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Research Article

Evaluating the performance of non-reactive and reactive agility tests in elite and average soccer players under the age of 14

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Abstract

Background: Agility is one of the most critical factors in the sport performance of soccer players. Although various tests have been designed to measure agility, there is no agility test, based on soccer-specific movement patterns. Therefore, this study aimed to develop and examine of a soccer Specific Reactive Agility Test (SSRAGT)for Players U14 Years.

Materials and Methods: 48 soccer players under the age of 14 years divided in two groups composed of 24 players. The group A were elite soccer players and active at the level of Asia vision, while group B were soccer players were active at the level of neighborhood and local competitions One hundred and seventy competitive soccer players under 14 years volunteered to participation in this study as subjects. The standard 505 Agility Test (505AT), Zig-zag Curl (ZZC)، Zig-zag straight (ZZS) the test was performed for all participants on two separate days within a two-day interval at the same time and place. The SSRAGT was performed after two days.

Results: In order to evaluate the intensity of agility test the number of steps and heartbeat after activity was applied. The 505-agility test with a heartbeat of 159.4±11.245b was lower than other tests. The number of steps in the 505-agility test indicated lower intensity and fewer steps 26.30±4.794[b.] The heartbeat and number of steps in the other test had a significant correlation with each other. The results of logistic regression between 48 player SSRAGT test can significantly predict the level of performance of young football players (OR = 1.437, P <0.01). As the ZZC test was able to significantly predict the performance level of the subjects in this study (OR = 1.05, P <0.01).

Conclusion: Based on the result the reactive agility test for the soccer player in comparison with non-reactive agility test had the potential to distinguish between average and elite soccer players and due to its reactive nature, it is similar to movement patter in soccer, so it can be used as an efficient field tool to evaluate players' agility levels.

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1. Introduction

Sport in general can be distinguished and known as team or individual sports in which the performance is exclusively determined by the individual compared to the group or team(1, 2). Another more complex evaluation is based on division by their movement and technical characteristics and physiological needs. Comparing individual sports with team sports we found that athletes need to perform high and low activities(3, 4). In this confrontation, the athlete in the field and field of completion need to run at maximum speed, hard activities for each specific sport, jumps etc. all of which rely on speed and strength(5, 6). A unified factor that all individual and team sports need is to make a change in their direction in order to have speed and appropriate position which is known as agility(7, 8). In team sports like soccer agility is a skill and important quality to escape from opponents when you attack or defend(9). Agility is a basic and fundamental element in performing sport activities(10, 11). Research has shown that a soccer player changes direction every 2-4 seconds, so as a whole he /she will have 1200-1400 change of direction during a game(12, 13). Another study in English premier league showed that each player on the average will have 727 turns during a 90-minute match, it shows the importance of changing direction and agility even more(14). Agility can be defined as the ability to change the direction in response to an external stimulus along with maintaining balance at maximum speed while performing as well as ability to perceive and make a decision, accordingly agility field tests are pre-planned and unplanned(15, 16).

In pre-planned agility tests the subject is fully aware of the movement direction and knows in which direction should move such as agility tests: Illinois, straight zigzag and spiral, 505 and other similar tests(17, 18). There is an evolved type of agility test which is called reactive agility tests, where subject's movement path is not predetermined and subject does not know in which direction should move(19, 20). So, this movement pattern is more similar to movement pattern in soccer(21, 22). Due to lack of prediction of movement path of soccer player on the field, this movement pattern has been taken as a model and different reaction agility tests haven been designed and validated to identify the agility and the level of readiness of the players(23, 24). In order to evaluated players and increase the level of their progress there is a need for several evaluations(25, 26). In this regard, there are various laboratory tests. Despite the high accuracy and value of the existing laboratory tests, they are not always accessible to the coach and applying them require spending a lot of money, so field test that do not need a lot of money and can be implement with the least possible facilities become important and as an efficient tool, a cheap and applicable tool will be accessible to the coach to distinguish more agile and elite players from each other(27, 28). Whereas the majority of the existing agility tests are based on pre-determined conditions that are not in accordance with movement pattern in soccer, therefore various test have been designed and validated based on reactive pattern but there a is a need for special test that despite being reactive be in accordance with movement pattern of the player in the football field and the purpose of the current research is to do initial designing agility test especially for the players under 14 years old and comparing it with other non-reactive tests to distinguish between average and elite players.

2. Materials and Methods

48 soccer players under the age of 14 years divided in two groups composed of 24 players. The group A were elite soccer players and active at the level of Asia vision, while group B were soccer players were active at the level of neighborhood and local competitions. Also, both groups were without any muscle damage and voluntarily announced their readiness in this study as subjects. The method of selecting subjects was based on their level of activity. Group A had four training sessions per week in Tehran province. Group B had three training session per week and 2 competitions per month. Puberty time for all participated performed according method of Moor et al(15). written consent was obtained from the subjects and their parents in order to participate in this test. Test execution protocol was explained to the subjects during a briefing session by the experts of physiology department of Islamic Azad University of central Tehran branch. Results and interpretation of data were done by a third party who was in connection with the subjects. General characteristics of the participants can be seen in Table 1.

Table 1: General characteristics of included participants (n=٤٨)

Characteristics	Mean ± SD	Min	Max
Age(year)	13.18±0.781	12	14
Height(cm)	136.66±11.326	112	165
Weight(kg)	34.23±7.277	23	74
BMI (kg/m^2)	18.080±3.797	13.03	32.08

General characteristics and familiarity with the agility test

The subjects were asked to visit the exercise physiology laboratory for familiarization with the test method and determining their general characteristics. Considering the number of subjects, it was impossible to measure all of them in one day. Therefore, the subjects were divided into three groups. First, their height and weight were measured, using a wall-mounted stadiometer and a digital scale. They were then instructed on how to complete the 505Agility Test (505AT), Zig-zag Curl (ZZC)، Zig-zag straight (ZZS), Specific Reactive Agility Test (SSRAGT).

SSRAGT

This reactive agility test for soccer players is modeled based on actual soccer games and resembles a virtual soccer game that is visual and less audible. The movement path of the players in the soccer game is constantly changing in reaction, and there is no predetermined path (player with the ball may change direction at any time) (1, 13) (1, 13) (1, 11) (1, 9) (1, 9) (1, 9) (1, 9) (1, 9). Based on this principle, the SSRAGT was designed. The SSRAGT includes four round trips of four meters, with a reactive ball in four main way the entire area of route change is 32 meters. The graphic representation of this test is shown in Figure 1. After dividing the field into four main directions, the performance protocol is determined by the cones. With the participant standing at point 0 (starting point) with the ball, the examiner indicates a direction to lead. Then, the subject starts from point 0, which is marked on the sides (to determine if the distance is 4 m), moves in a direction that is not predetermined (at least 20-30 cm away from the cones), and changes direction to point 0.

When the subjects reach the starting point, the examiner makes a short sound and indicates a new path so that the subject changes direction. This process is repeated four times in four main directions. The distance that each subject ran in this test was 32 meters. The Less time for each subject is considered as his best recorded. The SSRAGT includes four main directions and four change of direction. Agility has been shown to play a critical role in athletic performance. It requires the power of perception and quick decision-making skills to prepare for a new direction and path as quickly as possible. The principles of perception and decision-making have been considered in the SSRAGT. A subject must be ready to change direction quickly based on visual indication. In other non-reactive agility tests, such as 505AT, ZZC, ZZS, MICOD, ICOD the path includes obstacles that may affect an individual's ability to perform the test. Other reactive agility tests, such as Y test, are performed after the path is changed, indicate that individual skills may be influential. This important principle was considered in the design of SSRAGT. We tried to identify the weaknesses of previous tests, where individual skills were effective. One of advantage of SSRAGT this is it there are no obstacles or shots on the routes, and there are only swift changes of route in reactive and linear ways. Also, the ball movement is exactly designed, based on the pattern of soccer players' movements.

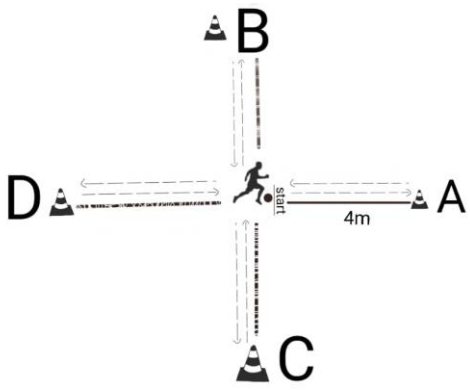

Figure 1: layout SSRAGT

Exercise protocol

A trial session was held at 3-5 p.m. to prevent daily diurnal variations. Each subject was tested three times, and their best record was documented. All players wore soccer uniforms, shorts, shoes, and socks to ensure that the test conditions were identical for everyone. Also, all of the tests were performed on artificial turf, and the conditions were the same for all soccer players.

Agility test

Forty-eight hours before the first test, the subjects were asked to avoid training hard. Fifteen minutes were allowed for warm-up before the test. The warm-up included a general warm-up, dynamic stretching, and a dedicated warm-up. The general warm-up included 800 meters of walk (200 m in 90 seconds, 200 m in 70 seconds, 200 m in 60 seconds, and 200 m in 45 seconds, respectively). Dynamic stretching included front and back lounges, squats to improve muscle contraction, and leg stretching movements. The dedicated warm-up included ten rotation movements at 90 degrees, with knee flexion and sprints in short distances at 70%, 80%, 90%, and 100% acceleration. Finally, after 3-4 minutes of activation rest, the subjects were be for the test.

Statistical analysis

The assumption of normality was examined using the Kolmogorov-Smirnov test at a significance level of $P<0.05$. Also we use the repeated measure ANOVA test to compare participation heart rate and steps.To assess the difference between the number of steps and heart rate were used Mean ± SD. The logistic model is used to model the probability of elite or not elite soccer players. The division of players into high and low soccer performance was based on their competitive level. high performance group competed in the national premier league and the low performance group competed in the provincial league. Logistic regression dependent variable Two variables

Surface (High performance = code 0 and low performance = code one) is considered. GraphPad Prism version 8.3 for Windows 10 was used to evaluate the data.

3. Results

It should be noted that the heart rate and the number of steps of the participants in the agility tests 505AT, ZZC, SSRAGT, ZZS were compared with each other. Significant differences in heart rate and number of steps were observed only between 505AT test whit SSRAGT. There was no significant difference in heart rate and number of steps between SSRAGT and ZZC, ZZS tests (Table 2).

Table 2: Comparison of heart rate and number of steps of the agility tests 505AT, ZZC, SSRAGT, ZZS

	Heart Rate Comparison		Step Comparison	
SSRAGT	166.4±11.149[a]		34.95±5.114[a]	
505AT	159.4±11.245[b]	P<0.001	26.30±4.794[b]	P<0.001
ZZC	167.63±10.448[a]		35.85±6.546[a]	
ZZS	168.33±8.480[a]		34.17±5.551[a]	

Diagnostic analysis (logistic regression)

The results of logistic regression between 48 players in 2 groups of 24 people with high and low soccer performance showed that SSRAGT test can significantly predict the level of performance of young football players (OR = 1.437, P <0.01). As the ZZC test was able to significantly predict the performance level of the subjects in this study (OR = 1.05, P <0.01) Table3.

Also, there is a positive correlation between agility test for the soccer players and 505 test as well as zigzag Slalom based on beta regression coefficient in the logistic model.

Table 3: Evaluation of diagnostic validity of tests based on logistic regression.

Agility test	B	P-value	OR	CI 95%	
				Lower	Upper
SSRAGT	.362	**<0.01**	**1.43**	1.35	1.52
505 AT	.017	0.50	1.01	0.96	1.06
ZZC	.049	0.27	**1.05**	0.96	1.14
ZZS	-.002	0.94	0.99	0.94	1.05

4. Discussion

The finding of this study showed that reactive agility test for the soccer players is not as a preliminary and reactive test where the movement path of the subject is not predetermined has a positive and significant agreement with other non-reactive agility test. One of the criteria for field evaluation to determine the severity of agility tests is the use of maximum heart rate. Accordingly, the heart rate of the subjects was compared in the 505AT, ZZC, ZZS and SSRAGT agility tests, and the results showed that the heart rate and the number of steps in the 505AT agility test were smaller than the other tests, which was related to the movement pattern is linear in this test and in SSRAGT agility test in comparison with other tests, there is no significant difference between heart rate and number of steps between tests, which shows that SSRAGT test is similar to other tests in terms of activity intensity. In all agility tests, the movement path of the players is predetermined and the player follows the movement path with full awareness, and finally the person's stagnation is recorded, which is different from the pattern and features of the soccer game, because in the soccer match a path is predetermined. There is no set and players are constantly changing direction depending on the conditions of the match.

During a 90-minute soccer match, there are about 1200-1400 diversions, and players are forced to change sudden and unpredictable routes during the match, based on the opponent's tactics(29, 30). Therefore, this very important pattern is used in the design of the SSRAGT test as far as the movement logo may not be predetermined and soccer's change direction to a new path in the shortest possible time based on perception, decision, cognitive factors and conditions(31, 32). Give soccer is a visual game and players must change their direction in the shortest possible time based on the movement of the ball and the opponent(33, 34). Therefore, the SSRAGT agility test is designed exactly accordingly, and the experimenter, after the test taker has determined a new path for him, should change the path to the determined path in the shortest possible time based on visual perception and timely decision. The results of previous studies in soccer's show that they have a lateral advantage in the right half of their body (ears, eyes, right foot) compared to the left half, and if they know the direction of movement before the test, lateral superiority may affect the record(35). The experimenter is incorrectly considered to have the desired agility.

However, in the SSRAGT agility test, this issue has been taken into consideration, and since the subject has to change direction in four main directions, the share of lateral superiority in the test result has been reduced to a minimum and its distorting effect has been curbed as much as possible. Regarding initial preliminary results of agility test for the soccer players as a reactive field test and in accordance with movement pattern of soccer players the results obtained based on logistic model indicates positive significance with other non-reactive agility tests which has a potential to distinguish between average and elite players.

Conclusion

The result showed that the preliminary reactive agility test for the soccer player enjoys an acceptable level of significance and in comparison as a reactive agility test compared with non-reactive agility test empowered to distinguish the average players from elite ones. So, it has recorded this important principle just like non-reactive agility tests. Therefore, as an efficient, field and accessible tool for the coach can be applied to distinguish between ordinary and elite players. Since, the change of direction in reactive agility test for soccer players is done with a ball in four main direction, therefore, it reduces the share of lateral advantage which is inclined toward right side of the players' body and presents him/her a more agile person.

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Compliance with ethical standards

Conflict of interest None declared.

Ethical approval the research was conducted with regard to the ethical principles.

Informed consent Informed consent was obtained from all participants.

Author contributions

Conceptualization: M.T., M.A.A., M.P.; Methodology: M.T., M.A.A., M.P.; Software: M.T., M.A.A., M.P.; Validation: M.T., M.P.; Formal analysis: M.T., M.P.; Investigation: M.T., M.A.A., M.P.; Resources: M.T., M.A.A., M.P.; Data curation: M.T., M.A.A., M.P.; Writing - original draft: M.A.A., M.P.; Writing - review & editing: M.T., M.A.A.; Visualization: M.T., M.A.A., M.P.; Supervision: M.T., M.A.A., M.P.; Project administration: M.T., M.A.A., M.P.; Funding acquisition: M.T., M.A.A.

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