coaches who are not yet acquainted with the modern motor tests meant to properly determine the agility. Therefore, these coaches still make the assessment

of agility and speed in sport games using the Illinois test only (Šimonek, Horička & Hianik, 2017).

A study was conducted in order to determine the effect of circuit training on agility and speed of teenaged male basketball players. The tests used for this purpose: 50 m sprint and 4x10 m shuttle run. Both the t-ratios were found to be significant at 0.05 level of confidence with 29 degrees of freedom (Shekhawat & Chauhan, 2021).

In modern team sports, agility has become more important than in the past, because the game is much faster than before. The agility in sport is a multifactorial parameter; it is correlated with body stability, rapidity and speed. In order to understand which parameters are more important, a pre-post case study, based on three different training protocols and a control group, was made for obtaining objective data (Izzo & Hosseini Varde'i, 2018).

Other studies pointed out the well-known importance of jumping ability in basketball, but the different jumping testing protocols in basketball players at advanced levels were not approached sufficiently (Pehar et al., 2017).

There were determined the reliability and validity of the simple test of agility (T-TEST) and of four newly developed basketball-specific agility-tests, in defining playing-positions and performance-levels in basketball (Sekulic et al., 2017).

A new test of planned agility in elite junior basketball players was analyzed to investigate the reliability and determinants of performance. The results highlighted a good reliability of the test. A gender effect on the determinants of planned-agility performance in young elite basketball players was found out. The results also suggest that straight-line sprint and unilateral jump tests must be implemented in the elite junior players testing program. The agility development and testing can improve sport performance (Sabin & Marcel, 2016).

Agility is highly important in the dribble. Research done on the playing field shows that a poor dribbling technique gives chance to the opponents to take the ball easily. There is a significant relationship between agility and dribble basic technique in playing basketball (Nuryadi, & Indah, 2019).

Some specialists analysed the difference between the dribble crossover method and the two ball dribble method and their results in basketball training and also the effects of high or low agility in basketball dribbling results. The method used is an experiment with 2x2 factorial design (Pratomo, Pramono & Soenyoto, 2019).

Another research identified and analyzed the difference in effects of two ball dribble and dribble of the wall exercise method on the dribble skills of basketball. The research also focused on the effects of the different agility levels of the players on the dribble skills (Afrilliyan, Pramono, & Soenyoto 2018).

There were also examined the exercise models with water and sand as exercise media meant to maximize the training ability of athletes. The experiment conducted for this purpose revealed a significant difference in the effect of the exercise methods (water exercise and sand exercise) on agility. The sand exercise training

method was better than the water exercise for increasing the agility of basketball players (Waffak, Sukoco & Sugiyanto, 2022).

4. Conclusions

The results of the anthropometric measurements of the 13-15-year-old girls included in the research were compared with the average values of the biometric potential, highlighting a normal body mass.

The analysis of the results of agility testing shows the average value lower by 0.9 sec than the minimum values and by 10.06 sec than the maximum value. The results of the responses at each LED reveals lower minimum values with 30% reaction difference under 1.0 sec, 40% maximum values above 3.0 sec, while the average has 90% differences below 3.0 sec.

The results of the correlation analysis highlight 30% strong connections at $p<0.05$ between weight and execution time, 40% strong connections between height and execution time and 90% negative weak connections between BMI and agility indices.

Agility testing with the help of basketball methods and the relationship of their indices with the anthropometric measurements in the middle school girl students aged 13-15 years determined their development level and the value of the connections between the studied indices.

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