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Research article

STANDARDIZED PLANNED AGILITY TESTS IN YOUNG FOOTBALL PLAYERS: MATHEMATICAL MODELING IN THE FUNCTION OF DEFINING PHYSICAL POTENTIAL

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Zoran Pajić[1], Slobodan Simović[2], Milivoj Dopsaj[1,3]

[1]Faculty of Sport and Physical Education, University of Belgrade, Belgrade, Serbia
[2]Faculty of Physical Education and Sport, University of Banja Luka, Banja Luka, The Republic of Srpska, Bosnia and Herzegovina
[3]Institute of Sport, Tourism and Service, South Ural State University, Chelyabinsk, Russia

Abstract. *Each process of efficient management of an athlete's condition entails proper diagnostics, prognostics, and modelling by measuring gathered information. This study aims to come up with a standardized mathematical model for assessing the physical condition of young football players in relation to planned and programmed agility. This study implemented the mathematical modelling method for the general profiling of the evaluated motor capacity, in order to obtain a tool for classifying the condition of an individual in relation to the population standard. This study applied planned and pre-programmed motion patterns to test the capacity of planned agility using six variables: 3 original and 3 calculated. All the original variables underwent mathematical transformation in relation to the multiscale modelling of Z-distribution, so that all the results have been transformed into an analogous result in the range between 0, as the distribution minimum, and 100, as the distribution maximum. This produced analogous quantitative, i.e. numerical values of the score, i.e. the distributive position of each result in relation to the tested age group. The defined mathematical models for the prediction of the level of development of the measured agility type do not only have absolute, but also hypothetical potential for determining the relative position of each young player in relation to their age population. The proposed models have strength at the level of absolute explained common variance (Adj R^2 = 1.000, i.e. 100.0% of the explanation) with a marginal standard error of prediction (only 0.003 points). Processing diagnosed information in such a way makes it possible to precisely define the initial, transit, and final condition of the athlete, programming an efficient, optimized and quality training process, as well as proper identification of talents in selecting young athletes.*

Key words: *diagnostics, planned agility, modelling, prediction, standardization.*

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Corresponding author: Milivoj Dopsaj
Faculty of Sport and Physical Education, University of Belgrade, Blagoja Parovića 156, 11030 Belgrade, Serbia
E-mail: milivoj.dopsaj@gmail.com

1. INTRODUCTION

In team sports, one of the important characteristics for success greatly depends on the athletes' abilities to shift their bodies (transposition) or individual limbs (translocation) in relation to the space around them, as quickly as possible when changing direction of movement in a specific competitive situation (Sarmento et al., 2018). The speed of change of direction (COD) is especially dominant in team sports , or in other words, the ability to accelerate and decelerate and change direction while maintaining good control of the movement of one's body or its segments while maintaining speed (Baechle, 1994; Draper & Lancaster, 1985), or the ability to change direction rapidly (Brown & Ferrigno, 2005; Drabik, 1996), efficiently carry out stop-and-go motion (Flisk, 2000), change the direction of movement without losing balance, speed, power and control (Pearson, 2001), change of direction in relation to quick and accurate action in space and time (Gabbet & Sheppard, 2013), etc. However, it was recognized some time ago that no prior definition of this ability had taken into account the perceptual components and decision-making components which are involved in executing basic movements present in the competitive structure of most sports. Later research on this ability created a clear discrepancy and definitively introduced the term agility, which defines the ability comprising components of change of direction and components of perception and decision-making, since change of direction and speed is often carried out in response to the opponent's action (Rigg & Reilly, 1988; Young et al., 2002). Because of its complex structure and cognitive demands, agility is considered an isolated motor capacity (Jeffreys, 2006), an open motor skill which requires athletes to respond to the surrounding sensory stimuli, while their response is not involuntary (Cox, 2002). So, according to current theory (Pajić, 2017), the accepted conceptual model of agility is accepted, but instead of the terms "agility" and "speed of change of direction", the terms "reactive/random agility" and "planned agility" are used (Oliver & Meyers, 2009), as well as programmed agility (familiar movement conditions) and randomized agility (unknown movement conditions) (Person, 2001; Scarlan et al., 2021). In tests of carrying out planned agility, participants were introduced to the required movement pattern beforehand, while for reactive agility the direction changed in response to stimuli applied during the test.

Efficiency of every motor task primarily depends on the influence of coordination factors such as accuracy in relation to the complexity of the task, space, time, and intensity of the exerted force. For this reason, the study presupposes that each engaged age group will successfully and efficiently carry out the planned agility tests assigned to them, without a negative impact from any of these transfer factors.

During adolescence, almost all young players go through significant variations in growth (body size) and development (biological maturity) which can impede the prediction of their future performance (Figueiredo et al., 2011; Malina et al., 2004; Malina et al., 2004). It is therefore necessary to continually model possible relations between the kind of offered information regarding the carried out measurements, and form evaluation criteria which would be accurate and usable for their training. This allows for quality feedback, which is a necessary condition for optimizing and controlling the effects of the modern-day training processes. An optimized process of preparation in sports requires constant evaluation of the effects of training by applying suitable diagnostic procedures and consequently suitable modelling of the obtained information. The obtained results and their proper interpretation allow for ascertaining the advantages and disadvantages of athletes' physical condition, as well as setting realistic goals and tasks of the training process in programming individual training.

Athletic training entails a controlled multi-year process with systematic application of various training methods and motor workload on athletes of various ages (Malina et al., 2004). During a given multi-year training process, the methods applied in controlling the physical condition of the athlete must be as responsive and specific as possible, but also individually sensitive, both in recognizing the effects of the applied training models and in recognizing the specific talents of an individual, i.e. the level of their motor potential as an important part of sporting talent (Nikolaidis et al., 2012; Dopsaj et al., 2019; Lima-Souza et al., 2020; Majstorović et al., 2020). For all of the above, and for efficient control of long-term athlete development, it is necessary to develop reliable procedures which would make it possible to monitor the development of an athlete in relation to motor capacities which are significant to the individual's sport. A significant scientific method is the mathematical modelling method for the general profiling of a given motor capacity, in order to obtain a tool for classifying the condition of an individual in relation to the population standard (Majstorović et al., 2020; Dopsaj et al., 2010; Zatsiorsky, 1982).

This study aims to come up with a standardized mathematical model for assessing the physical condition of young football players in relation to planned and programmed agility, which would be applicable to the long-term control of the development of a young athlete.

2. Materials and Methods

This study applied planned and pre-programmed motion patterns to test the ability of planned agility. They were selected in such a way that their temporal, spatial and intensity organization were age-appropriate for the participants. This presupposes the elementary reliability of these tests, with the avoidance of any possible negative transfer. The organization of the tests allows the evaluation of planned agility (speed of change of direction) because they provide: biomechanical specificity (kinetic and kinematic congruence), mode specificity (congruence of mode in generating muscular force occurs in that mode of muscular operation in which the evaluated speed of change of direction occurs), muscle adaptation specificity (congruence of the engaged musculature – inter-muscle coordination), and metabolic specificity (congruence and high correlation with energy requirements of the chosen tests, taking into account the age of the participants).

1.1. Participants

The sample of participants comprised 960 male participants, divided into three groups according to their chronological age: 320 boys of age 8.5 ± 0.4 years, body high - BH = 132.0 ± 0.06 m, body mass - BM = 28.7 ± 4.60 kg, body mass index - BMI = 16.4 ± 1.83 kg•m^{-2}; 320 boys of age 11.6 ± 0.4 years, BH = 162.5 ± 0.05 m, BM = 37.5 ± 6.70 kg, BMI = 17.4 ± 2.17 kg•m^{-2}; and 320 boys of age 15.5 ± 0.4 years, BH = 173.0 ± 0.08 m, BM = 60.9 ± 9.80 kg, BMI = 20.1 ± 2.49 kg•m^{-2}. All the participants had regularly taken part in football training processes for 3-8 years. The research was carried out in accordance with ethical approval number 484-2 of the ethical board of the Faculty of Sport and Physical Education, University of Belgrade.

1.2. Testing Procedure

All testing was carried out in accordance with previously described standard procedures (Gabbet, & Sheppard, 2013). To measure time, the study used a photocell timing system (Brower Timing Systems) with 0.001 s measurement accuracy. The first age group (8-year-olds) was tested using the *505 agility test*, the second (11-year-olds) using the zig-zag *Envelope test*, and the third (15-year-olds) using the *Illinois test.* Figure 1 shows all three tests of planned agility of motion.

Measurements were taken on an indoor synthetic grass pitch from 9 to 12 in the morning. Before submitting to the tests according to their age groups, the participants carried out two sets of warm-up exercises. The first set (a basic functional 10-minute warm-up) comprised a 6-minute steady state run, mobility exercises for the spinal column, especially for the legs, and the most important exercises from dynamic warm-up protocols. The second set (a specific 10-minute warm-up) was aimed at increasing neuromuscular activation and comprised coordination exercises which are suitable to the age group in their temporal, spatial and intensity organization, as well as to the complexity and structure of the tests applied in this study.

Prior to the testing, the participants were advised to follow a suitable diet, without consuming too much spicy, salty, sweet, or greasy food, or any beverages that contain caffeine or sugar for at least 2.5 hours before the test. The coaches were also informed to avoid any energy-intensive activities of motor training 48 hours before the test.

505 Agility Test

The *505 Agility Test* (Figure 1a) is of very short duration (alactate intensity), and it completely removes the occurrence of anaerobic fatigue, while measuring pure capacity of short sprints with change of direction (Draper & Lancaster, 1985; Gabbet, & Sheppard, 2013; Reaburn et al., 2011). The participants were given a task to travel a 15 m distance between two markers. The photocell system was set at the ten-meter distance. The participants were required to accelerate fully from the start line to the photocell line (10 m), stop behind the second marker, make a 180° turn, and again run with full acceleration to the finish line (5 m). The total distance travelled in this task is 20 meters.

Zig-zag test (Envelope test)

The *Envelope test* (Figure 1b) is more complex and somewhat longer planned agility test, of a relatively short duration (ATP + CP energy system), and minimizes the occurrence of anaerobic fatigue. The participants were given a task to travel the distance between five markers placed in a 3x5 m rectangle (Jones et al., 2009; Little & Williams, 2006). One photocell system was set at the start, and at the same time the finish. The participants were asked to accelerate fully from the start line along the rectangle, decelerate, properly change direction, and then accelerate to full speed to the finish line. The total distance travelled in this task is around 20 meters.

Illinois test

The *Illinois test* (Figure 1c) is a significantly complex and long planned agility test. The test completely covers the energy system capacity (ATP + CP), but it is possible that young or less fit athletes exhibit an increased significance of the anaerobic glycolytic energy support to the ATP resynthesis, with a significant occurrence of acidic metabolites. It can be assumed that in such a situation, negative transfer may be intensified from the aspect of metabolic congruence, which brings into question the validity of the planned agility measurements, with an increased significance of lactate intensity (Pajić, 2017; Hachana et al., 2013; Raya et al., 2013). It can therefore be assumed that it is not sufficiently advisable for participants under the age of 15. The participants were given a task to travel the distance between markers in a very specifically arranged course in the shortest possible time. Two photocell systems were set, at the start and at the finish. The participants were asked to accelerate fully from the start line along the course, decelerate, properly change direction, and then accelerate to full speed to the finish line. The total distance travelled in this task is around 65 meters.

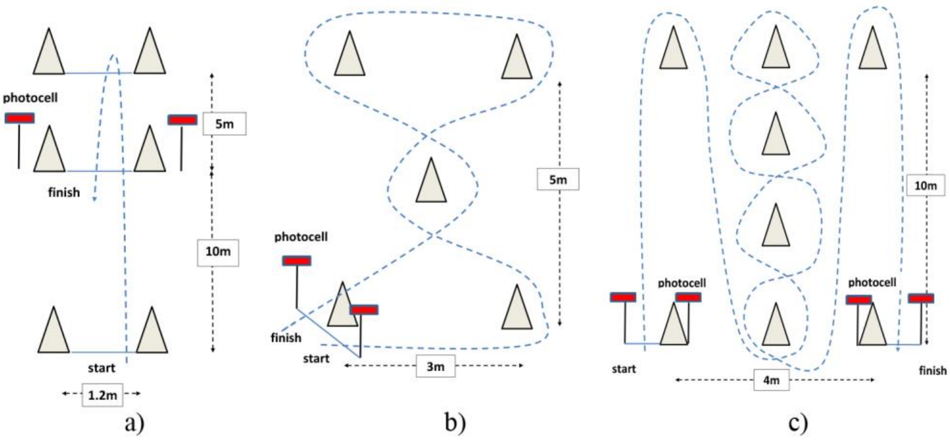

Fig. 1 The motion of the participants during the planned agility tests: a) during the 505 Running test, b) during the Envelope test, and c) during the Illinois test.

Before the measurement, the participants were given one trial attempt, and then they ran according to the provided protocol. For each individual test three measurements were made for the *505 Agility test* and *Envelope test*, and two measurements for the *Illinois test*. The best times were used in the analysis . Unlike the previous two tests, where the participants carried out three test attempts, the Illinois test was carried out only two times in each group, perhaps because a third attempt in this test, which activates the anaerobic alactate-lactate mechanism of energetic transformations for the resynthesis of ATP, might have caused significant fatigue, which in turn might compromise the reliability of the application of the test for the observed age group. The rest periods in between individual attempts were 1:20 or 1.5 minutes for the *505 Agility test*, 1:15 or 2 minutes for the *Envelope test*, and 1:10 or 3.5 minutes for the *Illinois test*, which is in line with protocols exploring movement whose structure is dominated by speed of execution (Pajić, 2017).

1.3. Statistical analysis

All the data were analysed using descriptive statistical procedures for calculating basic measures of central tendency (M), dispersion (SD), homogeneity – variation coefficient (cV%), minimal and maximal values (Min and Max) and variable range. The distribution form was described using the skewness and kurtosis coefficient, while the normality of the result distribution was determined by applying the Kolmogorov–Smirnov nonparametric test. Percentile distribution was used to define five intervals of the normative value levels (five separate classes), including the position of each individual result expressed as a score (Zatsiorsky, 1982; Yanci et al., 2017). A linear regression was used to define the prediction equation for the achieved results of testing planned agility in the function of distribution, i.e. the distribution value, as a measure of actual motor potential of planned agility in relation to the tested age group (Hair et al., 2014).

All the original variables underwent mathematical transformation in relation to the multiscale modelling of Z-distribution (Lima-Souza et al., 2020), so that all the results were transformed into an analogous result in the range between 0 and 100 (Dopsaj et al., 2010). This produced analogous quantitative, i.e. numerical values of the score, i.e. the distributive position of each result in relation to the tested age group, which made it possible to proportionately compare individuals from the same age group in the sense of their position from the aspect of the result distribution. It also provided for a realistic comparison of an individual's position in relation to the other age groups as well (Dopsaj et al., 2019; Majstorović et al., 2020).

All of the analyses were carried out using the IBM SPSS v23.0 statistics software, while the statistical difference was set at 95% with a level of significance of $p \leq 0.05$ (Hair et al., 2014).

3. RESULTS

Table 1 represents the basic descriptive indicators of the tested variables. Table 2 represents the percentile distribution of the test results for planned agility for original and standardized variables. The given data were also defined in relation to the cut-off values of the distribution normative standards which can be used in assessing the development of the measured capacity for the purpose of the test. Further, as a function of age, the defined norms can be used in the sense of recognizing motor potential in initial diagnostics for the purposes of talent detection in football.

Table 1 Basic descriptive data on the variability of all planned agility tests

	Running Agility tests (sec.)			Running Agility score (score number)		
	505	Env	Illinois	Score_505	Score_Env	Score_Illinois
M	3.129	7.701	17.824	50.000	50.000	50.000
SD	0.232	0.420	993	16.670	16.670	16.670
cV (%)	7.41	5.450	5.57	33.340	33.340	33.340
Std. Meas. Err.	0.013	0.023	0.055	0.932	0.932	0.932
Std. Meas. Err. (%)	0.410	0.300	0.31	1.860	1.860	1.860
Min	2.29	6.580	15.41	7.570	-19.790	19.000
Max	3.72	9.460	19.67	110.220	94.500	90.520
Range	1.43	2.880	4.26	102.650	114.290	71.520
Skewness	-0.279	0.475	-0.084	0.280	-0.475	0.084
Kurtosis	1.276	0.894	-1.111	1.227	0.894	-1.111
K-S Z	0.057	0.039	0.108			
p value	0.200	0.200	0.000			

Table 2 Percentile distribution of the planned agility test results for original and standardized variables in accordance to the subsample

Percentiles	Classes	Running Agility tests (sec.)			Running Agility score (score number)		
		505	Env	Illinois	Score_505	Score_Env	Score_Illinois
97.5	Good (5)	2.77	6.94	16.06	75.76	80.19	79.60
95		2.78	7.08	16.26	75.16	74.65	76.22
90	Above Average (4)	2.86	7.21	16.51	69.30	69.49	72.03
70		3.03	7.49	17.18	57.10	58.38	60.87
60	Average (3)	3.07	7.58	17.29	54.23	54.65	58.99
50		3.12	7.68	17.82	50.64	50.65	50.06
40		3.16	7.79	18.12	47.77	46.48	45.09
30	Below Average (2)	3.23	7.90	18.56	42.74	42.23	37.63
10		3.49	8.21	19.19	24.08	29.85	27.06
5	Bad (1)	3.52	8.42	19.26	21.93	21.54	25.88
2.5		3.55	8.70	19.32	19.77	10.47	24.87

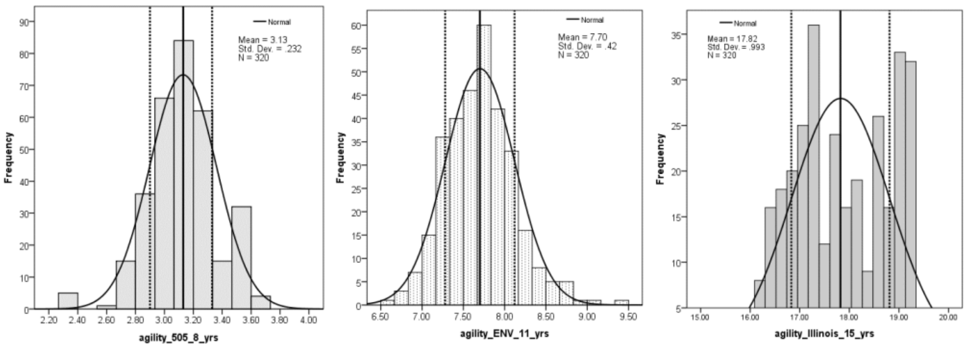

Fig. 2 Frequency distribution graphs for all three running agility tests

Based on the results of the distribution regularity obtained by applying the K-S test, it is clear that the distribution in the age groups of 8 and 11 does not statistically significantly deviate from the hypothetical normality (Table 1, *505 Agility test* and *Envelope test*, p = 0.200, Figure 2). However, the result distribution for the third test is statistically significantly different from the hypothetically regular one (Table 1, *Illinois test*, p = 0.000, Figure 2) which indicates certain inconsistency in the distribution structure of the measured results.

Table 3 presents the results of the0020regression analyses with a calculated model of predicting the score distribution position for the applied running agility tests.

Table 3 Regression analyses and calculated prediction models

Predictors	Dependent Variable	Adj R^2	Std. Err. Est.	ANOVA of regression F value	p
505 Agility Test	Score_505	1.000	0.003	1134520.7	0.000
	Model of prediction: Score_505 = 274.59942 – (505 Agility test (sec) • 71.78201)				
Envelope test	Score_ENV	1.000	0.003	1047850.2	0.000
	Model of prediction: Score_ENV = 355.61145 – (Envelope test (sec) • 39.68338)				
Illinois test	Score_Illinois	1.000	0.003	1029826.6	0.000
	Model of prediction: Score_Illinois = 349.24793 – (Illinois test (sec) • 16.78949)				

4. DISCUSSION

Based on the obtained results (Table 1) it can be concluded that average results in this study for the evaluated *505 Agility test*, *Envelope test* and *Illinois test* are at the level of 3.129 ± 0.232, 7.701 ± 0.420 and 17.824 ± 0.993 seconds, respectively, as well as that similar results were obtained for the *505 Agility test* (3.13 ± 0.138) (Yanci et al., 2017), then for the *Envelope test* (7.06 ± 0.26) (Erikoglu, & Arslan, 2016); 7.01 ± 0.65 (Kutlu et al., 2014); 25.21 ± 1.10 (Lipecki, 2018); 7.45 ± 0.20 (BrianMac Sports Coach, 2020); 4.5 - 7.00 (Nimphius et al., 2018); as well as for the *Illinois test* (16.26 ± 1.02) (Howard, & Stavrianeas, 2017; Born et al., 2016).

It can also be said that all the results are very homogeneous, because the variation coefficient (cV) is under 10.0% for all the tests, i.e. it ranges from 5.45 % for the *Envelope test* to 7.41 % for the *505 Agility test*. Adding the fact that the relative value of the standard measurement error for all three tests is under 0.5% (from 0.30 to 0.41% for the *Envelope test* and the *505 Agility test*, respectively, Table 1), it can be said that all the tests were carried out uniformly in terms of methodology and following a strict measurement procedure, so that the obtained results can be accepted as very representative.

The results of the distribution normality have shown that the distribution test result for the *505 Agility test* and the *Envelope test* is regular (K-S Z 0.057 and 0.039, $p \geq 0.200$) while the only test with an irregular result distribution is the *Illinois test*, i.e. the test with the narrowest duration range (Min-Max = 15.41 - 19.67 s, Table 1), as well as the most motor complexity - which was indeed why it was given to the oldest player age group, the 15-year-olds. The distribution is in the form of a bimodal curve (Figure 2), i.e. the participants are grouped around the above and below average values of the given test.

The displayed graphs of distribution normality obtained by applying the K-S test clearly indicate that in the 8 and 11 age group, empirical distribution does not deviate in a statistically significant way from normal distribution with a 5% margin of error. However, the graph for the third distribution clearly indicates a certain inconsistency of the structure of distribution normality. It might be assumed that the noted heterogeneity of the obtained results in the study for the age group of 15-year-olds may have multiple reasons. The first stems from the fact that at this age, the participants exhibit more significant differences in the efficiency of performance of both basic and, perhaps even more so, specific motor capacities (skills). It is possible that the difference is less prominent in younger age groups because these periods are characterized by a more significant (60-80%) application of general and focused exercises, which have a general and almost equal effect on all young athletes doing the exercises. Hence, as the length of the training history increases, so does the difference between less efficient athletes and those for whom the skill of carrying out motor tasks becomes the result of the effect of positive transfer, i.e. the quality of their adaptation to the effects of applying specific forms of exercise. This is, of course, the privilege of the better, the best, and most talented athletes. The second important reason might be the fact that the sample of participants for the study comprised participants who are in training with national teams, clubs, and football camps, i.e. of children with three different levels of knowledge and capacity. This particularly refers to participants from summer camps, who include some children who have a very low level of capacity and football skills, but have been included in this study. The third, very notable reason might be the fact that in such a large sample of participants, there can hypothetically be a proportionately large number of boys whose chronological age does not match their biological age. This in turn produces results which do not fit the current chronological age of the given sample, which is an established criterion in this study. Namely, it is well documented that the maturity process does not follow the same pattern for every individual. So, young players of the same chronological age, but who are biologically more advanced, are taller and heavier than those players that develop later on, and can therefore potentially exhibit a greater quality of motor manifestations (Malina et al., 2004; Valente-dos-Santos et al., 2012). In this study, the year in which the height increment peaked for young players (attacking players) was 14.84 ± 0.30. Similar arguments that young football players exhibit increments in weight, height, running speed, and aerobic endurance near the height increment peak were stated by Philippaerts et al. (2006). In can be said that the findings in this study for players aged 15 are similar to that of previous claims. It is therefore possible that the heterogeneity of their results is the consequence of the relation between chronological and biological age, which is especially prominent at this age, and which affected the distribution normality (third graph). Failure to identify the issue of this relation systematically excludes talented players who mature at a slower rate, which is impermissible in diagnostics, prognostics, and the modelling standard for recognition of young talents in football.

Defined test standards are diagnostic decision-making criteria in the sense of evaluating the current level of a given motor ability of the tested individual (Table 2). This allows the coach to monitor both the absolute and the relative development trend of the given player over longer training cycles. In other words, this methodology makes it possible to not only monitor absolute changes in the sense of the development of the given motor capacity (changes in the individual's result in seconds – result progress, or result decline), but also to monitor the relative development trend, i.e. the change of the individual’s position (progress or decline) in relation to the distribution scale, i.e. age group (result score). On the other hand, defined standard norms in terms of the numerical value of the score broken down for each individual test give the coach information on the hypothetical placement of the given individual in relation to other age groups, i.e. the absolute age population range for the measured ability (Table 2).

The calculated prediction models are mathematically defined at the level of the absolute explained common variance (Adj R^2 = 1.000, i.e. 100.0% of the explanation) with a marginal standard error of the prediction (only 0.003 points, Table 3). Unification and distribution standardization make it possible to define an individual’s position in relation to the population age, i.e. to apply an individual approach of controlling the effects of the applied training programme, and thus to monitor the level of the individual’s adaptation throughout a year-long training period in relation to the rest of the group, which is the foundation of the modern concept of controlling the effects of sports training (Majstorović et al., 2020; Nikolaidis et al., 2012; Muazu Musa et al., 2019).

The defined prediction models for the population positioning of the results of the applied agility tests for young football players in the tested age groups (Table 3) have the potential for standard application within programmes for the development of football talents in terms of recognizing motor talent (Malina et al., 2004).

Some limitations of this study must also be pointed out. Certainly, even though the current data should be applied within talent development programmes, other components as well, such as power characteristics, sports skills, tactical variables, psychological and social factors, which, unfortunately, have not been analysed in this study, may be of importance for success in football (Meylan et al., 2010; Scanlan et al., 2021). Further, in order to create a full profile for each of the playing positions in identifying talents and the development of young football players, future research should focus on the separate analysis of each position in a large group of young football players.

5. Conclusion

Contemporary sports use assorted sophisticated diagnostics procedures for measuring an athletes' capacity, skills, traits, and knowledge for the purpose of various scientifically verified models of evaluating their physical condition and sporting condition. Results evaluated and explained in such a way are the foundation for quality planning, programming and control of training processes. Results of high quality and accuracy allow for setting clearly defined goals, tasks, and preparation cycles, and accordingly, implementing suitable means, loads and methods of training work.

This study highlights one of the possible new, scientific approaches to evaluating athletes' identified capacities, which are becoming increasingly topical in training practice. In other words, this means that each highly ranked sports results is inevitably preceded by the application of highly sophisticated diagnostics and prognostics, established on the basis of clear, precise, scientifically affirmed standards, high quality evaluation (quantification) of measurement results in relation to the modern concept of controlling the effects of sports training, as well as optimally defined concepts, projections, and strategies for the development of an athlete.

The defined mathematical models for the prediction of the level of development of the measured agility type do not only have absolute, but also hypothetical potential for determining the relative position of each young player in relation to their age population, and have strength at the level of the absolute explained common variance (Adj R^2 = 1.000, i.e. 100.0% of the explanation) with a marginal standard error of the prediction (only 0.003 points, Table 3). The application of these model provides coaches with an individual approach of controlling the effects of the applied training programme, and thus of monitoring the level of an individual's motor adaptation throughout a year-long training period with maximal efficiency in relation to the rest of the group, which is the foundation of the modern concept of controlling the effects of sports training.

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STANDARDIZOVANI PLANIRANI TESTOVI AGILNOSTI KOD MLADIH FUDBALERA: MATEMATIČKO MODELIRANJE U FUNKCIJI DEFINISANJA FIZIČKOG POTENCIJALA

Svaki proces efikasnog upravljanja stanjem sportiste podrazumeva odgovarajuću dijagnostiku, prognozu i modeliranje merenjem prikupljenih informacija. Ova studija ima za cilj da dođe do standardizovanog matematičkog modela za procenu fizičkog stanja mladih fudbalera u odnosu na planiranu i programiranu agilnost. Ovom studijom implementiran je metod matematičkog modeliranja za opšte profilisanje procenjenog motoričkog kapaciteta, kako bi se dobio alat za klasifikaciju stanja pojedinca u odnosu na standard populacije. Ova studija je primenila planirane i unapred programirane obrasce pokreta za testiranje kapaciteta planirane agilnosti, koristeći šest varijabli: 3 originalne i 3 izračunate. Sve originalne varijable su pretrpele matematičku transformaciju u odnosu na višeskalno modelovanje Z-distribucije, tako da su svi rezultati transformisani u analogni rezultat u opsegu između 0, kao minimuma distribucije, i 100, kao maksimuma distribucije. Ovo je proizvelo analogne kvantitativne, odnosno numeričke vrednosti skora, odnosno distributivnu poziciju svakog rezultata u odnosu na ispitanu starosnu grupu. Definisani matematički modeli za predviđanje stepena razvoja merenog tipa agilnosti poseduju ne samo apsolutni, već i hipotetički potencijal za određivanje relativnog položaja svakog mladog igrača u odnosu na njegovu starosnu populaciju. Predloženi modeli imaju snagu na nivou apsolutno objašnjene zajedničke varijanse (Adj R^2 = 1.000, tj. 100,0% objašnjenja) sa marginalnom standardnom greškom predviđanja (samo 0,003 poena). Obrada dijagnostikovanih informacija na ovaj način omogućava precizno definisanje početnog, tranzitnog i konačnog stanja sportiste, programiranje efikasnog, optimizovanog i kvalitetnog trenažnog procesa, kao i pravilnu identifikaciju talenata u selekciji mladih sportista.

Ključne reči: *dijagnostika, planirana agilnost, modelovanje, predvidjanje, standardizacija*