Evaluation of a Specific Reaction and Action Speed Test for the Soccer Goalkeeper

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Abstract

Knoop, M, Fernandez-Fernandez, J, and Ferrauti, A. Evaluation of a specific reaction and action speed test for the soccer goalkeeper. *J Strength Cond Res* 27(8): 2141–2148, 2013—The aim of this study was to develop and evaluate a new test for the soccer goalkeeper that involved perceptual and movement response components (i.e., sprint running, jumping, diving, and direction changing). The evaluation consisted of measurements in different age (U19 [18.0 ± 0.9 years], $n = 21$; U14 [14.1 ± 0.3 years], $n = 13$) and performance (i.e., first goalkeepers and substitutes) groups of goalkeepers, including measures of test-retest reliability. Validity was assessed comparing the 2 groups of goalkeepers with different expertise levels (i.e., competitive level and age group). The test-retest correlations of the reaction and action speed (RAS) test performance were significant in all single (intraclass correlation coefficient [ICC] = 0.68–0.95; $p < 0.01$) and complex measurements (ICC = 0.91; $p < 0.01$). The RAS single test performance was higher in older (U19) compared with in younger (U14) players ($p < 0.001$), and they also showed better results in the RAS complex tests ($p = 0.000$), being significantly different between the first goalkeepers and their substitutes ($p = 0.001$). Moreover, for all age groups (i.e., U14, U19), defensive actions to the bottom corners were faster than those to the top corners, with large ES (i.e., > 1). The major findings of the study were that the RAS test provided a reliable and valid method of assessing specific defensive agility in a group of youth soccer goalkeepers. Performance responses during the RAS test allow coaches to discriminate between age-matched goalkeepers, identify weaknesses (e.g., nonpreferred side dive performance), and to design specific training tasks.

Key Words soccer, agility, perceptual, diving

Introduction

Soccer is the world's most popular sport, being played in every nation without exception (31). Up to now, there has been a remarkable expansion of sport science applied to this sport, and analyses of amateur and professional soccer have identified activity profiles and physical requirements of contemporary match play (6,41,46). Surprisingly, the goalkeeper is often excluded within the sports science literature, despite his importance to the team's success. During the last decade, the only information available was mainly focused on training approaches (17–19,45), and scientific studies regarding the specific demands of the goalkeeper took place rather sporadically (8,11,12,23,24,44). Most of these studies covered isolated parameters, such as the cognitive demands during penalty situations (21,24), biomechanical analyses of specific actions (39), or injury rates (7,16,25,28,32,38). Moreover, testing protocols in soccer are usually designed for field players (19,26,34,43), and the studies that addressed goalkeepers, just compared their general performance characteristics with those of field players (i.e., basic strength, countermovement jump [CMJ]) (1,13,45). None of the cited studies dealt with more specific measurements adapted to the goalkeeper's specific demands.

In the defensive situation, especially while defending the goal (e.g., 1 vs. 1 and shots), goalkeepers' actions are typically explosive, short term, and technically demanding, highlighting "agility" as one of the basic qualities of a modern goalkeeper (13,22). Shepard and Young (37) identified agility as "a rapid whole-body movement with change of speed or direction in response to a stimulus." In the context of the soccer goalkeeper, we also have to take into account the ability to react quickly, the specific neuromuscular aspects, and the power performance ability. These necessary open motor skills are executed in a constantly changing environment or in response to an unpredictable stimulus, requiring constant adaptation by the performer (36,37).

To the best of our knowledge, no scientific literature was found evaluating a sport-specific agility test focusing on reaction and decision making for the defensive actions of the goalkeeper. Therefore, the purpose of this research study was to develop and evaluate a test that involved perceptual and movement response components (i.e., sprint running, jumping, diving, and direction changing) in the soccer

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goalkeeper. The evaluation consisted of validity and reliability measurements. For ensuring validity, we refer to construct validity, assuming that younger goalkeepers with a lower level of expertise, as well as substitute goalkeepers, will show lower performance levels in a valid specific test. Additionally, a sufficient logical validity can be assumed, because we tried to mimic the reality of the goalkeeper's demands as well as possible in our test. To evaluate the test-retest reliability, we compared the performance measured during the first and second attempts of all the players during each test components by calculating the respective measures.

Table 1. Subject characteristics.*†

Sample groups	N	Age (y)	Body height (m)	Body mass (kg)	BMI ($kg \cdot m^{-1}$)
U14	13	14.1 ± 0.3	1.76 ± 0.08	63.0 ± 10.8	20.3 ± 2.3
U19 1st Gk	10	18.4 ± 0.8	1.88 ± 0.05	81.7 ± 7.9	23.0 ± 1.4
U19 subst	11	17.7 ± 0.7	1.86 ± 0.04	81.7 ± 7.9	23.0 ± 1.4

*U14 = under 14; U19 = under 19; 1st Gk = first goalkeeper; subst = substitutes; BMI = body mass index.
†Values are mean ± *SD*.

Methods

Experimental Approach to the Problem

A cross-sectional study was performed on 34 soccer goalkeepers aged 14–19 years. All measurements were taken in 1 experimental day, at the end of the annual training season. The same assessors performed all test procedures. The players were familiar with all the test procedures. Test sessions were undertaken between 15:00 and 19:00 hours. Testing began after a 15-minute standardized warm-up, which consisted of low-intensity forward, sideways, and backward running; acceleration runs; skipping and hopping exercises; and jumps of increasing intensity. Test sessions included linear sprints, vertical jumping, and measurements of reaction and action speed (RAS), always following the same order, number of repetitions, and recovery duration (Table 2). To reduce the interference of uncontrolled variables, all the subjects were instructed to maintain their habitual lifestyle and normal dietary intake before and during the study. The subjects were told not to exercise on the day before a test and to consume their last (caffeine-free) meal at least 3 hours before the scheduled test time. All the fitness tests were performed in an outdoor facility (temperature 21.2–25.4° C, relative humidity 55–60%; Kestrel 4000 Pocket Weather Tracker, Nielsen Kellerman, Boothwyn, PA, USA).

Linear Sprints (10 m). Sprint time during a 10-m dash in a straight line was measured by means of photocell gates placed 1.0 m above the ground level (Sportronic, Leutenbach-Nellmersbach, Germany). Each sprint was initiated from an individually chosen high starting position, 0.5 m behind the photocell gate, which started a digital timer. Each player performed 3 maximal sprints over 10 m interspersed with 1 minute of passive recovery, and the fastest time achieved was recorded.

Vertical Jumping. Countermovement jumps with arm swing were performed on a contact platform (Haynl Elektronik, Schönebeck, Germany) according to Bosco et al. (5). Each player performed 3 maximal CMJs interspersed with a 30- second recovery, and the best height was recorded.

Reaction and Action Speed. For RAS, a special testing device was developed. The RAS test system consists of a fourfold signal panel with 4 light-emitting diodes (LEDs) and a specific software (Sportronic, Leutenbach-Nellmersbach, Germany) for initiating and controlling the test procedure. Moreover, 4 soccer balls were modified by implementing touch-sensitive triaxial transponders (typical error of 0.03 seconds), independently working from each other (Sportronic, Leutenbach-Nellmersbach, Germany), and a special constructed rig for the proper positioning of the swing balls, being fixed in the top left and -right angle of a soccer goal (Figure 1). By activating 1 LED of the fourfold signal panel (i.e., and remaining on during the whole repetition), the wireless touch-sensor system in the balls will be initiated and time will run. The time stops when the determined ball is being moved from its position by an external impact (i.e., a hit from a goalkeeper). The time is shown in the signal panel. The test configuration was evaluated in 2 defensive situations of different complexities.

Table 2. Content and order of the test sessions.*

Tests	Repetitions	Recovery (s)
Linear sprints (10 m)	3	60
Countermovement jumps	3	30
RAS single bottom left	2	60
RAS single bottom right†	2	60
RAS single top left	2	60
RAS single top right†	2	60
RAS complex top left–bottom right	2	90
RAS complex top right–bottom left†	2	90

*RAS = reaction and action speed test.
†Randomly assigned to left and right directions.

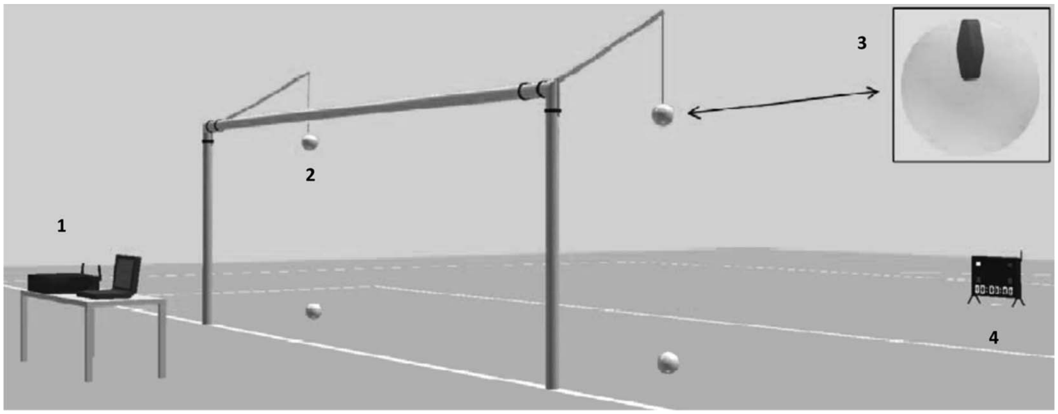

Figure 1. Schematic representation of the reaction and action velocity device. 1. Computer and receptor; 2. soccer balls; 3. slot position for the touch-sensitive triaxial transponder; and 4. signal panel.

Reaction and Action Speed Single Test. The goalkeeper is instructed to react upon an optic signal by deflecting a ball out of 1 of the 4 angles of the goal as fast as possible (i. e., diving to the angle showed by the signal panel). One LED of the signal panel, which flashed up at random order, determined the movement direction. Each player performed overall 8 attempts: 2 attempts to both sides (left or right), either to the top or to the bottom corner. The 4 attempts to the top or to the bottom corner were tested successively, wherea the movement direction (left or right corner) was randomly determined by the researchers, with a 60-second recovery in between.

Reaction and Action Speed Complex Test. The goalkeeper was instructed to react upon an optic signal, by deflecting a ball out of 1 of the 2 upper angles of the goal as fast as possible; subsequently, he stands up quickly to deflect the ball at the bottom of the opposite post (i.e., using diving movements). The initial direction was given by 1 LED from the signal panel. Each player performed 2 attempts to both directions (top left–bottom right, or top right–bottom left), randomly determined by the researchers, with a 90-second recovery in between.

Subjects

Thirty-four junior goalkeepers participated in the study (Table 1). The 21 under-19 (U19) goalkeepers were members of 10 different German professional football clubs (i.e., first division). The U19 players had at least 1-year experience in their competitive category with a mean goalkeepers' specific training background of 10.2 ± 0.6 years. We distinguished between the first goalkeeper of each team ($N = 10$) and their substitutes ($N = 11$). The 13 under-14 (U14) goalkeepers (Table 1) were a selection of talented players, chosen from regional talent spots of the German Football Federation and considered the best goalkeepers of their competitive category. The players had at least 1-year experience in their competitive category, and a mean training

Table 3. Reproducibility of measures between the first and second attempts.*

Tests		Mean	95% CI	*SD*	*SEM*	Bias	ICC
Linear sprints (10 m) (s)	First	1.93	1.89–1.97	0.10	0.02	−0.02	0.745
	Second	1.91	1.88–1.95	0.09	0.02		
CMJ (cm)	First	42.7	39.8–45.5	7.7	1.4	0.30	0.955
	Second	43.0	40.3–45.8	7.4	1.4		
RAS single bottom left (s)	First	1.37	1.34–1.41	0.09	0.02	−0.03	0.738
	Second	1.34	1.30–1.38	0.12	0.02		
RAS single bottom right (s)	First	1.34	1.29–1.39	0.13	0.02	−0.02	0.683
	Second	1.32	1.28–1.36	0.12	0.02		
RAS single top left (s)	First	1.51	1.47–1.56	0.13	0.02	0.00	0.840
	Second	1.51	1.46–1.57	0.15	0.03		
RAS single top right (s)	First	1.49	1.44–1.53	0.13	0.02	0.00	0.867
	Second	1.49	1.45–1.54	0.13	0.02		
RAS complex top left–bottom right (s)	First	4.72	4.53–4.92	0.56	0.09	−0.02	0.910
	Second	4.70	4.51–4.89	0.53	0.09		
RAS complex top right–bottom left (s)	First	4.79	4.59–5.01	0.61	0.10	−0.04	0.918
	Second	4.76	4.58–4.93	0.51	0.09		

*CMJ = countermovement jump; RAS = reaction and action speed test; CI = confidence interval of means; bias = mean difference between measures; ICC = intraclass correlation coefficients.

background of 4.5 ± 0.8 years. Before any participation, the experimental procedures and potential risks were explained fully to the subjects or parents, respectively, and all provided written informed consent. The study was approved by the institutional research ethics committee and conformed to the recommendations of the Declaration of Helsinki.

Statistical Analyses

Data are presented as mean values with *SD*. Data from the RAS test evaluation were analyzed by a mixed-design analysis of variance after testing the sphericity by using the Mauchly test and in the case of necessity the Greenhouse-Geisser correction. As the between-group factors we defined the standard of goalkeepers (first goalkeepers vs. substitutes) and the different age groups (under 14 vs. under 19). As the within-group factor we defined the corner of the goal (left vs. right). Significance levels were set at $p < 0.05$ and $p < 0.01$. To determine the meaningfulness of statistical effects, effect sizes (ESs) were calculated for the between- and within-group effects (9). Threshold values for Cohen ES statistic were >0.2 (small), 0.5 (moderate), and >0.8 (large) (20). Construct validity of the RAS test was indirectly assessed by comparing 2 groups of goalkeepers with different competition levels or age groups, respectively, assuming that the first goalkeepers and the older ones should obtain significantly better results. Within-group reproducibility of the dependent variables was calculated by comparing the results of the first and second attempts of each test. Therefore, Bland and Altman analysis was performed and the mean bias (±*SD*), the confidence interval of means and the *SEM*s were calculated (3). Additionally, the intraclass correlation coefficient (ICC) was calculated for the respective test-retest situations.

Table 4. Results (mean ± *SD*) of the 10-m sprint, CMJ, and RAS single and complex tests, and the ANOVA between-group (age) and within-group effects (corner), with effect sizes.*

	U14 ($n = 13$)	U19 ($n = 21$)	p values	ES
10-m Sprint (s)	1.98 ± 0.08	1.86 ± 0.05	<0.01‡	1.79
CMJ (cm)	36.0 ± 4.3	47.8 ± 5.5	<0.01‡	2.39
RAS				
Bottom left (s)	1.40 ± 0.10	1.28 ± 0.06	Age <0.01‡	1.57
Bottom right (s)	1.39 ± 0.12	1.23 ± 0.06	Corner 0.57	0.58
Top left (s)	1.59 ± 0.13	1.41 ± 0.08	Age <0.01‡	1.95
Top right (s)	1.58 ± 0.12	1.39 ± 0.06	Corner 0.23	0.10
Top left–bottom right (s)	5.20 ± 0.41	4.40 ± 0.26	Age <0.01‡	2.16
Top right–bottom left (s)	5.09 ± 0.59	4.32 ± 0.23	Corner 0.08	0.23

*CMJ = countermovement jump; RAS = reaction and action speed; ANOVA = analysis of variance; ES = effect size.
†$p < 0.05$.
‡$p < 0.01$.

Table 5. Results (mean ± *SD*) of the first and substitute goalkeepers during the 10-m sprint, CMJ, RAS single and complex tests, and the ANOVA between-group (first vs. substitutes) and within-group effects (corner), with ESs.*

	1st Gk ($n = 10$)	Subst ($n = 11$)	p Values	ES
10-m Sprint (s)	1.83 ± 0.03	1.89 ± 0.05	<0.05†	1.45
CMJ (cm)	54.7 ± 5.8	50.4 ± 4.2	0.07	0.85
RAS				
Bottom left (s)	1.25 ± 0.07	1.31 ± 0.05	First/subst. 0.04†	0.66
Bottom right (s)	1.21 ± 0.06	1.24 ± 0.06	Corner 0.009‡	0.83
Top left (s)	1.38 ± 0.06	1.44 ± 0.08	First/subst. 0.06	0.56
Top right (s)	1.38 ± 0.04	1.41 ± 0.08	Corner 0.28	0.15
Top left–bottom right (s)	4.28 ± 0.23	4.51 ± 0.24	First/subst. <0.01‡	1.06
Top right–bottom left (s)	4.20 ± 0.20	4.43 ± 0.20	Corner 0.16	0.37

*CMJ = countermovement jump; RAS = reaction and action speed; ANOVA = analysis of variance; Gk = goalkeeper; Subst = substitutes; ES = effect size.
†$p < 0.05$.
‡$p < 0.01$.

Results

The test-retest correlations of the RAS test performance were significant (ICC values ranging from 0.68 to 0.95) in all single and complex measurements (Table 3). The standard error and confidence intervals of means were similar between both measurements for all depending variables. The mean bias for test repetition differed between −0.04 seconds (RAS complex test) and 0.00 seconds (top left and right corners; Table 3).

The results of the test evaluation in different age and performance groups are shown in Tables 4 and 5. The RAS single and complex test performance was significantly better in older (U19) compared with that in younger (U14) players ($p < 0.001$), which was confirmed by large ES (values ranging from 1.57 to 2.16; Table 4). Differences between the first

TABLE 6. Pearson correlation coefficients between single and complex RAS test performances and body height and sprint and CMJ performances.*

	Body height	10 m-Sprint	CMJ
U19 ($n = 21$)			
Bottom left	−0.07	0.20	−0.01
Bottom right	0.29	0.18	0.03
Top left	−0.34	0.35	−0.37
Top right	0.06	0.44	−0.28
Top left–bottom right	0.09	0.17	−0.49†
Top right–bottom left	−0.41	0.24	−0.65‡
U14 ($n = 13$)			
Bottom left	−0.47	0.65†	−0.73†
Bottom right	−0.42	0.81‡	−0.45
Top left	−0.60†	0.47	−0.63†
Top right	−0.69‡	0.67‡	−0.77‡
Top left–bottom right	−0.23	0.29	−0.52
Top right–bottom left	−0.64†	0.33	−0.61

*CMJ = countermovement jump; RAS = reaction and action speed.
†$p < 0.05$.
‡$p < 0.01$.

goalkeepers compared with their substitutes were also partly significant (single bottom test [$p = 0.04$; ES = 0.66], and complex test [$p = 0.01$; ES = 1.06]) but overall less pronounced with small or moderate ESs (Table 5). Generally, in all RAS single tests, there was a significant effect of the height of the ball (e.g., top vs. bottom), showing that defensive actions into the top goal corners take significantly more time than into the bottom corners ($p < 0.001$; ES > 1). Interestingly, in the U19 (i.e., first and substitute goalkeepers), there was a moderate but significant within-group effect of the dive direction in the RAS single test pointing to a quicker action when diving into the right bottom corner of the goal ($p = 0.009$; ES = 0.83; Table 5).

Correlation coefficients between single and complex RAS test performances and body height and physical capacities are presented in Table 6. The results showed no correlation between body height and RAS test performance in the U19 ($r = -0.41$–0.09) but significant correlations in the U14 when a single action is tested into the top corners of the goal ($r = -0.60$ to -0.90; $p < 0.05$).

Generally, basic sprint and jumping performance seems to have no impact on RAS single test performance in U19 players, whereas small to moderate correlations were found for U14 goalkeepers ($r = -0.49$ to -0.65; $p < 0.05$; Table 6). Overall, vertical jump performance seems to have a closer correlation to the RAS test performances than sprint performance, especially in the complex testing situation.

DISCUSSION

The aim of this study was to evaluate a new agility test for the soccer goalkeeper involving perceptual and movement response components (e.g., sprint running, jumping, diving, and change of direction). The major findings of the study were that the RAS test provided a reliable and valid method of assessing specific defensive agility in a group of youth soccer goalkeepers. Performance responses during the RAS test allows coaches to discriminate between age-matched goalkeepers, identify weaknesses (e.g., non-preferred-side dive performance), and to design specific training tasks to obtain gains in performance.

Comparing 2 groups of goalkeepers with different ages and competition levels, we indirectly assessed construct validity in general and the discriminative validity of the RAS test in detail. As expected, there were significant differences, supported by large ES, in performance (i.e., sprint, jumps and RAS tests) between the different age groups, with U19 goalkeepers showing better results than U14 (Table 4). This clearly shows marked differences in body height and physical qualities, especially evident in explosive power (i.e., ~10-cm difference in average CMJ height). In this regard, it is well known that, although the individual timing and tempo of growth and maturation should be taken into account, strength increases in both boys and girls until about the age of 14 years, when it begins to plateau in girls and a spurt is evident in boys (15,33), with significant development in leg power at the ages of 14 and 15 years (4). Moreover, although speculative (i.e., because of the training information reported by coaches), differences are also related to training. In this regard, U19 players already had some experience with specific strength training, which, together with maturation, could be mainly responsible for the differences obtained.

The present results showed a small impact of the goalkeeper's position (i.e., first or substitutes) in all RAS single tests. Also, and more important, bigger differences (i.e., with large ES) were found between the first and substitute goalkeepers in the RAS complex tests, being the first goalkeepers who were faster in the execution of the test (Table 5). These results point to a sufficient construct validity of the RAS tests in general and to a higher discriminative validity of the RAS complex tests. It is well accepted that performance testing in intermittent sports should consider the specific workload demands (14,19). In this regard, the RAS complex test involve perceptual and movement response components, and this could lead to a better performance in the first goalkeepers compared with their substitutes.

We assume that a goalkeeper's skill level is determined by additional important but more elusive factors, such as tactical understanding, placing, perception, and anticipation (39), which are not considered in the RAS test. This has to be accepted and considered when assessing the RAS test results. On the other hand, it does not seem to be possible to create a more complex and valid testing without having a considerable loss in reliability. The test-retest comparison of measurements taken during the first and second attempts point to a sufficient level of reproducibility with constant standard errors and confidence intervals of means, a low mean bias, and a moderate correlation between test repetitions (Table 3). As expected, the complex RAS test seems to be more differentiating to assess a goalkeeper's performance (higher validity), but this leads to a small increase in the mean bias. This can be related to a more pronounced familiarization and coordinative improvement (i.e., lower reliability). Based on our results, we can suggest that a combination of both single and complex tests should be recommended without overstating the aspect of complexity.

The results obtained during the RAS single test showed that, for all age groups (i.e., U14, U19), defensive actions to the bottom corners were faster than those to the top corners, with large ES (i.e., >1; Tables 4 and 5). This can partly be explained by anthropometrical factors, as the distance between goalkeeper's hands and the goal corners, especially in smaller U14 players, is longer to the top compared with that the bottom corners. In this regard, we found a close correlation between body height and RAS test performance only in the U14 players and only into the top corners (Table 6). However, we can speculate that the main reason for these differences seems to be the position of the center of gravity, being lower for the U14, and resulting in slower times to reach the top corners. In this regard, vertical jump performance was found to have a greater importance for RAS test performance into the top compared with the bottom corners, where sprint performance tended to be more relevant (Table 6). Consequently, the usual techniques reported by several authors (29,42) to the top corner (e.g., side steps followed by a side jump) take more time than those into the bottom corners (e.g., side steps and "dive"). From a practical point of view, this information seems to be important for the penalty kicker, having a higher probability of success when choosing the top corners of the goal.

Interestingly, we found that the RAS single test performance in the U19 players was significantly better into the right corner (i.e., with moderate ES), and during the RAS complex tests, all groups performed slightly faster dives when the test started with a movement to the top right corner (Tables 4 and 5). Albeit speculative, because these differences were not reported, this could be due to the use of the preferred side of the body, which could be the right side in the groups analyzed here (i.e., right-handed dominance of our subjects (>90 %)). Natural asymmetries exist within the musculoskeletal system (10), which can create differences between both sides of the body (i.e., dominant and nondominant) (35). Because goalkeepers must dive to both sides of their bodies to defend the ball, these potential asymmetries could influence the movement characteristics during a specific test such as the one presented here, subsequently affecting the performance on the nonpreferred side (30,40). Right-handed goalkeepers may be more self-confident and generate more acceleration, being more precise, when diving to the right corner. This observation underlines the importance of an individual specific bilateral testing (e.g., by the use of the RAS test presented) during the long-term development of soccer goalkeepers.

The impact of physical capacities and body height in the U14 goalkeepers were higher than in the U19, with moderate to high correlations between sprinting and jumping abilities and the RAS tests (Table 6). These results seem to be not very surprising, because the specific skills (e.g., perceptual, decision making) from the U14 players are in development, and therefore, basic physical capacities seem to be more determinant in these athletes (15). Moreover, body height plays an important role in these players, showing medium correlations with performance in top single actions and in the RAS complex test. In this regard, relative age effect and maturation should be particularly considered during talent detection in young soccer goalkeepers (2,11).

In conclusion, the results of this study show that the RAS test provides a sufficient reliable and valid method of assessing specific defensive agility in a group of youth soccer goalkeepers. Moreover, performance responses during the RAS test allow coaches to profile players. The evaluation of different training strategies (e.g., low to high impact plyometric training) on the RAS test performance warrants future studies.

Practical Applications

The differences in performance found for the different groups (i.e., U19 vs. U14), with large ESs, suggest that the RAS test could be recommended as a practical tool for goalkeepers of different levels and ages, and allows coaches to discriminate between age-matched goalkeepers, identify weaknesses (e.g., non-preferred-side dive performance), and to design specific training tasks to obtain gains in performance (i.e., the prescription of strength training for the nondominant side, or plyometric workouts to improve the take-off movements). In this regard, good vertical jump skills are important for goalkeepers, because they are often required to leap vertically or diagonally, to catch or deflect the ball. Low-frequency plyometric training (i.e., 25 minutes per session, 2 per week and including, for example, single- and double-leg forward hops over hurdles, lateral hops over hurdles, and lateral shuffles over a box, skipping, low depth jumps, and footwork [ladder drills]) could be recommended, in combination with traditional goalkeeper's practice to obtain greater performance gains (27). Moreover, goalkeepers need to be agile, because their role requires quick movements and directional changes. Training programs that reflect the specific needs of goalkeepers should be planned by coaches (i.e., using specific agility drills emphasizing quick changes of directions around the goal line). It is advisable that strength and conditioning specialists apply the specificity principle by including exercises in their protocols that incorporate both eccentric and concentric actions and movements to various directions during deceleration and acceleration to improve the stretch-shortening cycle, jump ability, and agility in combination with more traditional resistance exercise training.

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