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Assessment of Speed and Agility Female Students Using the Illinois Agility Test

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Abstract

The aim of the research was to assess the level of agility of female students, i.e. the correlation between speed and the results of the IAT. The research included 21 female students, who at the time of measurement corresponded to the 3rd year of study, aged 20-22 years. The IAT was used to assess motor agility based on the average test results (sec.) and the average movement speed during the test (m/s). The average IAT result achieved is 19.58 sec. with an average speed of 3.32 m/s. As many as 86 % of respondents had an average score (18.0-21.7 sec). The obtained results confirmed a high inverse correlation between the success of the IAT results and the speed of the IAT performance ($r = -0.985$; $p < 0.05$). The fact that the analyzed population of physical education and sports (PES) students is mainly characterized by good physical condition, significantly better results are expected (reference above average value). The upgrading of this motor area of agility is possible in the moments of solving a specific motor task, in the course of applied adequate exercise or some sports activities.

Keywords: agility, change of direction (COD), speed.

1. Introduction

Coordination (or motor intelligence), highly genetically predisposed, is present in most complex motor movements of varying intensity. It is purposefully integrated in a spatial time frame that includes movements in one continuous cycle. When performing complex movements in sports, most activities are integrated into one unit that defines different compositions of movements with a strong presence of conscious activity. It is known that coordinated movement is subordinated to the synergistic functions of the CNS in its highest centers. As a motor ability, it records a positive development trend until the puberty period, after which stagnation occurs as a result of accelerating changes in growth and development. The maximum effect of the development period is recorded around the age of 25 (Stojiljković 2003; Demirhan et al., 2017).

Agility defines different manifestations of motor performance and spatio-temporal control of body posture in a synergistic relationship that is coordinated with explosive changes in the direction of movement during motor activity. At the same time, the rapid manifestation of force and power is extremely important, as the possibility of efficient use of the concentric-eccentric cycle in ballistic movements (Asadi, 2012). It often implies the progression of strength development and the ability to efficiently perform myometric-plyometric muscle cycles during various complex movements, making it an extremely important technical skill and the most important training factor. We encounter different definitions of agility, some consider it a type of speed (Čoh, 2003), others a primary dimension of coordination (Metikoš et al., 2003). Although there are disagreements about a clear definition of agility, most authors consider agility an

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important component, necessary for success in many sports (Sporiš et al., 2010; Tomljanović et al., 2011). The competitor's ability to accelerate, decelerate, move in the right direction, make a quick and sudden change in the direction of his movement, and at the same time to control space, often time, also requires abilities such as balance, speed, explosive strength and flexibility.

The extremely good agility of the athlete, which is closely related to technical performance and biomotor movement, increases and gains importance in most collective sports. It is highly correlated with changes in the athlete's movement speed, but also with correlations during different vertical and horizontal jumps (Milošević et al., 2014). Due to the structure and dynamics of their activity, the competitors of sports games are usually forced to change the rhythm of movement and the direction of movement in order to achieve a significant field advantage in a combination of different monostructural movements, passing, throwing, etc. (Farow et al., 2005; Bal et al., 2011). Their change of rhythm of movement in an imaginary field or line in order to outplay the opposing player is an important ability that manifests itself based on the anticipation of the opponent's movement. Accurate, correct and well-controlled change of direction of movement at the highest speed is highly correlated with the speed of change of place on the field. It is significantly correlated with the speed of change of the current position, often requires a suitable morpho-motor profile of the athlete, which will have a positive transfer to every other motor ability of the competitor (Fajar, 2022). The integrated action of speed, strength, endurance and flexibility define motor components, and their combinations are the basis for specific abilities (Waffak et al., 2022).

Athletes with a higher level of agility are generally characterized by a higher level of other abilities of energy and central regulation of movement, good visual perception and anticipation of players and events during activities. The fact is that agility is influenced by the speed and running technique, the morphological characteristics of the individual as well as the muscular development of the legs. These are mainly parameters that are subordinated to high-quality levels of agonistic-synergistic regulation of the muscle system (Young et al., 2006). Subak et al. (2022) suggest that efficiency in repeated sprint speed, explosiveness, speed, change of direction to different stimuli is the main success factor in field sports. Today, it is an unwritten rule that players, mostly in team sports, must have the motoric and technical ability to move in multiple directions on a limited space with the dimensions of the field (Bloomfield et al., 2007), which always includes the ability to perceptual reasoning and most often change the direction of movement (Brughelii et al., 2007; Acar et al., 2019).

The IAT is a reliable test and often applicable in sports, developed to detect speed, independent of the subject's gender (Hachana et al., 2013), the difference in COD between athletes and non-athletes (Sekulić et al. 2013). Significant correlations between agility and anaerobic power were also determined using COD (McFarland et al., 2016), it is crucial in karate fights (Jukić et al., 2012), it determines differences in sports games based on gender (Pereira et al., 2018; Sonesson et al., 2021). Body height was shown to be a dominant factor in the IAT, in relation to body mass, fat percentage, fat mass and visceral fat level, which appear as negative factors. The IAT test on sand proved to be a good and reliable tool in the recovery process of basketball players compared to exercises performed in water (Waffak et al., 2022). The study by Milošević et al. (2014) determined a high correlation between strength and speed in agility tests, situations in which eccentric-concentric contractions are not emphasized (zigzag movements, lateral movements) and recognized the influence of vertical jump with preparation as a significant predictor in the manifestations of eccentric-concentric contraction.

There is a lack of research on this topic, when it comes to female PES students or their field of agility. This is the first study that analyzes agility in the female population of PES in East Sarajevo. Female students of this faculty represent a physically active population that engages, or should engage in sports and physical activities. All test subjects, as part of classes, encounter the area of agility, which manifests itself through various sports that are represented in the faculty's plan and program, and as part of practical exercises at the home faculty. The assumption is that agility has defined its existence in this population to a significant extent

The primary goal was to assess the motor agility of female students using the IAT, on the basis of which the speed of direct change of direction and the connection with the result success would be determined.

2. Materials and methods

Participants study

The research included sample 21 female students of Faculty of Physical Education and Sport, University of East Sarajevo, aged 20-22. Measurements of the IAT were performed during regular classes in the premises of the Faculty of Physical Education and Sports, where the microclimate corresponded to the standards of the metric test. Measurements were performed successively, every year, in the 3rd year of study. All participants are familiar with the nature of the research and all measurement procedures. The consent was voluntary and everything was in accordance with the Declaration of Helsinki.

Experimental design study

The length of the IAT track was dimension (length 10 meters, width 5 meters). It was marked with cones (with four central cones 3.3 m apart and four corner cones placed 2.5 m from the central cones) (Figure 1). IAT was measured according to the Roozen (2008).

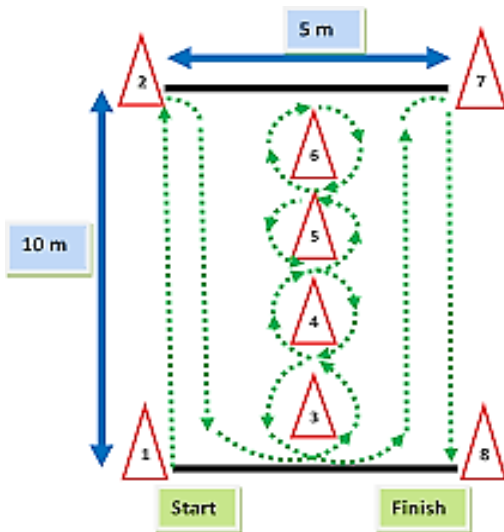


Fig. 1. Illinois Agility Test (IAT)

Data analysis

The central and dispersion parameters (Mean, SD, Min., Max., Range, CI \pm 95.00 %, Standard Error, CV, %) were calculated for Illinois Agility Test (IAT). The normality of the distribution of results was determined by the Shapiro Wilk test ($p > 0.05$). The Pearson moment correlation was determined ($p < 0.05$). All data were processed with the statistical package Statistica 10.0

3. Results

The statistical parameters of the IAT test subjects are contained in Table 1. The IAT results were in the range (17.53 sec to 22.22 sec) with the average speed of the test performance (2.96 m/s to 3.71 m/s). The average achieved result of the IAT sample of female students was 19.58sec with an average speed of 3.32 m/s. In relation to the IAT reference values (MacKenzie, 2000), 18 test subjects recorded an average result (18.0-21.7 sec), 2 test subjects scored below the average values (21.8-23.0 sec), and only one test subject achieved a result of 17.53 sec and Speed 3.71 m/s which categorizes it above average (17.0-17.9 sec). The Standard error value is minimal and is an indicator of the good precision of the estimation of the arithmetic mean. The obtained results (Figure 2) confirmed a high inverse correlation between IAT results and speed, which was expected ($r = -0.985$; $p < 0.05$).

Table 1. Descriptive statistic of results IAT (sec) and Speed (m/s)

	Mean \pm SD	Min	Max	Range	CI \pm 95	CV, %	Standard Error
Result IAT (sec)	19.58 \pm 1.39	17.53	22.22	4.69	1.06-2.01	7.09	0.30
Speed (m/s)	3.32 \pm 0.22	2.96	3.71	0.75	0.17-0.32	6.62	0.05

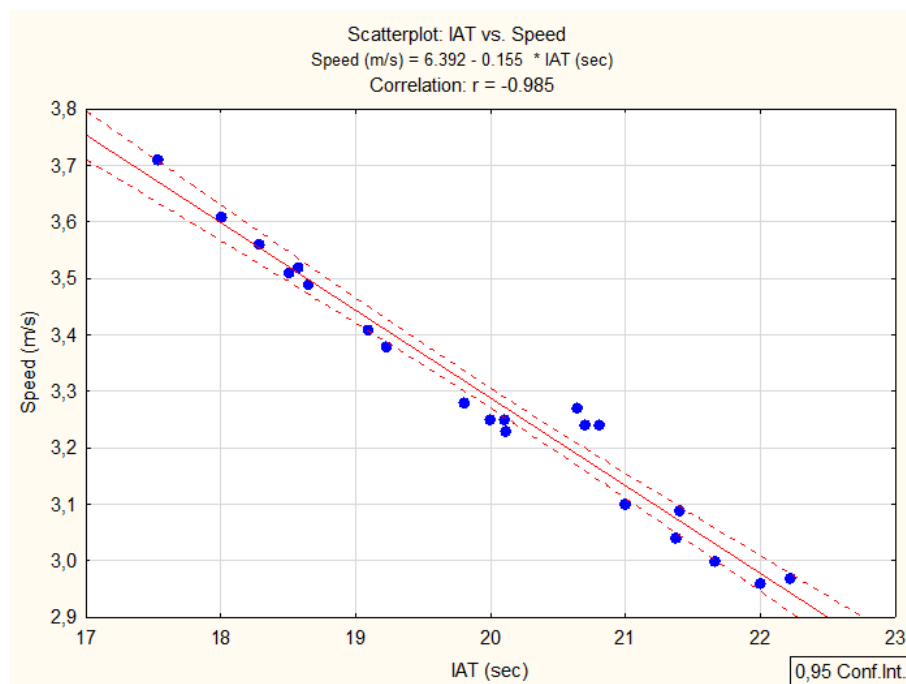


Fig. 2. Correlation between IAT (sec) vs. Speed (m/s)

3. Discussion

The primary goal was to evaluate the motor agility of female students using the IAT, on the basis of which the speed of direct change of direction and the connection with the result success would be determined. The achieved results of the study in relation to the reference values show the average category (Table 1). A detailed analysis of the sample shows that 86 % of the respondents achieved an average result, and only one respondent achieved an above average result. A high inverse relationship between IAT results and test performance speed was recorded (Figure 2).

In general, the results are at a satisfactory level. Given that these are subjects of PES, who are motorically active, an above average result was expected. However, this distribution of results is probably a consequence of the state of the nervous system, students' insufficiently developed motor abilities that define agility (speed, explosive strength, balance), morphological parameters (primarily height and body mass), which appear as a disturbing factor in agility tests, which supports the findings of some studies (Fayar, 2022)

It is evident that During the duration of the match, the activities of the athletes are related to solving a significant number of different coordinated actions with the aim of manifesting them during the activity. It has been proven that the speed of activity in some sports can be the difference between competitive success and failure. Along with speed goes the ability of the muscles to contract with maximum force, i.e. how strong the muscle is or how much force it can exert (Jovanović et al., 2011), which was probably manifested here to a large extent when performing the IAT.

Agility as a part of coordination, utilitarian and represented in motor structural movements, depends on the age of the individual and the synergistic functioning of central and energy regulation, which is under the influence of the CNS (Perić et al., 2015). It defines the ability to quickly change the direction, the position of the body in the space-time frame, as easily as possible and with good control without disturbing the balance. It also refers to good audio-visual narration and speed, which should be the hallmark of every successful athlete (Demirhan et al., 2017). Asadi (2012) suggests that the psychophysical and neurophysiological adaptations of the organism simultaneously improve motor activity of the CNS, increasing agility performance, and that a faster transition from eccentric exercises to concentric exercises increases muscle activity in the extensors of the lower extremities.

Agility is primary in sports that integrate activities with very fast leg movements and changes in body position in space, and an athlete who has good agility performs movements much faster and

better (Subak et al., 2022). Precisely the curriculum of the Faculty of PES is specific in that it defines different forms of motor manifestation in the structure of the subject of studying different sports. So that the components of agility at the level of central and energy regulation are improved in synchronization, through the implementation of teaching programs. Such activity structure probably defined the current distribution of the results of the participants of our study, which enabled a positive transfer of agility components (strength, speed, balance) to the final result of the IAT.

Also, certain agility movements are subordinated to eccentric movements to a significant extent, which accelerates its development as a motor skill. Nimphius et al. (2010) suggest the use of training programs to develop muscle strength and power in order to achieve a shorter duration of manifestations involving changes in the direction of movement. However, we have conflicting opinions on this matter. Some authors believe that speed and strength in selected athletes are weak predictors of agility (Tomljanović et al., 2011; Sekulić et al., 2013). In this regard, a low correlation was found between leg extensor strength and agility in physically active men (Marković et al., 2007). Similar low correlations between jumps, sprints and agility were reported by Salaj et al. (2011) citing a limited transfer between them, while Uzunović (2008) found a positive relationship between strength and speed in sports dance characterized by frequent changes of direction. However, the speed at which the direction of movement is changed and how much force is communicated, i.e. coordinated balance, should be taken into account here, which can affect the result of agility (Young et al., 2006). Precisely in our case, in addition to everything mentioned above, the wooden parquet floor and the size of the exerted force and the size of friction at the moment of changing the direction of movement can be a factor in the average results of the study.

Although the results of this study are inferior to the results of some similar studies with a mixed sample (Milošević et al., 2014), the current study defined the assumption that subjects who had better developed components of agility also achieved better results. This is another confirmation of the high correlation between agility components and the success of IAT implementation.

4. Conclusion

The results of the IAT, which assessed motor agility, confirmed the positive but average results of the sample. Moreover, 86 % of the respondents achieved average results in relation to the reference values. Given that these are PES students, these results must be much better (category above average). Also, a significant prediction of agility components in relation to IAT results was confirmed. It is necessary to focus more attention on the targeted development of agility components (speed, strength, balance) in this population, so that the resulting success is better.

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